TABLE OF CONTENTS

Table of Contents.....1

Call to Order.....2

Roll Call and Adoption of the Agenda.....3

National SSC Update.....12

SEDAR 57 Spiny Lobster.....13

Finalize the Generic Ecosystem Conceptual Model.....98
Summary 2019 Meeting - Chair Presentation to CFMC 168.....98
Mental Modeler Review.....101
Presentations on Each Component Followed by Discussion...103
Marine Ecosystem.....103

Spiny Lobster Update Discussion.....150

Presentations on Each Component Followed by Discussion (cont).187
Habitat.....187
Land-Based Uses.....196
Fishing.....212
Water Quality.....251
Socioeconomic and Cultural Drivers.....286
Abiotic Factors.....386
Competing Use of Resources.....397

Caribbean Ecosystem Status Report Update.....425

PR DNER E-Reporting Update.....433

Adjournment.....440

- - -

CARIBBEAN FISHERY MANAGEMENT COUNCIL
SCIENTIFIC AND STATISTICAL COMMITTEE
Webinar

May 18-22, 2020

The Scientific and Statistical Committee of the Caribbean Fishery Management Council convened via webinar on Monday morning, May 18, 2020, and was called to order by Chairman Richard Appeldoorn.

CALL TO ORDER (0:00)

GRACIELA GARCIA-MOLINER: Do you want me to do the housekeeping beforehand, or do you want to go ahead and start the meeting officially and amend the agenda, et cetera?

RICHARD APPELDOORN: Well, I think we should officially start the meeting so you can read the instructions, because I think we need to have those first, before we get into the agenda, because obviously those instructions apply to the agenda, and so let's go through the instructions first, and then we'll do the agenda, and, actually the roll call would be after the instructions.

GRACIELA GARCIA-MOLINER: Okay. Perfect. Good morning, everyone. Welcome to the all virtual SSC meeting. This is a first for everyone, and so please be patient with all of us, because this is our first all-virtual meeting, and we're up to over forty-four people online, and so we'll do our best. Do send us messages in the chat if you have any problems, and thank you, everyone, for being online.

Because we have so many people online, we might have people who will need either the English or the Spanish translation as we move along during the week, and so there are instructions, just so everyone knows that we have this available. Please let us know if you are trying to connect and if you have any problems.

To speak, please write to us in the chat room. If you see that we don't answer, Richard, I suppose that they can interrupt, if we're having problems with the chat, especially the SSC members, and we will definitely need all your collaboration and cooperation with this part of the process.

There are a set of guidelines that we had sent that are part of the how-to conduct the meetings, and I think that most everyone has been aware of all the guidelines, and so please be patient to make sure that you get a turn to speak.

RICHARD APPELDOORN: In the list, in the chat list, for almost everybody, your name is actually already there when you chat, and so you don't have to write the name, but there are some people who have logged on, I assume by phone, and it's just Caller Number 6 or Caller Number 7 or something like that, and they will have to put their names -- Well, I guess they can't through the chat, if they're in by phone.

GRACIELA GARCIA-MOLINER: That will be the other thing, and so some of them have my cellphone number or Miguel's cellphone number, or Natalia's, and they can text us, or text someone in their group, and then they can chat with us.

The other thing, Richard, that I sent you earlier this morning, because I just remembered this morning, is please make sure that you say your name for the record when you are speaking, and, Richard, when you do the roll call, you can actually call their names, and they can repeat it, so that we have it on the record. As you know, the meeting is being recorded, and it will be available both as a Go To Meeting video recording and as verbatim transcriptions, the ones that you have received before. That is what I have for housekeeping items, and we can go to the agenda now, and so Richard.

DIANA MARTINO: Graciela, I would like to say, before we continue, that, for the reason of the minutes, it's very important that, before everybody speaks, they say their name every time they have a turn to speak. Thank you.

ROLL CALL AND ADOPTION OF AGENDA (07:45)

GRACIELA GARCIA-MOLINER: You should have received the Federal Register notice of the agenda, and we do have a Word version for you to modify, as needed.

RICHARD APPELDOORN: Before we get to the agenda, we would like to do the voice roll call, and I will call out the names of the SSC members first, and, after that, I will call out the names of other people, in the order that I have them on my screen, and I will start.

GRACIELA GARCIA-MOLINER: Wait, Richard. The date and the time, we haven't stated that, and so sorry. Today's date is, and this is the SSC meeting, et cetera.

RICHARD APPELDOORN: It's Monday, May 18, 2020, and it is 10:14, and this is the SSC meeting for the Caribbean Fishery Management Council, and so now the voice roll call. I'm Rich Appeldoorn, SSC

Chair. J.J.

GRACIELA GARCIA-MOLINER: He is saying, Richard, that he will switch computers and he will call in again, but he's here.

RICHARD APPELDOORN: I am going to go down the list. Doug.

DOUGLAS GREGORY: This is Doug. I am having trouble with fading in and out. I get disconnected, and then eventually it reconnects, and so there may be a time lag. I can't answer you there, and, also, the computers and headsets have a second mute button, and so we've got to deal with two, one on the webinar plus the one on our own devices.

RICHARD APPELDOORN: Okay. We can hear you fine though. Vance.

VANCE VICENTE: I am here. Vance Vicente, present.

RICHARD APPELDOORN: Jason.

JASON COPE: Jason Cope, SSC.

RICHARD APPELDOORN: Reni.

JORGE GARCIA-SAIS: Reni Garcia, SSC member

RICHARD APPELDOORN: Tarsila.

TARSILA SEARA: Tarsila Seara, SSC.

RICHARD APPELDOORN: Joe.

JOE KIMMEL: Joe Kimmel, SSC.

RICHARD APPELDOORN: Kevin.

KEVIN MCCARTHY: Good morning. Kevin McCarthy, SSC.

RICHARD APPELDOORN: Walter.

WALTER KEITHLY: Walter Keithly, present.

RICHARD APPELDOORN: Churchill.

CHURCHILL GRIMES: Churchill Grimes, SSC.

RICHARD APPELDOORN: J.J., are you there?

JUAN CRUZ-MOTTA: Can you hear me?

RICHARD APPELDOORN: Perfectly.

JUAN CRUZ-MOTTA: Excellent. J.J. Cruz, SSC member.

RICHARD APPELDOORN: Okay. Now I'm just going to go through the list of people as they appear on my screen, and so that has probably something to do with the order in which you signed in. Give your full name and your affiliation, please. Liajay Rivera.

LIAJAY RIVERA: Liajay Rivera, council staff.

GRACIELA GARCIA-MOLINER: Graciela Garcia-Moliner, council staff.

RICHARD APPELDOORN: Ricardo Lopez.

RICARDO LOPEZ: Ricardo Lopez, Puerto Rico DNER.

RICHARD APPELDOORN: Thank you. Sarah Stephenson.

SARAH STEPHENSON: Sarah Stephenson, NOAA Fisheries.

RICHARD APPELDOORN: Natalia.

NATALIA PERDOMO: Natalia Perdomo, council staff.

RICHARD APPELDOORN: Nelson Crespo.

NELSON CRESPO: Good morning, everyone. Nelson Crespo, DAP Chair, Puerto Rico.

RICHARD APPELDOORN: Okay. Bill Arnold.

BILL ARNOLD: Bill Arnold, EBFM Technical Advisory Panel Chair.

RICHARD APPELDOORN: Good morning. Christina.

CHRISTINA OLAN: Christina Olan, council staff.

RICHARD APPELDOORN: Carlos Farchette.

CARLOS FARCHETTE: Carlos Farchette, council member, good morning to all.

RICHARD APPELDOORN: Thank you. Mandy Karnauskas.

MANDY KARNAUSKAS: Mandy Karnauskas, Southeast Fisheries Science

Center.

RICHARD APPELDOORN: Iris.

IRIS OLIVERAS: Iris Oliveras, council staff.

RICHARD APPELDOORN: Thank you. Scott Crosson.

SCOTT CROSSON: Scott Crosson, Southeast Fisheries Science Center.

RICHARD APPELDOORN: Guillermo Diaz.

GRACIELA GARCIA-MOLINER: He's in the chat. The mic is not working, and so Guillermo Diaz, NOAA Fisheries, Southeast Fisheries Science Center.

RICHARD APPELDOORN: Thank you. Francesca Forrestal.

FRANCESCA FORRESTAL: Francesca Forrestal, Southeast Fisheries Science Center.

RICHARD APPELDOORN: Jocelyn.

JOCELYN D'AMBROSIO: Jocelyn D'Ambrosio, NOAA Office of General Counsel.

RICHARD APPELDOORN: Adyan.

ADYAN RIOS: Good morning, everyone. This is Adyan Rios, Southeast Fisheries Science Center.

RICHARD APPELDOORN: Alida Ortiz.

ALIDA ORTIZ: Good morning. This is Alida, Outreach and Education Advisory Panel.

RICHARD APPELDOORN: Thank you. Helena Antoun.

GRACIELA GARCIA-MOLINER: Helena is in the chat, and she says that sorry, but my setup makes audio difficult, but she's online.

RICHARD APPELDOORN: Okay. Orian Tzadik.

GRACIELA GARCIA-MOLINER: He just texted me, and he can hear us, and so he's there.

RICHARD APPELDOORN: Okay.

ORIAN TZADIK: Orian Tzadik, Pew Charitable Trusts.

RICHARD APPELDOORN: Wilson Santiago.

WILSON SANTIAGO: Hello, everyone. Wilson Santiago, Puerto Rico DNER.

RICHARD APPELDOORN: Bill Cordero.

BILL CORDERO: Good morning. Bill Cordero, staff interpreter, present.

RICHARD APPELDOORN: Thank you. Shannon.

SHANNON CALAY: Good morning, everybody. This is Shannon Calay, Southeast Fisheries Science Center.

RICHARD APPELDOORN: Maria Lopez.

MARIA LOPEZ: Maria Lopez, NOAA Fisheries.

RICHARD APPELDOORN: Marcos Hanke.

MARCOS HANKE: Present, Marcos Hanke, CFMC Chair.

RICHARD APPELDOORN: Skyler.

SKYLER SAGARESE: Skyler Sagarese, Southeast Fisheries Science Center.

RICHARD APPELDOORN: Matt Kammann.

MATT KAMMANN: Present.

RICHARD APPELDOORN: Thank you. Kelly Montenero.

KELLY MONTENERO: This is Kelly Montenero from NOAA Atlantic Oceanographic and Meteorological Laboratories in Miami.

RICHARD APPELDOORN: Stephanie Martinez.

STEPHANIE MARTINEZ: Good morning. This is Stephanie Martinez from the Southeast Fisheries Science Center.

RICHARD APPELDOORN: Kelly Quinlan.

GRACIELA GARCIA-MOLINER: I am not getting anything in the chat either.

RICHARD APPELDOORN: All right. We can come back. Damaris.

DAMARIS DELGADO: Good morning. Damaris Delgado from Puerto Rico DNER.

RICHARD APPELDOORN: Thank you. Diana, I guess we heard from you already.

DIANA MARTINO: Good morning. Diana Martino, Caribbean Council staff.

RICHARD APPELDOORN: Miguel.

MIGUEL ROLON: Miguel Rolon, Caribbean Council staff.

RICHARD APPELDOORN: Nancie Cummings.

NANCIE CUMMINGS: Good morning. Nancie Cummings, Southeast Fisheries Science Center.

RICHARD APPELDOORN: Alexis.

ALEXIS SABINE: Alexis Sabine, U.S. Virgin Islands DPNR Fisheries and Wildlife.

RICHARD APPELDOORN: Thank you. Julie Neer.

JULIE NEER: Yes, I am here.

RICHARD APPELDOORN: Okay. Sennai Habtes.

SENNAI HABTES: Good morning. Sennai Habtes, University of the Virgin Islands.

RICHARD APPELDOORN: The rest that I have are I think unknown callers.

GRACIELA GARCIA-MOLINER: Can you call Caller 1, 2, 3? They should know who they are.

RICHARD APPELDOORN: Caller 10.

RICARDO --: This is Ricardo --.

GRACIELA GARCIA-MOLINER: Ricardo, can you identify that you're a fisherman or --

RICARDO --: A fisherman. Good morning to all.

RICHARD APPELDOORN: Thank you. Caller Number 9. No response.

GRACIELA GARCIA-MOLINER: Nothing in the chat.

RICHARD APPELDOORN: Okay. Caller 7. Nothing from Caller 7. Caller 4.

KEVIN MCCARTHY: Hi, Richard. This is Kevin McCarthy. I think that's me.

RICHARD APPELDOORN: Okay. Are you also connected through the computer, or just by the phone?

KEVIN MCCARTHY: The audio is through the phone. I had some issues with audio through the computer, and so I'm seeing it on the computer and talking through the phone.

RICHARD APPELDOORN: All right, but you can text in the chat box, so we know when you want to speak?

KEVIN MCCARTHY: Let's find out.

GRACIELA GARCIA-MOLINER: Yes, we have him on the chat. Thank you, Kevin.

RICHARD APPELDOORN: Graciela, am I also supposed to see the chat window?

GRACIELA GARCIA-MOLINER: You are supposed to be able to see it. Do you have the bubble for the chat?

RICHARD APPELDOORN: I've got it now. Thanks.

GRACIELA GARCIA-MOLINER: You have Kelly Quinlan, who is online, but has not stated her name for the record.

RICHARD APPELDOORN: She can do that now.

GRACIELA GARCIA-MOLINER: We have someone online by that name, and so we'll just keep track of it, and I think you have called everyone in the participants list.

RICHARD APPELDOORN: Yes, I think so, at least on my screen.

GRACIELA GARCIA-MOLINER: If there is someone else who comes online, they can send us a message through the chat, and we will

record their presence.

RICHARD APPELDOORN: With that, we will then turn our attention to the agenda. There are basically three items on the agenda, and one of them is technically given no time and accurately reflects the time it will take to give that, and that's the National SSC Update.

After that, we will look at, or revisit, if you will, the SEDAR 57 spiny lobster assessment, and we're working toward the final steps for that, which would be to determine the ABCs for spiny lobster, and Adyan is going to show us what needs to be done to move forward with that and to hopefully get that finalized at the next council meeting.

Then, after that, everything is going to be working on the ecosystem conceptual model, and we're still working on the generic version of that, and we will work on that for several days, as we move from the generic model hopefully into the adaption of that model into the individual island fisheries, and so that's basically the agenda, as it works, and we are scheduled to --

GRACIELA GARCIA-MOLINER: Today you end at 4:00, but, again, except for now, the time when we began, you can alter the agenda as you see fit, and you will see that there are lapses of time in the week, and so you might want to rearrange that now. Like Wednesday, I think we only have the morning, and then nothing in the afternoon, and so you might want to go ahead and look through the whole agenda and fix it, as needed, or change it, as needed.

RICHARD APPELDOORN: I am certainly open for discussion or comments from the committee members on some changes that they see at the moment. My perspective is this is going to be somewhat of a let's-see-how-we-go approach, and we may need to do some modifications on the way, should we either finish some things quickly or need more time to discuss them, and so, as always, the timeframes in the agenda are a first-guess at what we're hoping to do.

GRACIELA GARCIA-MOLINER: Two things. Adyan just sent a text regarding can we go back up to the SEDAR time in the morning today, and so they will probably need more time, and so this needs to be rearranged, so that it will give them more time, up until the end, and when do you want to finish that, at 12:00 or 12:30?

ADYAN RIOS: Let's start by going through until 12:30 and then see if that's everything, or maybe after lunch as well, and I would suggest three hours.

RICHARD APPELDOORN: Okay. We might need a short break somewhere during that time, but we'll see how it goes.

ADYAN RIOS: How about until noon and then we start up at 1:00?

GRACIELA GARCIA-MOLINER: Richard, you don't have to have from 12:30 to 2:00 in the afternoon for lunch. You can change that and come back at 1:30, and you have Doug Gregory wanting to ask a question.

RICHARD APPELDOORN: Go ahead, Doug.

DOUGLAS GREGORY: Are there documents related to the lobster presentation that we can get by email? Sometimes it's hard to follow just on this one screen.

GRACIELA GARCIA-MOLINER: Let me check. I thought I had sent the presentations earlier this morning, but I will check again, because we have had some issues with the email, and Miguel can attest to that, and so I will do that right now, while you finish the agenda.

DOUGLAS GREGORY: Thank you.

RICHARD APPELDOORN: I can say that I have not gotten anything this morning. Any other issues with the agenda from anybody?

GRACIELA GARCIA-MOLINER: I do have a question, a clarifying question. Do we need to change the Wednesday and add the afternoon right now, or can the agenda be adjusted as we go? That's probably a question for Jocelyn, because, right now, the way the agenda is set up, it's set up for Wednesday morning only, and I don't know if you want to continue Wednesday afternoon or if you want to finish every day at 4:00, because they have different times during the different days.

JOCELYN D'AMBROSIO: I think, if you try to set up now what your plan is, you can adjust from there if you need more time, and so, at the end of the day -- If you set forth a plan in the morning, and you still have stuff left, you can come back to it and say, okay, well, tomorrow we're going to discuss -- Or continue that discussion, and so it can be a little bit flexible, but we just want folks to have a general sense of the topics that are going to be discussed and when.

RICHARD APPELDOORN: Thank you, Jocelyn. It sounds like we're probably going to start a little earlier this afternoon than 2:00, if we really want to have say three hours for the SEDAR presentation, but we might -- When we actually break that will

depend on when we get to a good spot to do that, but I guess our goal would be to maybe run to I would say 12:30, at the latest, before we break for lunch.

GRACIELA GARCIA-MOLINER: I have sent the presentations that Shannon and Adyan are going to do today, and I apologize if there is more than one email coming your way with the same set of presentations.

Richard, do you want to just tell everyone about the National SSC, and then we will make -- Who is going to begin, Shannon or Adyan? We will make them the presenter, and they can do the SEDAR presentations.

SHANNON CALAY: I think the first presenter will be Adyan Rios.

GRACIELA GARCIA-MOLINER: Okay.

NATIONAL SSC UPDATE (33:55)

RICHARD APPELDOORN: All right, and so let me give you my less than one-minute update on the National SSC Meeting. This was scheduled for August, in Sitka, Alaska, and the subject was going to be ecosystem-based fisheries management, and we were looking to focus in three areas.

The first one was on ecosystem indicators, and there were two components of that, how to incorporate various ecosystem indicators in the stock assessment process and using ecosystem indicators to conceptualize stock assessments using ecosystem status or condition reports, for example.

The second major topic was developing information to support management of interacting species, in consideration of ecosystem-based fisheries management, and the third one is how to assess and develop fishing level recommendations for species exhibiting distributional changes.

Some of these have more application to some jurisdictions than others. Clearly, for us in the council, the first one, looking at ecosystem indicators, is going to be very important for us, and we'll see how it goes. The way the meeting is set up is normally there are one to two expert presentations that are given to introduce these areas, and then those are followed by questions and then more general discussion on these points. At this point, however, it's already been agreed to postpone the meeting to 2021, and so stay tuned. Any questions on that?

If not, I know that Adyan had suggested a change to the agenda, which was to add, quote, wrap up lobster, unquote, as a tab under the 2:00 to 4:00 timeframe, but I think we pretty much agreed that lobster was going to continue after lunch, and so maybe we could just continue then, and, Adyan, you're going to give us a presentation on SEDAR 57, spiny lobster, and how we get to ABCs and OFLs.

SEDAR 57 SPINY LOBSTER (37:07)

ADYAN RIOS: Correct. To start out, we'll be reviewing the presentation, which is a slimmed-down version of what you last saw in October, and this is the presentation that was given in December to the Caribbean Fishery Management Council, and it's just to kind of remind everyone of what -- Remind everyone of -- You know, it might have been a while since you last saw the report and recall what all the data inputs were, and so this is to provide context for the discussions that will follow.

This has some background slides that we'll get through pretty quickly. This is just a little bit of context of what stock assessments are used for, the process of how the stock assessments are developed, and we reviewed the regulations for spiny lobster, with particular attention to the minimum size limit of 3.5 inches carapace length.

We also, for context again, review what the current ACLs are, and we have this table that further shows how lobster -- How important it is in the region, and most of you are familiar with all of this information, and so I'll keep going. We have the assessment history for spiny lobster in the region, noting that they have yet to be used as quantitative stock catch advice, quantitative catch advice, and that brings us to the current assessment, which is SEDAR 57, where Stock Synthesis was used, which is an integrated catch-at-age model.

That means that it simulates and tracks cohorts of fish, or lobster, as they age, and the model simulates the dynamics or characteristics of a biological stock, like growth, as well as the characteristics of the fishery, like target size or fishing effort, and this is a powerful tool, because it is flexible with the types of data that you can use and the types of stock and fishery characteristics that you can simulate.

So SS, how does it work? This is just a brief overview of how the model works. The data that we have give us pieces of information about reality, and then the model uses equations for various populations and fishery dynamics to create a simulated reality

inside the model.

It searches over different parameter values for those equations, to try and match that simulated data with the realized data, and the goal of the model is partly that we want to have a good match between the simulated data and the real data, and we also want to have believable values in the equations used to model to create the simulated data.

We get to choose which values in the model that we want to try and solve for, and those are referred to as the estimated parameters, and we also get to choose which assumed values we want to force the model to use, and those are called fixed parameters.

I also want to just briefly review the process that we used in SEDAR 57, which was starting with low complexity, and so, first, low complexity models were examined, and that means those with a simpler setup and fewer estimated parameters, and then we explored adding complexity.

This process provided a plan for either borrowing information or reducing complexity if the model resulted with poorly-estimated parameters or non-convergence. Tables of those step-by-step processes, ending with the base models, are provided in the stock assessment report and its addendum.

All three models have this information in common, and so, on this slide, we will review the summary of the inputs to each model, and the inputs fall into two categories. There are data inputs, as well as the parameters, the initial parameters, and there were two types of parameters, estimated parameters and fixed parameters, in each assessment model.

Generally, when you have more data, the model has more information with which to estimate more parameters, and the great feature about SS is that, when you assume fixed parameters, you're still able to explore the implications of different values, allowing you to identify if the model is particularly sensitive to a specific assumption, as well as identify where additional research would be particularly informative.

Under data, we have annual removals by gear and annual length composition by gear. For estimated parameters, we have unfished recruitment, selectivity, and retention, and, for the fixed parameters, we have growth, natural mortality, maturity, steepness, the sex ratio, and a time block to represent changes in retention due to the implementation of size limit regulations.

The next slide will go over the data, followed by the fixed parameters and the equations used in the assessment. Here, we have the annual removals in the top three plots, as well as the number of length samples in the bottom three plots, by year. The top figure shows the landings data used in the assessment, and most landings in St. Thomas come from pots and traps. In St. Croix, most landings are from the diving gear, and, in Puerto Rico, it is a combination of the two.

The bottom figure shows the number of individual lobster lengths used in the assessments, and the gears with most landings are also associated with the most lengths measures by the Trip Interview Program, especially in recent years.

Moving on discussing the parameters, starting with growth, we utilized parameters from Leon et al., where males have a larger terminal size than females, and this figure on the left shows a histogram for the carapace length by sex across all islands and gears, and notice that there are more large males than females. The figure on the right shows the relationship between age on the X-axis and length on the Y-axis for each sex that was used in the model.

Here are the references for the other six parameters, and natural mortality was 0.34, and release mortality was deemed negligible. the equations and values used for fecundity and maturity at-length are shown on the right. Notice that these lengths, where 50 percent of lobsters are mature, this L50, is similar to the 3.5 inch carapace length minimum size limit, and the 3.5 inches is eighty-nine millimeters.

That covers the data and the fixed parameters, and now we'll talk a little bit about the estimated parameters, and so this selectivity is a fishery characteristic, and the modeling process explored both asymptotic and dome-shaped selectivity relationships.

Just to remind folks, the asymptotic, or logistic, relationship is, at a certain size, everything becomes selected, and so that can be visualized this net. Anything larger than that net size will be retained, and so the selectivity will be one, as opposed to a dome-shaped selectivity, where individuals within a bin of certain lengths are selected for, and then, above a certain size, they are not selected for.

This is an important relationship, because the top curve assumes that everything above a certain size is vulnerable to the fishery, and the bottom curve assumes a plate-size relationship, where large

lobster are assumed to be less selected for than plate-sized lobster, and so the large lobster are assumed to be less selected for by the fishery than plate-sized lobster. This could be because the large lobster are not targeted or because they are not accessible to the fishery.

These figures show the estimated dome curves for each main fleet in the assessment, and the table on the top shows that each of the assessments achieved a better fit with the dome-shaped selectivity compared to the logistic selectivity, with the better fit being represented by a smaller value, or a smaller negative log likelihood.

We talked about, so far, the methods that are general to all three of the models, and now we'll just do a quick summary of each of the individual models, and, for St. Thomas, there were two fisheries in the model, with selectivity at-length estimated for the selectivity estimated for the pot and trap fishery, which contributes the most of the landings and the most of the length measurements, and the selectivity from that pot and trap fishery was mirrored for the diving fleet.

This model assumed an initial F of zero and had retention blocks to account for the minimum size limit introduced in 1985. There is a period of 2004 to 2006 where undersized reporting was evident, and that period was not included in the retention block. The estimated quantities were the unfished recruitment and the selectivity.

Moving on to St. Croix, there were two fisheries in the model as well, the diving fleet and the pot and trap fleet, and selectivity at-length was estimated using an informative prior borrowed from the St. Thomas model, and so that was estimated for the diving fleet and mirrored for the trap fleet. Initial F was also assumed to be zero, and the retention time block to account for the size limit was from 1985 to 2016. Now the estimated quantities are similar to St. Thomas, where the unfished recruitments are not, as well as with three selectivity parameters that had informative priors.

In Puerto Rico, there were also two fleets, and the selectivity at-length was estimated for each fleet. The initial F was set to zero for the pot and trap fleet and estimated for the diving fleet. The minimum size limit, while introduced in 1985, seemed to have been enforced starting in 1999.

Therefore, the retention block was 1999 to 2016, and, here on the bottom-left, we see the estimated quantities, which were the

unfished recruitment, the initial F for the diving fleet, the selectivity for each fleet, and so that's three parameters for each fleet, and the retention parameter for each fleet.

Moving on to the derived quantities from the model, here are the predicted trends for the fishery, for fishing mortality and for the spawning biomass over time. The top plot shows the estimated proportion of the stock killed by fishing each year, and the bottom plot shows the percentage of spawning depletion. Note that increases in fishing are associated with a decrease in spawning stock. They kind of mirror.

This slide reviews a little bit about the sensitivities as well as the diagnostics that were explored for all of these models as well as some of the recommendations from the review workshop, and so this points to summarizing that the assumptions of natural mortality, growth, initial F, and the selectivity were explored, and, for diagnostics, the report includes retrospective, jitters, correlation analyses, and likelihood profiles.

The panel, the review panel, concluded that the status was not overfished, and there was not overfishing, resulting from the base case models, using a proxy for MSY of SPR 30. There is also some notes here about the research ideas, research areas for improvement from the reviewers, and we can come back to that, perhaps. Ultimately, the reviewers recommended the model setup presented to you today, referred to as the review workshop base case.

Here are the conclusions, quantitative conclusions, from the review workshop base case, which used the placeholder proxy of SPR 30 percent, and these models resulted in a conclusion of not overfished and not -- These models resulted in a conclusion of not overfished for all three islands, since the current biomass estimates were above, right here where my cursor is, the biomass at the MSY proxy. These results also suggest not overfishing, since the current fishing rate was below the fishing rate associated with the MSY proxy.

We also had, resulting from those models, the provisional projections for OFL, and these started in 2017, utilizing the available data for 2017 and using that also for 2018 and projecting forward, and, so, later, we'll be reviewing a presentation where these have been updated, but what we learned from this was that the projections showed fairly high values that reflect the status of not overfished, meaning that these projections move the projected landings towards that level of MSY, which is the maximum level of landings that can be sustainable on a year-to-year basis moving forward, and so, while there is a trend here, that is the

direction the projections move towards, and we'll be looking at updated values of these later today, where we have information through 2020, and the projections start from 2021 to 2026.

Here is the final slide of this first presentation, where we just have the summary outline of the model inputs and summary of model recommendations, and I will leave this slide up as I ask if folks have any questions so far.

RICHARD APPELDOORN: Any questions from the committee for Adyan?

GRACIELA GARCIA-MOLINER: I don't have anything in the chat.

ADYAN RIOS: Okay. Will we be taking a break before the next presentation?

JORGE GARCIA-SAIS: Given what's going on with the locals and the restraint of fishermen by -- There is almost no restaurants, and, the sudden drastic drop in demand of lobster, would that have any implications, in terms of the projections that you have set up in these models?

ADYAN RIOS: Later, in the third presentation, when we review the revised projections, we will discuss the values used for 2020 and how that would potentially be affecting the future projections, and we will cover that probably in the third presentation, and so is it okay if I wait to answer that question then?

JORGE GARCIA-SAIS: Sure. Thank you.

ADYAN RIOS: All right. No problem.

RICHARD APPELDOORN: Go ahead, Adyan, or whoever is doing the next presentation.

ADYAN RIOS: Shannon will be up next. I think her presentation froze. Can we ask for five minutes?

GRACIELA GARCIA-MOLINER: I wouldn't mind. Richard?

RICHARD APPELDOORN: A five-minute break? Is that the question?

GRACIELA GARCIA-MOLINER: Yes.

RICHARD APPELDOORN: Yes, we can do that, and that would get us back at 11:15.

GRACIELA GARCIA-MOLINER: Okay. Perfect.

RICHARD APPELDOORN: Okay. We will break until 11:15.

(Whereupon, a recess was taken.)

GRACIELA GARCIA-MOLINER: We're back, and we're good to go.

SHANNON CALAY: My apologies. I had some technical difficulties, but I will just introduce you a little bit. This is a presentation that I made for the December council meeting, and it just describes and reviews how the control rule would function for a data-limited assessment, and so I thought it might be useful to review that here.

The first sheet just shows some definitions that are important. Overfishing simply means that the annual rate of catch is too high, that it's above FMSY or its proxy, and maximum sustainable yield is the largest long-term average catch that can be taken under existing conditions.

Scientific uncertainty, we are defining this as the uncertainty in the information about a stock and its MSY reference point, and so sources of scientific uncertainty could include the stock assessment results themselves, time lag in assessment updates, projection uncertainty, and potential changes in the ecosystem or environmental effects, as well as other factors.

There is also management uncertainty, and it's generally the role of the council to determine how to handle management uncertainty, and that would be uncertainty in the ability of managers to constrain the catch, so that the annual catch limit is not exceeded, and it could also be uncertainty in quantifying the true amount of catch that is taken, or it could be late catch reporting, misreporting of catch, underreporting, or other factors.

Many of you have seen all of the acronyms that are used in the lexicon, and so we have OFL, which is the overfishing limit, and overfishing occurs when catches exceed this level. If you fish at FMSY over the long term, then you should achieve the maximum sustainable yield. At some level equal to or below OFL is the acceptable biological catch, the ABC, and that is the catch which is reduced below OFL to account for scientific uncertainty, and, typically, this reduction from OFL to ABC is defined by the SSC's ABC control rule.

Another level, which can be equal to or below the ABC, is the annual catch limit, and that is the catch level that would invoke accountability measures, such as time/area closures or gear

restrictions, et cetera, et cetera, and, finally, some councils have chosen also to use another level, which can be equal to ACL or below, which is the annual catch target, and this is just a level that could account for management uncertainty or could be set to achieve some estimate of optimal yield. Now, the final two levels are generally the purview of the council to select.

Calculating the overfishing limit, the overfishing limit, again, is a level of catch that, over the long term, fishing at that level will achieve maximum sustainable yield. It also is the level above which overfishing will occur, and so OFL is actually estimated from stock assessment results. That's how you get a true quantitative estimate of OFL, is to run a stock assessment, and so, even at Tier 3, which is what this data-limited stock assessment is, it will produce an estimate of OFL, and so, in Tiers 1 through 3 of your Caribbean control rule, all of those stock assessment results could be used to compute the OFL.

The recent spiny lobster assessment, in all three island platforms, is considered a Tier 3 stock assessment, and so what we need from this meeting is -- Well, this was presented to the council, and so we were asking the council to give us an acceptable risk of overfishing, P*, so that this SSC could develop estimates of ABC, and so the council has given us a range of P* values, which Adyan will present to you, and our job here as the SSC is to finalize our estimate of scientific uncertainty, or sigma, that can be used to produce the ABC.

I think we can breeze through this, but, in your Tier 3 data-limited stock assessment, it is for data-limited or out-of-date stock assessments, and it does produce what we call status determination criteria, and so, using these results, we can give you the maximum fishing mortality threshold, the minimum stock size threshold, and the maximum sustainable yield.

We can also give you the OFL, which happens to be the annual catch when fishing at MFMT, which is typically FMSY or its proxy, and we can give you an estimate of ABC, as long as we have quantified the minimum level of scientific uncertainty, which we're calling sigma min.

How does it work? First, you estimate the OFL from the stock assessment results, and so I will show you what that would look like. This is just a theoretical example, where we have a stock assessment which has produced a point estimate of OFL. In this case, it's 100,000 pounds, and so, in this case, you would run the stock assessment once, and you have not characterized the scientific uncertainty. You have one point estimate.

Now, if you actually consider some of the built-in scientific uncertainty within the stock assessment model, you will get variance in the various data inputs and the model parameters, which produces a range of OFL estimates, and this is what we call the PDF, or probability density function.

In this case, it's on OFL, and that point estimate, which I have identified here with the red bar, is typically the median of that distribution, and so the 50th percentile, and the red line here that I've drawn is just the cumulative density function, and so, basically, if you sum across all of these results, you have 100 percent of the estimates are summarized by the time you get to say about 280,000 pounds.

This is a little bit confusing, but where does overfishing occur? In this case, it actually occurs if your estimate of OFL is actually higher than the true OFL, and so, if your true OFL is actually between zero and 99,000 pounds, say, then you will be overfishing if you take 100,000 pounds or above.

What is ABC? ABC is the acceptable biological catch, again, as reduced from OFL, in the language of Magnuson, by some estimate of scientific uncertainty, and it's also reflecting the acceptable probability of overfishing, P*, and that acceptable probability of overfishing cannot exceed 50 percent, and, in fact, it should be below that, for reasons that I will show you in a moment, but, again, there are two variables that determine the size of the reduction. It's sigma min, the scientific uncertainty estimate, and P*, the probability of overfishing.

First, let's just look at P* in isolation. Again, the highest legal P* is 0.5, which is a 50 percent probability of overfishing. You should only ever consider a P* near 0.5 for data-rich assessments or when scientific uncertainty is negligible. Most councils in the U.S. have chosen P* values ranging from 0.3 to 0.4, and they do this to avoid triggering an overfished determination, and so they basically buffer, so that there is a buffer in the yield between OFL and ABC, so that they don't exceed OFL and trigger an overfished or overfishing status determination, which can require then management action, including a recovery plan.

I have shown here, in the table, P*s ranging from 0.5 down to 0.25 and a sigma min of 0.36, in this case, and it's from the theoretical example that I showed you earlier, where the OFL is equal to 100,000 pounds, and so, if you look down this table, you will see that, any time you set a P* of 0.5, then, essentially, the ABC is

equal to the OFL. There is no -- That would be assuming that there is no scientific uncertainty, and that's true any time you set P* to 0.5, and so, although it's the highest level allowed by the law, it is exactly the same thing as saying that scientific uncertainty is negligible, and there would be no buffer between ABC and OFL.

If you set P* values that are lower, you will see that the buffer expands, and so this yellow line is a P* of 0.4, and that returns an ABC of about 91,000 pounds, which is a 9 percent reduction from OFL, and then, if you drop down to the green line, that is a P* of 0.25, and it returns an ABC of 78,000 pounds, which is a 22 percent reduction from OFL.

Now, remember there is a second factor here, which we'll discuss next, which is the minimum level of scientific uncertainty, and that will also affect the size of your buffers, and so here I used a sigma min of 0.36, and where did I get that from? That is from a paper by Ralston et al. 2011, and what he did is he looked at fifteen different historical stock assessments, or actually seventeen different stocks, finally, ultimately, and the first figure shows you fifteen historical stock assessments of Pacific whiting, and it shows you that, as you conduct stock assessments, sometimes you will see a lot of change in the results of a stock assessment, and this may occur because of different implementation methods, different stock assessment models that are used, different datasets that are available, or different analysts that may conduct the stock assessments.

This is a fairly -- The Pacific whiting case that I am showing you, Figure 1 here, is a fairly substantial level of scientific uncertainty. Not all stock assessments are this disparate, as you do them over time, and so, in the bottom table, he is looking now at seventeen different stocks that were all North Pacific stocks, and he has computed the scientific uncertainty from all the deviations between the different model results, and that median -- Actually, what he determines there is that the true minimum scientific uncertainty of those seventeen different data-rich stocks was 0.36.

In this paper, what he recommends is that, for a data-moderate stock, you would choose a value twice as large as sigma min, and so, for a data-moderate stock, he would recommend 0.72, and, for a data-limited stock, I think he's recommending an even larger sigma min of 1.4.

Now this shows you the size of the buffer between OFL and ABC as a function now of both the scientific uncertainty, sigma min, which

you will see I have done values from 0.36 to 1.44, as well as the P* value, the probability of overfishing, on the Y-axis, values from 0.25 to 0.5, and so, again, in every case that the P* is 0.5, there is no buffer between OFL and ABC, and ABC is 100 percent of OFL at a P* of 0.5, and you're assuming there is no scientific uncertainty.

At values of 0.4, say, you will see that there is about a 10 percent reduction in OFL, between ABC and OFL, at a sigma min of 0.36, and, way down in the brown color, at a sigma min of 1.44, you have about a 30 percent buffer between ABC and OFL, and Adyan is going to show you more results like this for the actual spiny lobster assessment.

These were presented to the council, and this is before the update of the projections. I was showing an example, which happened to be St. Thomas spiny lobster, with an OFL estimate of 160,000 pounds, and then I was showing essentially the -- If you assumed a sigma min of 0.5 in the Tier 3 control rule, which states that you're going to use two-times sigma min, and so that means the resulting sigma chosen for this would be one, two-times 0.5, and so that's where you see from P* values of 0.5 that would result in no buffer, and so ABC would 160,433 pounds. A P* of 0.4 would give you 124,528 pounds, and all the way down to a P* of 0.25, the largest reduction, is 81,727 pounds for ABC, a 49 percent reduction from OFL.

RICHARD APPELDOORN: Excuse me, Shannon. On your screen, you are showing both the current slide and the next coming one, and that's reducing the size that we're able to see these tables at, and so is there a way to just show the current slide?

SHANNON CALAY: I am going to try. There we go.

RICHARD APPELDOORN: Then now would you go through that slide again?

SHANNON CALAY: Yes. One more time, and this is important, and so I'm glad to do it. I am looking now only at how one would estimate the ABC value for St. Thomas spiny lobster in the year 2020, and so this is just an example of how this is done for a single estimate of ABC.

The OFL estimate for St. Thomas spiny lobster in 2020 is 160,433 pounds, prior to the update, which Adyan will show you next, and so this is from the council meeting in December. Now, the bottom table shows you the ABC estimate that would result in 2020 for St. Thomas spiny lobster from a P* value of 0.5, all the way down to

0.25, and then this one happens to assume that Tier 3 sigma min of 0.5, and so the sigma is two-times 0.5, or 1.0, and that's the assumptions of this slide, and you will see that, at a P* of 0.5, and I'm looking at the bottom table, the ABC is 160,433 pounds, which is equal to the OFL. There is no reduction at P* of 0.5.

The second row down, a P* of 0.45, is a 12 percent reduction from OFL, and so your ABC is 131,488 pounds, and they continue to -- There continues to be a larger reduction, a larger buffer, between OFL and ABC as your P* value decreases, and so are there any questions about this calculation or this slide?

It's just a reminder to everyone that P* values are typically -- In the way we set up this control rule, they typically will be selected by the council. They have asked us to consider values between 0.4 and 0.45, and so we have produced those, and Adyan will show them to you, and the sigma value is what represents scientific uncertainty, and that is the purview of the SSC. In a preliminary discussion, you had selected a sigma min of 0.5, but I'm not sure if that was a formal decision, and, in Tier 3, you used two-times sigma min.

The last slide, I think, just shows you how -- In this slide, I have assumed that P* is 0.4 and sigma min is 0.5, and so I have actually calculated the ABC value for each year, 2020, 2021, and 2022, for St. Thomas, St. Croix, and Puerto Rico, and so you can see here, on the top table, the OFLs that are produced from the stock assessment prior to updating it, and, in the bottom table, these are the preliminary ABC values, and, in the table on the very bottom, I am just comparing the ACLs from the 2012 fishery management plan and then the ABCs from the island-based fishery management plan and the ACLs and also the SEDAR 57 MSY estimates.

RICHARD APPELDOORN: Shannon, can you explain why, in the top table, the numbers go down? Is that because we have decreasing uncertainty going forward?

SHANNON CALAY: All of these stocks of spiny lobster are not overfished and not experiencing overfishing, and so they are currently at a level of spawning stock biomass that is above the level that produces MSY, and so there is surplus biomass that you can remove, and the law allows you to, and so the law says you can fish to FMSY, and so an F that produces MSY in equilibrium, and so, when you fish at FMSY, you take all the surplus biomass for a few years, and the stock actually declines to equilibrium, and so that is what is happening here.

It's not uncertainty, but it's that you're in a healthy stock

status, and so the stock assessment says go ahead and fish out all of that surplus biomass until you get to the level that produces MSY, which I think is at the bottom of the slide, and so you would be basically taking the stock down to a level where it produces about 134,000 pounds in St. Thomas, 128,000 pounds in St. Croix, and 433,000 pounds in Puerto Rico, and this stock assessment would tell you that you could fish at that level forever.

Now, of course, every time you update a stock assessment, these values could change, and that's why we recommend, for all stock assessments that are for high-priority stocks, that they be assessed about every three to five years, and so these don't stay in the books forever unchanged. We do reexamine them every three to five years, to make sure that there's no new information that changes our perception of the stock condition. If that's not clear, we can try to produce some graphics, later in the week, that would illustrate that better.

RICHARD APPELDOORN: So what you're saying is that we don't know what the future is going to be, in terms of the capacities of the markets for the species over time, but there is an equilibrium value that we would eventually get to, and that's kind of where the bottom is, and you can't go below -- Actually, you wouldn't be able to go above that, and is that correct?

SHANNON CALAY: Yes, and you achieve an equilibrium value, and, in this case, we're looking -- All of these metrics that I am showing in these tables are yield, and so, essentially, you're taking the stocks down to a level of spawning stock biomass that produces the maximum sustainable yield, and the MSY, in the case of St. Thomas, is about 134,000 pounds, and so, once you achieve that 134,000 pounds in equilibrium, if you continued to fish at that constant F value and took that yield every year, you would assume that the spawning stock biomass is also constant at the level that produces that yield.

Whenever you have a stock that's in a healthy condition, that's actually at a level above the level which supports MSY, you see these decreasing yields in projections, and that's because you are taking off surplus biomass. If this stock was actually overfished, then your projection is you would actually be able to take a little bit more yield every year, until you got to 134,000 pounds, and so it's a little bit counterintuitive to many people.

RICHARD APPELDOORN: Thank you. Jason has made a comment, and, Jason, do you want to make that, or should I just read it?

JASON COPE: I can make it. I just wanted to make sure -- First,

off, Adyan and Shannon, I really enjoy these presentations, and I find them very clear, and this is a really good discussion on P* and sigma and so forth, and I just wanted the other SSC members just to have in our minds that it's really easy, once you have a nice presentation like this, if the council had the misconception that, oh, we determine our P* by the amount of catch we want, it's very easily done, as Shannon has shown, because there is three variables here, and, if you're determining sigma and P*, you will then determine your catch.

Therefore, if you know what you want your catch to be, and you know that the SSC has just given you a sigma of whatever, you can then pick the P*, and so I just wanted to make it clear, so there's some sort of communication that, ideally, you want the council to choose their P* and then out of the stock assessment comes the sigma measure, which the SSC could have a default sigma value or use what comes out of the assessment or some combination of the two, and then that's coupled with the risk tolerance chosen P* by the council. Hopefully that's clear, and, again, thanks for these presentations.

RICHARD APPELDOORN: Thank you, Jason. Shannon, I think you can go on.

SHANNON CALAY: That was it. That was the last slide, and so now Adyan has actually the updated stock assessment projections.

DOUGLAS GREGORY: I have a question about -- I think Shannon mentioned that the SSC had preliminarily chosen a sigma of 0.5. If someone could find that in our minutes, because I don't recall that. I remember a lengthy discussion led by Jason about the new analyses coming out of the North Pacific Council, but we never really got into it in detail. I will look for it in the old minutes myself.

RICHARD APPELDOORN: My recollection is in the definition in the control rule that each of the tiers, 1, 2, 3, specify that the sigma min must be such and such a value or greater, and so there is not a fixed number that's invoked there, but there is something that says, as we get more data poor, our sigma min value must go up, and it cannot go below a certain value, but, if the analysis comes up with a distribution that is say more spread out than what the minimum value is that we could use, we are allowed to, and probably should, use what the assessment is telling us, in terms of how broad that uncertainty is.

SHANNON CALAY: I just wanted to mention one thing, which is that, for example, the Gulf Council does use the PDF directly that comes

out of the stock assessment, but they are also working on a revision to their ABC control rule, because what has happened is we have recognized that the PDF estimate for OFL from any single stock assessment is an underestimate of the true scientific uncertainty.

Because we have so many fixed parameters, for one thing, and because we're not considering any other assumptions about the shape, for example, of the spawner-recruit function or what fleets might be represented, and so that's why the Ralston paper is important, because it gives you a better idea of the effect of a greater suite of uncertainty concerns considered for any particular stock assessment, and so our PDFs that we produce from any given stock assessment are an underestimate of the true uncertainty.

RICHARD APPELDOORN: In your presentation, when you first defined "scientific uncertainty", you said there is the uncertainty in the assessment, which is actually just what you're talking about now, and then there was the other things, like the time lags relative to updates and what the status of the ecosystem or the environment is as well, and so there is greater uncertainty in the assessment than what is reflected in the OFL, and then there's uncertainties that are outside of the assessment.

SHANNON CALAY: Yes, that's correct, but, Doug, I don't disagree with you that -- That's why we're here today, is that the sigma value needs to be documented, so that we can produce these ABC estimates and be sure that it's what the SSC actually agreed to.

DOUGLAS GREGORY: Thank you. I found in the minutes that what Jason presented in the updated paper, which we didn't see, was that that 0.36, which was the default sigma in the original Ralston paper, had been modified to be 0.5 as a default in the updated analyses, and I am not comfortable just accepting something like that without some thought and evaluation.

JASON COPE: I think we ran out of time last time. We were kind of heating up that discussion, and we definitely should have more of it. Last week, I was being reviewed by our SSC, presenting simulation results and a whole slew of other sensitivity runs on exactly these types of length and catch models that you're seeing here, because our SSC wanted to determine at what level, and essentially at what sigma, those types of models would -- At the appropriate time, I can give more detail on that.

I think what Shannon has shown here is the general overview outline, and they basically just need us to tell them what the

sigma and P* is, because that's out of their hands, and so we can have that discussion, and I can provide some more information, and I can send the published version of that newer updated Ralston et al. style of determining sigma, and it just came out in March of this year, and so I can send that out, if folks want to see it.

DOUGLAS GREGORY: That would be great. Thank you.

RICHARD APPELDOORN: Thank you, Jason. I mean, this is exactly why we're discussing this, because what this boils down to is going to be what are we setting sigma at for the analysis, and the council will set the P*. One way to avoid cherry-picking, on anybody's part, is to not present what the other side has done yet for each group that's discussing this. Is this now going back to Adyan?

ADYAN RIOS: I will get started. This presentation is updating spiny lobster projections of the annual overfishing limit and acceptable biological catch, and so the goal of this presentation is to review and discuss the latest provisional OFL and ABCs to obtain guidance regarding key components for which we need SSC input.

The first topic will be about the commercial landings of spiny lobster in 2019 and 2020 for each island platform, and then we will also review and discuss sigma values and build on top of what Shannon presented as well.

Recall that we can use the stock assessment to produce a forecast of OFL for upcoming years based on what we know, or can assume, up until the current year. Assumptions about landings in the current year are unavoidable, but necessary, to obtain final OFL forecasts for the next year for which management measures could likely be applied.

After discussing the commercial landings, we will also discuss which values of sigma min should be used to account for scientific uncertainty and move towards finalizing ABC recommendations. Recall that sigma min will account for scientific uncertainty, including sources of uncertainty like stock assessment results, time lag in assessment updates, projections, potential ecosystem and environmental effects or other factors.

In the first part, we're going to review recent landings and discuss what the landings are for the 2019 and for 2020 years in the model, and so landings by year and gear were tabulated for each island platform using the data available as of April 20, 2020.

In Puerto Rico, those landings data are complete through 2018 and 99 percent complete in 2019. For 2017, the 2016 correction factors were used, and, for 2019, the 2018 correction factors were used. In St. Thomas and in St. Croix, landings are complete through 2018, but not yet complete in the database for 2019. The 2019 data include records through early September.

To show preliminary OFL values and facilitate today's discussion, we used the assumptions that I will describe now, and so the values for 2020 in Puerto Rico were set equal to the average landings from 2017 to 2019. The 2019 and 2020 values for St. Thomas and St. Croix were set equal to the average landings from 2016 to 2018.

The plot on the right shows the landings by year and by gear, shown by the two colors, and the gears aggregated together are summed in black. The asterisks on the far right show the values currently used to develop the updated projections of OFL that we will look at in a moment, and so I will just stay a little bit longer on this slide and show that the assumed landings for 2019 and 2020 are not seemingly unusual years in how we set up this run, and, again, 2019, in Puerto Rico, was reportedly 99 percent complete, and so that value remains, and 2020, again, was those means, and so these values that were used are in the ballpark of recent landings.

Provisional OFL estimates, the updated OFL estimates are shown here starting in 2021, and these OFLs were estimated by projecting constant fishing mortality.

RICHARD APPELDOORN: Excuse me, Adyan. In your previous slide, you're just projecting based on past landings, but we've just had several months of basically closure to much of the economy, and I've heard different stories about how that has played out a little bit in the Virgin Islands versus Puerto Rico, but do these numbers reflect information that you are aware of, in terms of has fishing been say in higher demand or less demand in the various islands, because of the closures?

ADYAN RIOS: Those assumptions for the 2019 and 2020 years can be changed and re-run, based on discussions that we have at the end of this presentation, and we can also come to that, and so these OFL estimates and how they're produced can accommodate more information and can be revisited any time we have more information about those assumptions that we need to make, and I think that will definitely be a topic to talk about, the values used here, but I'm also going to talk a little bit more about how that plays out in the projections, again, since all of the stocks are not overfished, and they're all going to, over a somewhat short period

of time, move towards the value of MSY.

Yes, I will touch on the effects of what might be happening if landings are lower than expected or higher than expected in these assumed recent years, in order to produce the OFLs for 2021 forward, and that is a very important -- It's important to have a decision on what values to use, so that to move forward, finalizing the next step of ABCs, but we're also able to discuss what values the SSC might want to see and talk about how, unless those values are extremely off -- Let me go back to those values.

Unless these are extremely off, we're not going to see large differences in the projections that just move towards MSY. They will be higher if these assumptions of these current landings are actually much lower, but it will still move towards that MSY within a few years, and so, unless these projections are drastically higher, that's where we would see more of a concern, but we are able to run a range and show the implication of what much lower might mean, but, in order to do that, we would want the SSC's informed guidance on how low they would like to see that or if they would just want to do kind of this kind of ballpark approach, and that is completely adaptable and easy to update.

I think, as far as the conversation of what's really happening, I would prefer -- I would opt for us to have that at the end of this presentation, just to, one more time, talk about how OFL is estimated and show again the implication of what would happen if it was just kind of pretty static following these plots.

RICHARD APPELDOORN: All right, and so, if I understand correctly, then, really, these projections are not affecting the key point of our discussion, which is the sigma value that's going to be applied, and only to the extent that the variability in landings may be one of the factors that is incorporated into scientific uncertainty.

ADYAN RIOS: Not so much -- Go ahead, Shannon.

SHANNON CALAY: Not quantitatively. We're not going to do a quantitative estimate of how uncertainty in catch would result in a different sigma, but you could consider uncertainty in catch as one of the elements that contributes to sigma min. The SSC could consider that.

What we need to produce final estimates of OFL and ABC from this SSC is we need the sigma value, and we need a range of P*, and it can be a range, and we need an agreement on how to treat the provisional landings that occurred between 2017 and 2020, and so

we gave you what was available to us, and we did not incorporate any estimate of the economic effects in the most recent months, but the SSC could choose to tell us to please reduce the 2020 provisional landings by X percent, and we could produce that for you, and so it's very quick, if you guys want to explore what changes in the catches might be, and it's very quick to run one or two different scenarios, but remember that everything we do is multiplied by three, because there are three platforms, and so it would be nice to try to look at just a few scenarios, to see how variability -- How a difference in the landings in the most recent months, if it were half or double, for example, might change the stock assessment results, and that's something that could be done pretty quickly.

RICHARD APPELDOORN: Thank you, Shannon, and I guess go ahead, Adyan.

ADYAN RIOS: This slide goes to the OFL estimates for the scenario on the previous slide, given the assumptions and data described, again showing the models converging towards the maximum sustainable yield, and these values are higher than the maximum sustainable yield, because they are not the sustainable values.

They are the values that get you to that level of yield that you can maintain, that is the highest going forward, and, like Shannon said, when new data are available, models and projections can be updated, and I think she pointed out that high-priority assessments considered should be updated about every three to five years, as a recommendation.

As we have improved information about 2019, or 2020, we can re-run this information. Like Shannon said, it can be done quickly, and we can show you perhaps as soon as after lunch, or we can show you as well if more information comes in a few months from now, before the council meeting, and it would just be a request to incorporate that new information.

RICHARD APPELDOORN: Adyan, another question. These are projections based now, but, each year, we'll actually get the landings from what happened that year, and so is OFL in this context, and then the calculations down the line to ABC and ACL, are those all recalculated every year once the landings data from the previous year are known?

ADYAN RIOS: They can be, and so, for instance, when your projections are say 400,000 for Puerto Rico in 2021, but you learn that either much more or much less was caught that year, that's a situation where you would want to do that. If it's more or less

exactly where the projections were at, then it kind of holds.

RICHARD APPELDOORN: Okay. Thank you.

ADYAN RIOS: Back to P* and sigma. Like we can quickly adjust the assumptions of the projections, we can also run information for showing the impacts of P* and sigma, and recall that Shannon explained how the P* method is implemented, where the OFLs from this model count as the 50th percentile, and she showed an example where a PDF was generated by a model, but, in this case, the PDF would be generated based on the sigma value, and that together, the P* and the sigma, can be used to determine the ABC.

Below and on the left, there is the relationship of ABC over OFL for a range of P* values and initial sigma values, using two-times sigma min, following the ABC control rule, with sigma min values of 0.5, 0.75, and 1.0.

This plot is interpreted as with the sigma min of 0.5 and a P* in this range, 0.4 to 0.45, and the ABC results being somewhere from the eighties to low seventies and so on, is how you can interpret this, and we can also present this as the percent reduction instead of the ratio, and so new ways of presenting this can also -- Any preferences can be developed, but it also comes back to the conversation of what sigma min, or what range of sigma min, and what range of P* does the SSC want to see for the values that we have generated already or for the values that we can generate over lunch regarding the assumptions for the 2019 and 2020 years, keeping in mind that everything we do is times three, and so perhaps just a few alternate scenarios and a defined range, and we would be able to -- That might be helpful for the discussion.

Going to this discussion slide, I think we will take questions, and then we'll hopefully maybe use the chat to have people comment on what direction to go for those 2019 and 2020 assumptions, perhaps one or two alternate scenarios want to be considered, to show just how that change sort of results in perhaps a little bit more build-up of biomass, but it also shows how that similar trend of how things move towards MSY.

We also would be able to show what, discuss what, sigma min the SSC is interested in recommending and the range of P*s, which, for now, I've been showing 0.4 to 0.45, and Shannon pointed out that the maximum is 0.5, which would assume no uncertainty whatsoever, and, if there is any questions about the interplay of sigma min and P*, we can prepare materials as well. With that, I will see if there are any overall questions before we go back to discussing these topics.

RICHARD APPELDOORN: I have a question for either you or Shannon. I think someone said that most councils are looking at P* values between 0.3 and 0.4, and is that correct?

SHANNON CALAY: The Gulf Council provided its SSC with a range from 0.3 and 0.5, and most of the actual P*s that come out of the Gulf Council tend to be between 0.35 and 0.42, because they use a specific tiers and dimensions table to get at those results. The South Atlantic Council tends to use lower P*s for their data-limited stocks, and so I think they see values as low as 0.3 with some frequency for the data-limited stocks.

The way that the Science Center has approached this council's ABC control rule is we have asked the SSC to focus on the width of the PDF, or the sigma min, and, with some guidance, we are intending to allow the council to select a P* value, with some agreement that it should not, in the Caribbean, exceed certainly 0.45, because that produces very narrow buffers, but that's a negotiation with the council.

To a large extent, it is their prerogative, the way that this control rule has been specified, but this SSC is the advisory body to the Caribbean Council, and, as such, you certainly have the prerogative to discuss an appropriate range of P*s.

RICHARD APPELDOORN: Thank you for that clarification.

SHANNON CALAY: Maybe Jason knows more about what types of P* values are produced in the North Pacific and the west coast, but I don't know that.

JASON COPE: I can say, on the west coast, obviously, we heavily use this approach, and our P*s are most commonly between 0.4 to 0.45. That's typically where we land with the vast majority of our stocks, with sigma increasing as the assessments are considered more data limited.

RICHARD APPELDOORN: Thank you, Jason. Graciela, is it possible to get, up on the screen, our Tier 3 ABC control rule?

GRACIELA GARCIA-MOLINER: Yes, if you give me a second.

RICHARD APPELDOORN: Take your time.

DOUGLAS GREGORY: While she's doing that, I thought Jason told us at the last meeting that the North Pacific Council, or maybe it was the State of Alaska, normally picked a P* of 0.4999, which was

kind of ignoring all the uncertainty in the assessment.

JASON COPE: That was one example from a crab fishery in Alaska, and it was a federal example that happened a long time ago. I haven't followed up on that, and I think that was a huge no-no, and I'm hoping that that's been updated. That happened maybe five or six years ago now, but it was one of those stark examples of kind of wrongly playing this system. You were technically below 0.5, but 0.4999 is certainly not in the spirit of this approach, but that's a good example, but it was like kind of a one-off example that hopefully has been addressed.

DOUGLAS GREGORY: I was just curious what the circumstances might be, and I was particularly curious, since you mentioned the crab fishery, and we're dealing with another crustacean here, and, for the most part, crustacean fisheries tend to be more resilient than finfish fisheries, but we'll explore some of that later, but thank you.

JASON COPE: I mean, that is a consideration. I think one way to conceptualize what we're trying to do here is that we are simply trying to identify the best realization of uncertainty coming out of these assessments, and understanding the fact that, the more uncertainty you have, the more probability that that median value is just not going to be the most -- It's going to be defined risk-neutral, but, as far as risk-averse, it's not going to be a great measure, and I don't think the choice of 0.4999 was based on life history.

I think it was based solely on the fact that you want to maximize profits, or catches, which, if that is your management objective, against everything else, then that would be a reasonable decision, given that we're trying to balance that conservation, or sustainability, mostly, is the best way to put it. It's just to conserve catches so they can be optimally realized into the future, and those different factors get balanced, I think, differently, and I don't think the 0.4999 plays well in that system, but the management objectives question is really going to dictate, to a large degree, the P* you choose.

It's, I think, on the SSC's side, just to look at the assessment and determine how much of the sigma coming out of the assessment is fully realizing all of the uncertainty in the stock assessment, and, if it's not, as Shannon has said, almost assuredly these assessments are going to be underestimating the overall uncertainty, and so then it's our job to maybe set up these default values and then check them against the assessment, to see how much is coming out of the assessment, and hopefully that helps.

DOUGLAS GREGORY: Mr. Chair, can I follow-up, quickly?

RICHARD APPELDOORN: Go ahead, Doug.

DOUGLAS GREGORY: I agree with everything you said, and P* is a risk thing, and the councils, or at least the ones I have worked with, have had a very difficult time identifying risk levels they want to take, and I can imagine it being different for different fisheries.

In this fishery, we have no variability in recruitment, and I think the assessment said 4 percent from year to year, and we have a fishery that is not suspected of being well beyond any suspect of overfishing or in trouble, because it's based on external recruitment that's been constant, regardless of catches, and so, from a council standpoint, I could see, in this instance, choosing a P* that was close to 0.5, because of the circumstances of this fishery.

It would be nice if the councils can look at P* on a fishery-by-fishery basis and use that life history information to inform what they choose, and so, given my knowledge of the lobster fisheries and the fishery, I would be more inclined, since the council has already sent a range for us, to be more inclined to go with the 0.45, because there is a very low risk of really overfishing this fishery.

Now, that's a different issue than exceeding OFL, and OFL is this artificial construct that comes out of the assessment, but is the fishery in trouble, and would it be in trouble if we fished with a low risk, and we'll, I guess, pick up on this later, but thank you very much.

SHANNON CALAY: May I speak for a moment? I would yield to Jason, if he wants to speak first.

JASON COPE: Go ahead, Shannon, but I was just going to ask if we wanted to have the discussion, and this is a really great discussion, if we wanted to have it now or if we were waiting for it at a different time, but I would like to hear what you have to say.

SHANNON CALAY: Okay. Well, I had a follow-up to Doug's question or statement. The way we have envisioned the Caribbean control rule actually differs from what was done in the Gulf, and we have set it up so that the SSC can truly focus on sigma, and we have allowed, essentially, the P* discussion to occur at the council

and to be truly that risk of probability of overfishing that they're willing to accept.

I wanted to just briefly say why these two rules are different. In the Gulf, the SSC focuses on P*, and they do it through what's called a tiers and dimensions table, and so they look at, for example, whether we're running a stock assessment model that requires proxy, whether there is retrospective bias, and there's a number of different tiers that they examine, and then what pops out at the end of that exploration is a P* value.

They apply it directly to the PDF, which comes out of the stock assessment, and so sigma is not in the Gulf control rule. We have one realization of the base stock assessment model that we bootstrap, essentially, to give you a PDF, and the PDF tends to be very narrow in Gulf assessments. The sigma that would come out of that assessment is lower than 0.36, and so we are much more concerned, in the Gulf, about the level of P* that is selected by the SSC, but it alone determines the buffer, essentially. All of the PDFs that come out of Gulf assessments all come from data-rich stock assessments, and they're all very similar, and they're all narrow.

What we're asking the Caribbean SSC to do is to try to actually specify what is the appropriate sigma min, which is the width of that PDF, the width of the range of OFL estimates.

The council, in December, requested P* values ranging from 0.4 to 0.45, which is what we intend to give them, and then I assume that they intend to discuss what P* value to accept at their next council meeting, and so I think it's absolutely appropriate if this SSC wants to comment on the range of values the council should consider, but, ultimately, we're only asking this SSC for an estimate of sigma and the council to determine what P* they are going to use.

JASON COPE: Just to follow-up on there, I agree with Shannon, in the sense that I think our best focus is, one, on talking through sigma, and then I think, secondarily, having some sort of general guidance on P*, and, Doug, you mentioned 0.45, and I think that's a very reasonable top-end. Once you start going much above 0.45, you really start completely discounting scientific uncertainty, and so, if this SSC could maybe just have a discussion on that top-end and why you don't want to pick something like 0.4999 or something like that, and maybe even suggest, if the group is agreeable to it, some sort of cap of, like, at least at 0.45, that then does allow the council to go in and do all of the other consideration of the management objectives and the life history

and so forth and choose their P*s with just a little bit -- I think my bottom-line point here is that the P* needs to be -- It needs to let the scientific uncertainty from the SSC speak, because, if it doesn't, our job is taken away, and the scientific uncertainty doesn't matter.

I think there needs to be some discussion from the SSC on that kind of maximum P* value. Other than that, I think the risk and all of that other stuff comes with the council's prerogative to discuss it and determine it, and so those would be my two focuses for this group.

JUAN CRUZ-MOTTA: Can I ask a question to Jason? Jason, what would be your consideration on going towards the lower unit of P*, provided that the region is data-limited, but that's also to Shannon, I guess, that question. Thank you.

JASON COPE: Again, I think I like what Shannon is doing, kind of breaking these two things apart. By focusing in on the sigma and the scientific uncertainty, we can have a really nice discussion about what does it mean to be data limited and how does that translate into scientific uncertainty, because that's where a lot of the uncertainty is going to come.

Now, with that, and certainly in the Caribbean, implementation error and management uncertainty can also be significant sources, and those can come in at the ACL sort of level, and maybe even the ACT level. For us, focusing in on scientific uncertainty and sigma, I think we can do a lot to address the data-limited nature of things.

Now, the P*, you're right, and there is a coupling with it, and you might also decide, the council might also decide, to be even a little bit more less risk tolerant in a data-limited situation, but I think we lead with scientific uncertainty, and I think we come up with a system of treating data-limitedness with scientific uncertainty, and then maybe the council, knowing and understanding that, can understand what the risk is going to be, based on how much scientific uncertainty we are allowing to be kind of rolled into this.

If we only took out the uncertainty out of the assessment and everything is fixed, all the parameters are fixed, even if it's data limited, we would have a little tiny bit of uncertainty, which you would want to have a very low P*, to address the fact that, essentially, you think there's more uncertainty there than there is. If we do a good job of taking care of the scientific uncertainty side, I think the council has to struggle less with

the P* decisions that they make.

RICHARD APPELDOORN: With that, I want to have us look at what the control rule says for Tier 3, and hopefully Graciela will blow that up even further.

GRACIELA GARCIA-MOLINER: You do have access, in your laptop or computer, to look at it, but here it is, and is it better now?

SHANNON CALAY: I think in Tier 1 is where we might specify sigma min, but I don't see a specification here, and so I think all we decide is that, in Tier 3, we're using two-times sigma min, whatever that sigma min value is.

RICHARD APPELDOORN: Right, and so that's kind of -- It has to be no less than two-times sigma min, and it could be more than two-times sigma min, and I think the next question is what is the sigma that comes out of the analysis for each of the three islands.

SHANNON CALAY: Well, we can't estimate that. That's the difficulty, because, in order to more appropriately estimate that, we would have to have a lengthy history of stock assessments of these stocks with multiple different -- Over twenty years, we would have to have ten different stock assessments to compare, or we would have to have run a simulation with a much broader exploration of the possible uncertainty, and so we can't answer that. That's where a paper like the Ralston approach, or that has been done in other places, becomes very useful.

All I can tell is that, in the Caribbean, it's pretty data limited. In the data-rich stock assessments that were examined by Ralston, it produces sigma min of about 0.36 for data-rich assessments, and so it certainly should be larger than that, but, beyond that, we can't tell you that number from this stock assessment alone.

RICHARD APPELDOORN: All right, and we had an update from Jason saying that that value was actually 0.5 now.

JASON COPE: Yes, and now it's 0.5, and, at a time that you think is appropriate, if you want me to give a really short updated status of how the west coast is treating their data-rich, data-moderate, and data-limited assessment sigma, I am happy to do that.

RICHARD APPELDOORN: I think that would be a good idea, and, it being 12:30 now, we could break for lunch, and that would give you a little time to organize your head on that, and I am suggesting that we meet back at 1:45. Any complaints on that? If not, then I suggest that we break for lunch now and reconvene at 1:45.

GRACIELA GARCIA-MOLINER: 1:45 it is.

RICHARD APPELDOORN: Thank you, all.

(Whereupon, the meeting recessed for lunch on May 18, 2020.)

- - -

May 18, 2020

MONDAY AFTERNOON SESSION **(143:45)**

- - -

The Scientific and Statistical Committee of the Caribbean Fishery Management Council reconvened via webinar on Monday afternoon, May 18, 2020, and was called to order by Chairman Richard Appeldoorn.

RICHARD APPELDOORN: Welcome back, everybody. At least I hope you're all here. I think the first thing I just want to do is, since we have the Tier 3 control rule up on the screen still, is make a comment on that.

Nowhere in the document does it say what sigma min is, and, therefore, that is one of the things that we should be looking at in this exercise, and it actually said that sigma could actually be a coefficient of variation, rather than the variance, but I guess we don't particularly have that, but I have a question for Shannon, if she's here.

SHANNON CALAY: I am still here.

RICHARD APPELDOORN: Great. In the probability density function, we do get the possibility of something being very narrow and something being very wide, but there is no way to quantitatively convert that into say a starting point?

SHANNON CALAY: Well, I can tell you, from all of the data-rich SS stock assessments that we have produced for the Gulf Council, they all share a PDF that happens to have a CV of about I believe 0.1, and so they're quite narrow, and that happens because of the fixed parameters. We're usually fixing growth parameters, and we're fixing M, and we're fixing some of the selectivity and retention parameters, and that is the case for this assessment, too.

We fixed most of the parameters, and so, really, to get a better idea of the scientific uncertainty, we would have to estimate those

parameters with some kind of a prior, and, furthermore, we would have to consider between-model variability, which has not been done, and so, if we give you the PDF that comes straight out of this stock assessment, Adyan has already estimated that there are deviations, but what I am cautioning you on is that it is a known underestimate of the true scientific uncertainty, and it's a vast underestimate, and so I don't think it's useful.

RICHARD APPELDOORN: Okay. Thank you for that clarification.

SHANNON CALAY: You're welcome.

RICHARD APPELDOORN: I think the next thing we were discussing before the break is Jason was going to give us a little bit on the perspective of what was happening in the Pacific, especially in reference to this updated analysis of what sigma values might be recommended, and so, Jason, are you there?

JASON COPE: I am here. I will sort of keep the time tight here, so we can have discussion, and so just to step back to the Ralston et al. and why there was another study done very recently, it was the Ralston et al. paper was based on the estimation of uncertainty that came from uncertainty in spawning biomass only, and now, when it comes to setting an OFL, we understand that you partially need biomass uncertainty, but you also need uncertainty in whatever the FMSY proxy or FMSY estimation is, and there is other uncertainty beyond just biomass that gets rolled into the OFL.

This new study actually looked at the PDF for OFL and not spawning biomass only, to define the sigma, and, when you look at that OFL, and they did this for data-rich assessments on the west coast, a bunch of them, and they compared -- Actually, they re-did the Ralston approach, doing just the spawning biomass, and they got back a sigma of around 0.36 again, and so they could kind of show you that, look, even with the newer assessments and the way that we treat them, we're still getting a sigma and spawning biomass around 0.36, but, when you compare that to the OFL, they were getting an OFL estimate of uncertainty around 0.5-ish.

As Shannon said, these are data rich, and, when we say data rich, we also mean information rich, in the sense that there's a lot of data, but they're also estimating probably more parameters, and so you're rolling in a bit more uncertainty in there. It's still an underestimate, to be honest, of the overall uncertainty, but they came out with a brand-new sigma of 0.5.

The other thing that they have done, and this is not something -- I wanted to bring this up, because I think we need to take this in

steps, and just sort of articulating where sigma is coming from and how that's being defined and moving forward with I think is a great step for us to take here.

The other thing that the west coast has done, that is opening up a whole new can of worms, is this idea of how long until the next assessment are you going to use projections from this current assessment, and so, if you do an assessment next year, it's not such a big deal, but, if you're going to revisit a certain stock, maybe five or ten years down the road, they now also have a, for lack of a better term, a sigma penalty, and so the sigma actually increases the farther away you get when setting catch limits from the assessment year that the assessment is done in.

What this does is it makes -- As you project down the line what the catches will be, those buffers away from the OFL start to increase more and more and more the farther you get away from the best available scientific information that is the current assessment benchmark, and so there's that aspect, but what that does is create this scarcity issue of we need more assessments, and then, all of a sudden, everyone wants more assessments, yet no one is hiring more analysts to do them, and so I just want to say that I think it's really good for us to consider what's been done before, because there's been a lot of work on this concept, and we should borrow concepts from other places that have done a lot of this background research for us.

I don't think we necessarily need to take all of those steps all at once, and so focusing just purely on a sigma for a stock assessment in this current year, this newly-updated default for a data-rich of 0.5, seems well-backed-up, with the caveat that everything coming out of an assessment -- One assessment realization is always a bit of an underestimation there.

What you can do is you can consider maybe modeling the specification error on top of internal estimates and pick certain things that, in this case, maybe that are fixed, like M or something, natural mortality, and bracket that uncertainty and see how much that increases sigma, and so there are things that we can think about in the future to maybe enhance, but I think this 0.5 for a default for kind of the best-case scenario is a very good foundation for us to build off. I will take questions, if anyone has anything.

RICHARD APPELDOORN: Any questions for Jason? Jason, I have one, or maybe two. This increasing of sigma as the years progress since the last assessment, is this actually a built-in thing, or is this something that gets looked at each year and a decision made?

JASON COPE: Good question. It's built in. There is an equation that calculates say if you were going to project the next assessment for spiny lobster, and it wouldn't be for another five years, and you could project out, from this equation, what the increasing sigma would be, and so, when you forecast it into the future, you would get those OFL estimates, or basically ABC estimates, based off of those assumptions of an increasing sigma.

What's great about the fact that this assessment is done in Stock Synthesis is Stock Synthesis does all of these calculations. You put in the sigma, and so you would calculate what the vector of sigma would be over the amount of years you want to look, but it does -- It does all of the calculations for us, and so doing this into the future, as long as we provide what the sigmas are, analysts can run this in Stock Synthesis very, very easily, and so this is a nice system to be able to work in.

RICHARD APPELDOORN: But then there is the problem, as you say, of demand for reassessment, I guess, as this is driving down ABC values, and has that created problems yet, other than the fact that, yes, we would like to see something, but they actually run up against limits, because they can't do the assessments quick enough?

JASON COPE: These sigmas are brand new, and we are just about to start to implement them in these next coming years, and I think, this last year, when we did assessments, it was the very first year we had implemented them, but you are absolutely right that this is causing this worry that, if we don't do assessments more and more and more often, we're going to get penalized more and more and more.

Now, the honesty there is the fact that, as you drift away from the most recent assessment, there is this -- There is more uncertainty, as you get away from that information, and so that is honestly there, and one of the things that we've tried to figure out is, in order to kind of reset the sigma, so you don't gain that penalty, can you do a more expedited, simpler update to the benchmark, and so not have to put in everything, but maybe put in the most recent catches, just so you're tracking catches, and then maybe you take upon yourself all of the same life history values and model specification and just project it with the most recent catches, and that would qualify as kind of resetting the sigma, and so that's something that could be discussed.

If we wanted to reset the sigma and not -- If you wanted to go through the system and have sigmas kind of deteriorate through

time, how do you reset them, and can you do something simple, so the analysts aren't overwhelmed with doing full-on stock assessments and everything that is asked of them and do maybe a simpler update that resets it, and so that's a discussion that could be had.

RICHARD APPELDOORN: That was kind of the nature of the conversation we had when we were talking about the projections of the catch limits into the future, and these could be updated as we actually get that information. Go ahead, Doug.

DOUGLAS GREGORY: Jason, the new sigma calculation is based on recruitment variability and incorporating recruitment variability, from looking at the paper you sent out, and I'm just looking at the abstract.

The issue I have, the concern I have, is this particular fishery, the spiny lobster fishery in the Caribbean U.S. islands. There is not any recruitment variability. In fact, we have external recruitment, and I think it was in the stock assessment that said, despite landings trends going up and down, recruitment has been stable, and I know this is all very formulaic, and it's all based on the National Standards. Not Magnuson, but the National Standards, but I don't know if it really applies to this fishery as a formula.

That's why it's like step back and think about how this fishery operates and how close to being overfished or undergoing overfishing it is or is not and use some judgment in this and not just apply a formula taken from the west coast, which is extremely variable, particularly in the more recent years, with the climate change and stuff, and so that's my main concern is just not apply everything as a strict formula. Thank you.

JASON COPE: Doug, that's an excellent question, and let me see if I can separate a couple of things out, because what you're saying is we do want to be thoughtful in applying things from other areas into this area, and so there is two bits of -- Let's say there is two major sources of uncertainty that could play into the scientific uncertainty that we care about, and one is what you're saying, which is what we call a process uncertainty, and sometimes they call it process error, but it's basically just the natural variability in the population, things that change over time, whether it's the life history parameters or recruitment, things like that.

Then there is this other side, which is the thing that we're really concerned about a lot in assessments, is this measurement error,

this inability to collect data perfectly and therefore inform our model in the best way possible, and so we see two things in this lobster assessment. One is, as you said, relative to maybe like groundfish on the west coast of the United States, their reproductive variability and recruitment variability is much lower.

The other thing though that we see that is different from those other assessments that are done on the west coast is there are a lot of fixed parameters here, and we assume growth and natural mortality and all these other things are fixed, meaning we know them exactly, and Shannon, I thought, did a good job of outlining several places where measurement and modeling uncertainty interact to create a whole lot of uncertainty, and so we have these two sources of uncertainty.

With lobster, I think the natural variability side might be less than the groundfish on the west coast, but the measurement error and the model specification error, in particular for this one, because we have a lot of fixed dynamic assumptions, might be very large.

When you put those two together, this is what the west coast sigma is measuring. It's measuring both, and so, to your question, I think you're probably getting at how much is that overall sigma process natural variability error versus measurement error in the assessment, and, in my experience of doing these sorts of assessments, the measurement side, or model specification error, the sensitivity to just assuming natural mortality is one thing versus something else, is -- It can be really large, and these models are very sensitive to those things.

I think your point is a good one, and it should be captured, and I think it does not discount the sigma coming from the west coast is something useful to look at, because most of that error, in my opinion, is coming not from recruitment variability, but it's coming from the parameter issues, which, to be honest, on the west coast, they totally underestimated over there, because they are not really doing model specification error. They're doing a lot of internal estimation of parameters and the uncertainty coming from it, and so what are your thoughts on that?

DOUGLAS GREGORY: I understand what you're saying, and I agree with you, and our estimate of landings over the years is very poor for this fishery, but this is a stable population, for all intents and purposes, with very good basic management measures that probably don't require a quota at all, and what we've been trying to do for the last fourteen years is develop ways of accommodating

the National Standard Guidelines, this formulaic approach.

The Ralston approach, and what the west coast is doing, is just an attempt to fill in the blanks in one way, and this way that they're doing it appeals to a lot of people, because it's simple, and it doesn't require a lot of work, and I agree with everything you've said, and I believe that our scientific uncertainty is probably infinite, in reality, and none of these measures really capture it, but we're trying to make something work, and that's why we're doing all of this, and so I will get off my soapbox. Thank you.

RICHARD APPELDOORN: To some extent, the width of the PDF distribution arises because they are accounting for some of the potential variability in those parameter estimates, and is that correct?

JASON COPE: Correct, yes. It's not purely just recruitment variability.

RICHARD APPELDOORN: No, I'm not talking about the paper. I'm talking about our lobster situation. The reason you get variability in your estimates is you have run this thing many times, and you're varying something, which I understand was we're varying the parameter values across the biologically realistic range that we think they might occur, and so some of that is reflected in the PDF, but, as Shannon clearly stated, even what you get out of that is grossly underestimating the real levels of uncertainty, but it's not like we're just taking fixed parameters and that's it. We do explore what the variability is in these parameters.

JASON COPE: Right. There is selectivity being estimated, and Adyan laid out all those parameters. Most of the productivity of the stock is being fixed, and that's where a lot of uncertainty can come in, and I think that's where Shannon's explanation comes in, is that, despite estimating certain parameters, the scale of the population, the initial size of the population, and then the selectivity parameters, there is still a lot of things, basically in the biology, that we have fixed, and you can put in different values for that and see how that changes the results, and so you can explore that model specification error in addition to this.

I had a question, and we keep talking, I think, Tier 3, and I'm reading Tier 2, and it would seem that this assessment fulfills Tier 2, and is that not right, or is there something about the time series of the data being in it, because I understand there is catches and there's lengths, and there is a time series of both of those things, and so just a clarification of is this a Tier 2 or

3, because I think that's the other thing that the SSC wants to make sure we're -- As far as the control rule, that we're looking at, what we're considering categorizing this as.

RICHARD APPELDOORN: Well, unfortunately, Shannon had to step out at two o'clock, and so I don't know if Adyan wants to tackle that one. In our discussions with Shannon, it's always been Tier 3, data limited.

ADYAN RIOS: I agree with Rich that most of the discussions have been Tier 3. I guess we would need more of Shannon's input. It seems right on the line, because, when it comes to Tier 2, we're not generating the PDF from the assessment.

JASON COPE: But you could. A PDF is coming from the assessment. I mean, it could be generated, but it just hasn't been expressed, and would that be another way to say it? It's not that the model that you ran has an inability to produce a PDF or OFL, but it just wasn't considered, because this is being looked at as a Tier 3.

ADYAN RIOS: I think that's a correct statement, and that's the level of parameters and additional runs that you would have to do to more completely capture uncertainty, and the SS model would have required more work, and so this is a kind of data-moderate run, where that was not yet accomplished, and so, as you alluded to earlier with just the selectivity parameters and the initial F being the values that are estimated, and only the estimated parameters, in addition to a few others, will carry forward the uncertainty, and so uncertainty of a lot of the fixed parameters, which I can pull up the slide of the fixed parameters later if we want, are not being captured currently, and so that's why Shannon referred to the OFL from the current SS models as drastically underestimates of what the uncertainty would be if that was done more comprehensively.

JASON COPE: Exactly, and so we've been talking a lot about sigma as basically a Tier 1 sigma, and let me just say 0.5, just for a value, but that would be different in a Tier 2. It wouldn't be 0.5. It would be something different, and then, like on the west coast, our Tier 2 doubles the sigma, arbitrarily, and now it becomes 1.0, and, in Tier 3, they quadruple it, or double it from the Tier 2, and so that becomes two, and so it's very, very large, and so that's the other part of the question here, is, if it is Tier 2 or Tier 3, treatment of this 0.5, or whatever the default Tier 1 is going to be, is different, and I think this also plays into what Doug is saying too.

Anyway, it's kind of -- Formalizing if it is a Tier 2 or Tier 3 is

probably also going to dictate what our ultimate sigma is going to be, because we don't have calculations for that. It is going to have to be, at this point, probably some sort of adjustment from the Tier 1, because it's not going to assume the Tier 1, and it looks like there is some guidance here, 1.5, and I'm not sure what the other one is, Tier 3, but that's another discussion point.

RICHARD APPELDOORN: Our multipliers are 1.0, 1.5, and 2.0, and so they are smaller than what was being discussed earlier, which was two and four, and so, if we use the 0.5, then the smallest we could make sigma would be 1.0.

JASON COPE: Right.

DOUGLAS GREGORY: In the stock assessment report, at least in two instances, it refers to this assessment as a data-limited/data-moderate assessment, and so it is like borderline. Thank you.

RICHARD APPELDOORN: I would be very uncomfortable having us dictate what level this is at, and I would like to hear that from Shannon, and maybe get her opinion when she gets back online.

JASON COPE: I agree that that's a good idea. I think having Shannon's input would be really valuable.

RICHARD APPELDOORN: But, if we are at a borderline, we're still going to go with Tier 3, and that would inform us in terms of how we're going to treat the sigma.

JASON COPE: Exactly.

RICHARD APPELDOORN: I see our job here is, following the discussion and the points raised by Jason and Doug, is we need to start someplace, and so there's two things. What is going to be maybe our basic sigma min that we're going to start from, and, secondly, what is our multiplier going to be?

We are constrained about -- Like, for a Tier 3, the multiplier has to be at least two, and it could be much greater than that, if the situation warranted it, and so we have flexibility in both of these areas, and we're going to have to justify whatever we do. We have, I think -- If we were just to say, okay, we're going to go with the 0.5, because that's the best guidance, and our control rule says it's a Tier 3, and we multiply it by two, and sigma is now 1.0, and we're done, then I think that's kind of the default situation that doesn't require any further justifications, because that's basically what the control rule states.

If we're going to make the sigma much higher, the multiplier much higher, shall we say, we would say, okay, the minimum value would be two, but we think, in this fishery, for whatever reasons, there is a lot of variability that's not being accounted for, and this is likely to have significant impact, given the history of the fishery and the variability in the stock, and then we're going to justify using some other higher value. Does that sound like kind of a regional way that we're going?

JASON COPE: Yes, I think so. I mean, there's a lot we could talk about, but I think there's also room here, given that -- Like I really appreciate what Doug has brought up and how we're having this conversation, and there's also good points where we could do some future research recommendations, where it says we would like to maybe differentiate out, in this area, the contribution of a process versus measurement error, and maybe do some investigations on that, to refine what we're doing, but there isn't a right answer hiding out there, which I think what you've laid out I think is a logical way.

We have evidence where we can start, and we have some good starting points here in this document that outline the control rule, and I think we just start putting those together, and then, where we feel like we would like more information, is it possible maybe to write those as research recommendations that would help refine this.

RICHARD APPELDOORN: That's going to something in the longer term though, yes?

JASON COPE: Yes, and I certainly won't dictate time scale on that, but that would be something that would, I guess, in just prioritization for research -- At least it's documented as these are things that would help the SSC come to either further refinement in this system. How that wants to be prioritized in the future I think is a different question, but at least capturing those things that would help us might be good.

RICHARD APPELDOORN: Graciela is pinging me to point out that Guillermo Diaz had a comment, saying the assessment didn't use an MSY-based benchmark and it used MSY proxies, as indicated in Tier 3, although I thought Tier 1 also allowed the use of proxies.

JASON COPE: I will say that the use of proxies is pretty standard in many places in the country, even in the most data-rich, because there's an admittance that FMSY, or MSY, can be hard to estimate within our assessments, and, therefore, proxies are -- They are fairly standard. We use them all the time on the west coast, for

everything, and not that we have to use proxies, but I don't see why that would be a good reason to lower the tier ranking of something, because it's using a proxy, in and of itself. That's my opinion.

RICHARD APPELDOORN: Thank you. This has been a great conversation between myself, Jason, and Doug. I would love to hear from some of the other committee members about what they think might be a way to proceed, given what we've been talking about.

WALTER KEITHLY: I have been listening, and I agree entirely with Doug. If you go back to the stock assessments, you will notice, and, again, it's in the minutes from the last meeting, because I brought it up there, but, if you go back to the last stock assessments, you will see that recruitment in St. Thomas and St. Croix, throughout the time period, only varied from a low to a high of 3 to 4 percent. In Puerto Rico, the variability was about 7 percent from the low to the high.

Yet, in the same time period, reported catches on the island would vary by 50 to 75 percent, and, again, saying that the reason for this, to some extent, would be that much of the recruitment is external, and, if that is the case, and I won't get into the P* or anything of that nature at this point, but, if the overwhelming proportion of recruitment is external, I do not see a reason why the ABC could not be very close to the OFL, and, given the setup that we have on the control rules, I don't see how that can be the case. I think we're kind of stuck with these control rules, which limits our ability to select an ABC that may be more realistic, in this case. Thank you.

JASON COPE: I do want to hear from others, and I do have a contribution in response to that, but I would like to hear from others, and so, Rich, when you feel it's appropriate, I can add my additional sense.

RICHARD APPELDOORN: Okay. Are there other comments? Please step forward.

JORGE GARCIA-SAIS: Rich, we have uncertainty about the uncertainty, and that is a problem, but it's kind of like an abstract problem, but, nevertheless, we see that the fishery is stable over time, and so, again, I sort of go back to what Walter was saying. We would probably be pretty good on a value close to OFL, and even a 0.45 that we were discussing earlier in the morning I thought was reasonable. I mean, it's a very abstract problem, because it's kind of like we don't know what we don't know, but we know it's stable. Nevertheless, we don't have the data-rich

resources to go to. Am I too off?

RICHARD APPELDOORN: No, I think your point was well made.

JASON COPE: Rich, can I add a perspective to that, just for others to think about?

RICHARD APPELDOORN: Yes, go ahead.

JASON COPE: The stability of the populations is very important, and I have zero disagreement with what is being said here. I think one of the other dimensions though -- That, we're talking about kind of the productivity of the stock and how it recruits and does it not recruit much and then all of a sudden recruit a lot and create a lot of variability, or is it just constantly kind of getting recruited to, and that's one dimension, and that can be measured on a very relative basis.

Stability is looked at as a trend, and that trend has no scale, and it doesn't -- It's just looking at whether it's pointing down or up or it's flat. One of the biggest sources of uncertainty, and one of the reasons, I believe, there are tiers in assessments, Tier 1, 2, and 3, is the fact that, as you move away from a data-rich, regardless of whether the species is highly dynamic or has very stable population dynamic attributes, is we lose the ability to understand how many are actually out there, and so the scale of the population, the actual absolute abundance, becomes less and less known as we move down these tiers.

When you enter a more data-moderate or data-limited, a lot of that uncertainty, again, aside from the population dynamics, is coming from the fact that you don't know how much is actually out there, and, if you don't know how much is out there, even if the rate of the population is stable, you multiply that rate by the actual abundance to get the OFL, and this is why the Ralston et al. -- That they first fixated on abundance, because that's where most of the uncertainty was coming in for our assessments, but we just don't know how many invertebrates or fish are out there.

A lot of that uncertainty is coming from that measure, and I believe that we have the same case here with lobster. Even if they're stable, how many are actually out there is not really well known, and it gets worse the less data we have, and, because you fix a lot of the population life history parameters, you now create a situation where you say you know a lot about the population biology, and then that fits it to the catch, and it makes you pretend like you know more about the scale or how many are out there than you do.

Once you start loosening up and exploring different values for those life histories, like growth and natural mortality, the scale of the population estimate changes, and it can change a lot, and, again, it's separate from whether this population is stable, growing, declining, highly variable, or whatever.

I just wanted to add that dimension here, and I hear what everyone is saying about the population dynamics, and they are very different than what we deal with on the west coast, and so it's apples and oranges, but, as far as this problem with scale and estimating scale, we have the same problem as the Caribbean has, as everyone in the world has, and that's figuring out how many actual fish are out there, and that is the bulk of scientific uncertainty that we are dealing with.

I do believe that Tier 1, 2, and 3 do, in reality, have different scientific uncertainty levels, because we don't know how many animals are out there, separate from the population dynamics, and so I want to just, as part of this discussion, have us remember that aspect. The productivity side, I think we've got really good expert opinion here on what's going on, and we also want to be able to put that with our certainty, or lack thereof, and how many animals we think are out there, because we have to have that to set a catch limit.

Now, whether we manage by a catch limit or not, truly that's a whole other discussion that is extraordinarily important to the Caribbean and elsewhere, but the simple fact that setting a weight or number-based catch limit -- It has to have an estimate of how many are out there, and I think that's where a lot of the uncertainty that we're really talking about in sigma is truly coming in. Thank you.

RICHARD APPELDOORN: Okay, and so I have two comments on that. One is the SSC, in the past, especially when we were dealing with lobster in the Tier 4 scenario, was basically on record as saying we don't know where the population levels are, but we believe they're actually pretty good, because of the -- This is because of the other management measures, but, particularly, the carapace length minimum size that was in place that seemed to be very effective in maintaining -- We actually were above that in the catch, and so, even though that level was high, we weren't even necessarily driving our catch down to that level.

On the other hand, and Adyan didn't show the graphs this time, but, in the previous presentation, she showed how the fisheries track on the -- I forget the name of the graph, where you've got

the four zones divided by the biomass and fishing levels, and one of the fisheries, and I'm thinking it was St. Thomas, but it could have been St. Croix, actually crossed into someplace that it was not supposed to be for one year and then came down again.

Probably that's as much a reflection of uncertainty in the estimates as what was really going on in the fishery, but that's what's driving what the assessment is going to be relative to what the catch limits are, and so, if we are in a situation where one of the fisheries could actually go over that limit, then we're going to have to shut things down. The closer we make that limit to the MSY, the greater the probability you could actually have to do a rebuilding plan or something like that and not just a slight adjustment.

While we certainly had the opinion that things were very good, we had this one outcome that said, hey, you know, we were approaching where we shouldn't have been, and it was actually because of there were serious problems that the Virgin Islands had economically, and those fisheries cracked back down into places that were very safe, but, if we ever get out of the corona business and actually get tourism back and things like that, potentially we could be driving these things in some areas, and we don't know, based on what these models were telling us, and that's what is going to be used to set those limits.

JASON COPE: That's a really good point, because, just as a reminder for us, ABCs -- If you exceed an ABC, that's not overfishing. It's when you exceed an OFL. ABC, and, ultimately, the ACL, which can be set to be exactly the same thing or not, those are meant to trigger accountability measures for us to go, wait, hold on, we're getting maybe too close to something we don't want to happen and what should we do.

By setting a lower ABC, and therefore ACL, that's not saying we're going to be causing overfishing to occur more often, but it's just that we're setting up a system that can be maybe more accountable to overages that are now getting us closer to the OFL, because there's a lot of uncertainty, whether it's management, implementation, or scientific uncertainty, that we think threatens -- If we make the ABC close to the OFL, we're right close to the edge, and we have very little room, and do we truly believe that we don't need much room away from each other, and so, Richard, I think you brought up some good things for us to think about.

SHANNON CALAY: I just wanted to let everyone know that I'm here again.

RICHARD APPELDOORN: Shannon, right into the fire. While you were gone, it was pointed out that perhaps our assessment is meeting, or almost meeting, a Tier 2 criteria, and so we wanted to get your view on that, because that clearly determines how we're going to look at things.

SHANNON CALAY: When we were developing guidance for the tiered control rule, we had talked about what was a data-rich versus a data-moderate and a data-limited assessment, and a data-rich assessment has composition data, indices of abundance, and catch, typically, or it had at least two of the three, and so that's what made a data-rich assessment, that it had two of the three components. A data-moderate assessment -- I am just trying to remember.

A data rich assessment had the three components, and, therefore, a possibility that you could estimate the FMSY estimate directly, and a data-moderate assessment has two of three of those components, and so it has either catch and CPUE or it has catch and length composition data. A data-limited assessment may have only one reliable component, such as just length composition data, and so this assessment does have catch and length composition data, and so the crux of this argument is really whether you believe that the catch data is reliable and the length composition data is reliable.

If you think that either one of those two data inputs is not particularly reliable, then this becomes a data-limited assessment. If you think that the catch data is reliable and the length composition data is reliable, then this is a Tier 2 assessment. The Science Center's position is that this is a data-limited assessment, because we have strong concerns about the reliability of the catch estimates.

WALTER KEITHLY: I have a question for Shannon. If the catch data are not reliable, what would that say about the reliability of the stock assessment itself?

SHANNON CALAY: Well, obviously, this is a data-limited assessment, and the only choices we have, because this is a federally-managed stock in an FMP, is to rely only on the catch information and do a Tier 4 or, as we have believed, and the CIE has agreed, that the length composition data and the life history information makes this more reliable, in the sense that it suffers from the same data uncertainties as the Tier 4 catch only, but it is actually -- It does contain more data with higher reliability. I mean, basically, if you don't believe that the catch is reliable, a Tier 4 approach would not be reliable either, and this is an improvement

over that.

WALTER KEITHLY: Thank you.

JASON COPE: To get also at -- Walter asked a really good question here, and I think it brings out and highlights some of the strengths and weaknesses of the current assessment model, and, in light of what Shannon has said, the most uncertain is probably this catch history. What we get from a catch history is kind of that what we were just talking about. That helps you understand how many animals are actually out in the water.

The length composition data are going to get you that kind of stock status, how is the population kind of doing in a relative sense, and is it probably doing all right or not doing so good, and then, lastly, all of those fixed life history parameters are telling us how productive the stock is, and so the biggest uncertainty, again, comes into that estimate of how many are actually out there.

To take this argument into the Tier 2 or Tier 3, technically, this has two out of the three, and you could say it has two out of the three inputs, catch and length composition, but we're highly uncertain about one, and, therefore, the sigma value should be larger, because we have scientific uncertainty in our measurement of the catches, or you could say this is a data-limited, Tier 3, because -- I think this is kind of saying the same thing.

You could then say this is Tier 3, because we have uncertainty in the catches, and it's certainly better than a Tier 4, because we have lengths, no doubt, and, therefore, because it's a Tier 3, we're essentially going to inherit a bigger sigma, because that's what you do in a Tier 3 versus a Tier 2, and so I think we're kind of -- I think we're in the same place. Whether we call it a Tier 2 or a Tier 3, I think, if you do a Tier 2, you wouldn't want to incorporate the default Tier 2 sigma, because there is, I think, additional uncertainty in one of the two of the three data streams.

If you do take a Tier 3, you could do whatever that default Tier 3 sigma is, just because it's going to be much bigger, and I didn't know if there was a benefit. Basically, my question came down to I don't know if there's a benefit to calling it a data-moderate, because it does fulfill those two out of three data requirements, and then deal with the scientific uncertainty in the SSC, and that kind of separates out the components, versus doing this kind of hybrid sort of classification.

I think, ultimately, for management, it's going to come out very similar, and I was just more curious, given that it seems like it

fits technically in Tier 2, if there's a benefit for putting it into a Tier 2.

SHANNON CALAY: I think it could belong in Tier 2, and I think, if you put it in Tier 2, on the basis that it has both catch and length composition data, you just need to consider the scientific uncertainty in the sigma min, and you can always choose a larger multiplier than the minimum listed in the Tier 2 control rule.

JASON COPE: Exactly.

SHANNON CALAY: I think that's fine, if that's the way this SSC prefers to do it.

RICHARD APPELDOORN: I would like to point out that we're talking about uncertainty in the catch, but my recollection is that there's a fair amount of uncertainty in the length information, not so much in the sense that we can't measure the lengths, but that is something that is very variable year to year, and my recollection is that, for -- I don't remember which platform this was, but, in the early years, that the lengths were all say traps, and, in the later years, the lengths were all from diving, and so we don't have a situation where you have consistent amounts of information coming in across all years, and so there's, I think, a fair amount of variability in certainly the quantity of length information and how that's distributed.

JASON COPE: I'm curious about just a broad SSC question, and would it be better to call it Tier 2, just because it fulfills the data requirements, and then deal with the scientific uncertainty in those data on that backend, or is there a benefit to calling it data limited? I guess I'm trying to think of when future assessments come through and they fulfill these requirements, yet they are still getting classified as Tier 3, because that's why this one was, and is it going to be harder to justify Tier 2 in the future, because of this classification?

If so, I think that would be a shame, because I think the Tier 2 is set up in a very particular way and that a lot of that uncertainty in the data can be handled in the sigma treatment. With that said, oftentimes, things will fulfill requirements, but, if there are fundamentally flawed issues with the data, that is a very good justification to bring it down a tier and deal with it in there, and I guess I would rely on the experts here to feel like do they think that the data challenges in this one are so huge that we can't handle them purely in the sigma and we should have a Tier 3 or are they adequate enough to be in a Tier 2, and then we handle the bigger sigma, for all of the reasons that you

brought up.

DOUGLAS GREGORY: In 2016, there was a data-limited stock assessment for lobster. In this assessment, Stock Synthesis was used. Is Stock Synthesis used, or has it been used, with data-limited assessments in the past, or does the fact that we could use Stock Synthesis imply a data-moderate, and, like I said, the CIE reports, or the report, the consensus report, refers to this assessment as a data-limited/data-moderate, borderline, but I am just wondering. Compared to previous assessments, it's more sophisticated, and it's not classified as a data-limited approach. I guess that would be a Shannon question.

SHANNON CALAY: This particular SS implementation is a data-limited approach. It could be in the data-limited of data-moderate categories, but this is not -- Just because it's SS, it does not mean that it's implemented like the Gulf assessments in a data-rich configuration.

This model only includes catch, length composition data, and biological parameters, and estimates of selectivity, and so it is a little bit more rich, in a sense, than say using length composition data alone, like some of the SEDAR 46 methodologies, but it's by no means as data rich as a Gulf of Mexico SS implementation. If I have answered the question, I don't know, but this configuration of SS is new for us, and it's the first time we have attempted a data-limited/moderate assessment in SS. It belongs in either Tiers 3 or 2.

DOUGLAS GREGORY: Thank you. I didn't mean to imply that I thought it was data rich.

SHANNON CALAY: No, and it is the first time we have attempted, in our region, to use SS in a data-moderate or limited condition.

KEVIN MCCARTHY: I've got a comment or two about the data. Just to give everybody a reminder of the data as they are collected, or at least as we understand them to be collected at the Science Center, the landings are all self-reported fishery logbooks. In Puerto Rico, the staff in Puerto Rico run a second survey, where they go out and try and get a handle on underreporting, overreporting, whatever the case may be, and so they develop these correction or expansion factors, which are applied to the reported landings.

There is an acknowledgement there that there is underreporting, and there is an effort to account for that, and those expansion factors, correction factors, are not species-specific, and this is

a concern of the lobster fishermen in Puerto Rico. There is a concern there that, if they report better as a group than the fishery as a whole, those expansion factors are inappropriate for them. That's the Puerto Rico situation.

In the Virgin Islands, the landings are as reported, with no independent verification or validation, and so that's the landings side of things, very briefly, and the size composition that comes out of the TIP data, as I understand it in Puerto Rico, that's based on a survey design, where the port samplers will go out and intercept fishers coming in.

In the Virgin Islands, the case is a bit different, where the fisher has to be -- Their catch has to be sampled four times a year, and the fisher decides when that's going to happen, and they will either arrange for a port sampler to come meet them or they take it by the lab, and then it gets measured there, and so it's far from a random selection. The fisher is deciding, and so there are some questions about the data, as they are collected and how representative they might be, and so there's some questions there, and so that's the realm in which we're operating, where the data is applied to this assessment. That's just a little reminder.

Based on that, I guess I would be -- I mean, what I'm hearing is we can get to the same place, whether it's a Tier 2 or a Tier 3. However, I am leaning, because of those data collection questions, more towards a Tier 3 than a Tier 2.

RICHARD APPELDOORN: This is somewhat difficult, because I can't look around the table and see people's faces about which way they are kind of leaning on this, though it's almost like we need to have motions and a vote, or at least some starting point, and see if anybody just disagrees or not with that approach, and it sounds like we have three questions.

One is what tier level are we in, and two is what is going to be our sigma min, and how are we going to go about determining that, and then three is what's our multiplier going to be for this particular species, and it could be different for the three island platforms.

I am actually rather uncomfortable, myself, making the call about whether this is Tier 2 or Tier 3, and I personally would have preferred to have the Science Center tell us that this is where we are, relative to everything else we've done, and this is clearly a Tier 3 situation, in regard to the fact that we had technically two sets of data, and I think that's kind of what Shannon was saying, but we do have the issue that someone else brought up of,

well, we have two things, and what are we going to do in the future if we set lobster, which is probably our best-case, two-dataset situation, and does that mean that we'll never get to data moderate?

Anyway, I can't make any motions, and those have to come from the committee, and so, unless anybody else has some comments, I think we kind of need to move forward and start with some of these questions.

KEVIN MCCARTHY: I've got one more comment, Rich.

RICHARD APPELDOORN: Okay, Kevin. Go ahead.

KEVIN MCCARTHY: Adyan is chatting with me about some additional information, and so we should also recall that, for this assessment, the terminal year of the length data is 2016, and so, while we were updating, with some caveats, the landings for these projections, the size comp data is -- The terminal year is 2016, and so now we've got some data that are getting a little old, and we haven't filled in the information for the more recent years, at least on the size count comp side of the available data, and so that's something else to keep in mind.

RICHARD APPELDOORN: Thank you.

VANCE VICENTE: My only thought up to this point is that, first, Adyan, when she began her presentation this morning, earlier this morning, she stated that the simulated data should be close to, or they should match, to a significant degree, the real data, and I am trying to determine which criteria is being used to measure the closeness or disparity between the simulated and the real data, and so, in that respect, I really would like to hear the position from the fishermen, from Nelson in Puerto Rico and Julian in St. Thomas and et cetera from St. Croix.

The thing that worries me is that the 2019 and 2020 data is based on an average of 2016 and 2017, and, as was pointed out earlier, these have been different years, regarding tectonic activities and climatic activities and hurricanes and pandemics and whatever, and there are many other variables that we have been discussing for now some time, and I don't see them being weighted properly, and so those are my two concerns.

JASON COPE: Would it be fair just to kind of clarify that, when we talk about simulated and real data, what that's really meaning is that the model has underlying equations that, when you put parameters in it, it makes the population dynamics do certain

things, and then, with the real data, it's using a statistical theory to figure out what estimates of selectivity best fit the real -- What we're calling the real are the catches that are going in.

Now, when we call that real, what we're talking about here is that we're feeding the model data that are real, but we're saying they're real with a lot of uncertainty, and this is exactly the point, is that the model does not know the catches are uncertain, and it fits those catches perfectly, and so it finds the parameters that fit those catches perfectly, but now we, rightfully so, point out that that information going into the model, the real information, has uncertainty, and I think this is really where that sigma comes in, is we admit that that is going on.

VANCE VICENTE: I understand that point, but I still would like to hear from the fishermen what is their opinion on what they have been gathering out in the field, their catch per unit effort, and I would like to hear from them before we come to any conclusion.

RICHARD APPELDOORN: I don't really think our discussions are based on that kind of input. That would inform how we go forward in setting these things as more data comes in, because then we're going to be informed by what's been going on, but, right now, we have an assessment, and it used data of a certain degree of reliability, and we need to be able to account for that.

As I mentioned before, to some degree, we've had discussions about this in the past, and the level that we think spiny lobster is relative to what it might be able to handle, and we still have a question of whether we're going to Tier 2 or Tier 3, and it's not locking us into a final answer, because we can adjust the -- Well, it's not locking us into necessarily a final answer, because, if we go to Tier 2, we can make the sigma multiplier larger.

VANCE VICENTE: I understand how these adjustments can be made, but, on the hand, in this discussion, I wanted to hear more from the outside, from the fishers, and, for example, you brought up, in the last meeting, about the lobster, the disease, that apparently was significant in the Caribbean and about predation, and those things are not even mentioned up until this point, but maybe it's not necessary at this point.

JORGE GARCIA-SAIS: Richard, you mentioned something that I think is a central problem here, and that is reliability of the data. You said that we have here lobster, which is -- We all know that that's probably our best dataset. It's long term, and it's one species, and there is no problem taxonomically with it, and it's

mostly a commercial product, rather than recreational or whatever, and so, if we have any reliable data in Puerto Rico about any species, it's lobster. It's spiny lobster, and so, from that standpoint, I am trying to ask you again.

You say that the data is -- That there is a certain reliability, and how reliable do you think it really is, because, if you think that it's -- I think it's the most reliable that we have, and, if that is reliable, I think that we should go to Tier 2. If you think that we still don't think it's reliable, that we better back off from saying that it is reliable, then we have to go Tier 3. For me, that's where we are.

In my opinion, I think that we should go ahead and try to build our management platform for lobster with a Tier 2 situation, where we recognize that this is probably our best dataset for Puerto Rico, at least for Puerto Rico, and I am not going into the USVI, but, for Puerto Rico, that's our best dataset, and we should try to start refining our management strategies from a data-moderate standpoint. That's my ten-cents.

RICHARD APPELDOORN: Okay. Remember also, in the case of Puerto Rico, we have the correction factors, which are not based on lobster. They are based on the entire fishery, by coast, and, to the degree that lobster people either underreport or report accurately or overreport, whatever, relative to the other components of the fishery, that also introduces uncertainty into those data, but I agree that they are the best data that we have.

KEVIN MCCARTHY: Just another data thing to think about, and, Reni, actually, you reminded me of this, but you're right. The other unknown in all of this is the size of the recreational fishery, because we don't measure that in any way. We have MRFSS and MRIP in Puerto Rico, but only in Puerto Rico, but they did not collect data on spiny lobster. There was only finfish, and we don't know what the impact of the recreational fishery is on the stock, and so that's something else to think about, and that's also true for the Virgin Islands. There is no recreational information, not in the long-term, year-by-year collection effort.

RICHARD APPELDOORN: Thank you for making our job easier, Kevin.

KEVIN MCCARTHY: You're welcome.

RICHARD APPELDOORN: A reminder from a comment that I got is the multiplier we're talking about is the multiplier that we're putting on the value of sigma min, and, for Tier 3, that's a minimum of two, and, for Tier 2, it's a minimum of 1.5, and this is totally

separate from the P* stuff that the council will have to deal with.

JASON COPE: Not to make this more complicated, but it does sound like there might be worthwhile conversation about each area. Maybe some areas are more clearly in one tier than the other, or maybe already just going for all of them in one tier, and I don't know.

KEVIN MCCARTHY: I don't -- I mean, it sounds to me like we can get to the same place whether it's Tier 3 or Tier 2, and I also don't think that lobster would be stuck in Tier 3 forever. Recall that, a year ago, they were in Tier 4, and now we're talking about Tier 3 and Tier 2, and there are numerous initiatives that the Science Center is now doing in the Caribbean to improve data streams, data inputs, and to validate things like what sort of confidence we have in the landings, and so we're doing those things, and so I don't think we're going to be in a place where spiny lobster are stuck, as it were, in Tier 3 forever, even if we opt for a Tier 3 for this assessment.

I think that spiny lobster are on their way up in the ladder of tiers, and so it won't be a case that the spiny lobster is here forever, and we're way ahead of where we were last year, and so I don't know that we need to -- I mean, I don't want to limit the discussion or try and shut anything down, but it's a decision that we'll have to live with forever, and, as I said, I think we could get to the same ABC whether it's Tier 2 or Tier 3, and so I don't know that we want to get too hung up on the tiers, but that's not for me to decide. I just think that there's hope for the future, is what I'm trying to say.

WALTER KEITHLY: May I ask a question that is -- I am not sure if this is going to lead us any closer, but I prefer Tier 3 to Tier 2, but the question was specifically for Kevin. Kevin, you mentioned that changes are being made. Now, when I looked at Adyan's presentation, the provisional lobster landings for Puerto Rico for 2019 were over 600,000 pounds, which was approximately 150,000 pounds larger than any other year. Could some of that be explained by changes in how the data are being collected for Puerto Rico?

KEVIN MCCARTHY: Well, yes, but maybe not in the way that you are imagining. What happened for 2019 is there are no changes. We haven't changed anything. What we've had in Puerto Rico has been an independent survey, port sampling survey, to compare directly with the estimates to come out of Daniel Matos's group, and so we haven't -- That's what I am referring to, and we're developing programs down there in Puerto Rico, and we haven't gotten off the ground in the Virgin Islands, and we're trying to do, but, you

know, pandemic, and so we're trying to get at ways to have an independent estimate of the landings.

What happened in Puerto Rico in 2019 was they have not yet completed their analysis to come up with their correction factors, and so Daniel Matos is working on that now, or shortly will be, and so that number could change.

We borrowed from 2018, because that's what we had, and so that 650,000, or whatever the number was for 2019, could change with new correction factors, and so it's -- They are continuing to do things the same way for the time being, with the exception that, in that case, we borrowed the correction factor, and so that's still a preliminary number, in that regard, and the numbers that Adyan had were about -- The estimate was they had about 99 percent of all the data entered, but we didn't have that correction factor.

We are getting programs started, and we haven't made changes yet, because it will take a few years to get these new surveys up and running and properly designed.

WALTER KEITHLY: Thank you. When I saw that number, or that graph, the 2019 figure, it just jumped out at me, and your explanation makes sense, that it could simply be the correction factor, and you're right that Adyan said that about 99 percent of the data had been entered, and so it would appear that it may be a correction factor, and you perhaps could answer one other question then. How much does the correction factor vary from year-to-year? Is there enough variation in the correction factor to account for that large increase in 2019?

KEVIN MCCARTHY: There is a correction factor for every coast, north, south, east, west, and I don't remember the strict definitions of each of those, but there have been times, and recall we had the 2005 data for every species, and I saw that big spike, and so we had to account for that somehow, and that was a change of a correction factor on a single coast, and so they can be quite different year-to-year, and I can't remember the sort of range that they typically fall within, but they can bounce around, and so you're right that it could very well be this correction factor that accounts for a big jump for 2019, and I don't know that that's the case, and hopefully Daniel will have those numbers soon and we can recalculate the landings for 2019.

RICHARD APPELDOORN: Graciela, can you read and translate, if you will -- Nelson typed in a comment relative to the question about how the fishery was doing and his experience in Puerto Rico.

GRACIELA GARCIA-MOLINER: Certainly. He is saying, Nelson Crespo, and he's the Chair of the DAP Puerto Rico, that his last few years have been extremely different, but there is a reality that one cannot let pass. There has been a significant increase in poaching of lobsters, and the data are not reported, and so that's just another source of uncertainty.

RICHARD APPELDOORN: Thank you.

JORGE GARCIA-SAIS: Poaching from where, from recreational divers, or what is the poaching all about? Poaching where? In seasonally-closed areas or permanently-closed areas, or what kind of poaching are you referring to?

GRACIELA GARCIA-MOLINER: Well, he is just referring to a significant amount, that fishing is being done and it's not being accounted for. He is not saying anything about specific areas, but just that people -- Maybe they are not licensed or are fishing -- They are not reporting a lot of the data, but he doesn't mention anything specific about the sites or whether it's commercial or recreational, but it's only the commercial who reports landings, as Kevin was saying, and we don't have anything on the recreational side.

JORGE GARCIA-SAIS: Well, that was precisely my point before, and that, if we are uncertain about the lobster catches, it's probably due to underreporting. I don't know, and, obviously, that means that we are taking out much more lobster than we think, and, if that is not being accounted in the expansion factors, because I am not sure, year-to-year, how stable the expansion factors are being applied to the data.

Frankly, I don't have that in my hands right now, but my perception is that, if the lobster fishery is stable, in the midst of underreporting by whatever fishermen, and, on an outlook of declining fishery effort, because of less fishermen in the last five or six years, and we have less fishermen than before, and so, in the midst of less effort, and in the midst of underreporting, we have a stable lobster fishery, and that tells me that we are not in a situation where we are probably overfishing the lobster, and so that is what I believe in regard to all of this.

There is certainly something to think about, in terms of applying uncertainty to the values that we have for ABC or whatever. My point is that our uncertainty is in the underreporting side and not on the overreporting side, to be more clear.

RICHARD APPELDOORN: Thank you, Reni. Jason, I think you have a

way forward for us?

JASON COPE: I can throw this out there and see what everyone thinks. This is just assimilating all of the discussion that's going on, and, if folks agree here, but a suggested way forward would be to state it this way.

The spiny lobster stock assessment qualifies as a data-moderate Tier 2 assessment, and so you start with that, because it technically qualifies for that. Now, this is where, if people agree with this, we can move forward with this proposal. If the Science Center folks -- If both the Science Center folks and the SSC, through discussion, agree that, because of uncertainties in both of the datasets included, the length and the catch compositions, currently, this should be considered a Tier 3 assessment, with the future prospects being improvement in those two datasets would re-qualify it as a data-moderate.

Again, like Rich, I put a lot of weight into what the Science Center analysts deem is a good fit here, and there is a lot of uncertainty in certain things, and I appreciate that, but this does technically qualify for a data-moderate, and so, if it's not a straight Tier 2, I think we just need to say, and here's why it's going to be applied as a Tier 3, but it preserves that ability for it to be, I think, a clear Tier 2 next time, when those couple of things are addressed, if they can be, and so that would be a suggestion. I would love to hear what people think.

RICHARD APPELDOORN: Do we want to make this a motion and force people to speak up? Is anybody in particular opposition to that thought?

JASON COPE: The other aspect to this that I like is that it preserves that the data streams qualify for what it should be, and that's what you want to start working towards, but I think it's also nice to be able to recognize that, okay, there are places where we could hopefully improve this, and then, next time around, feel more secure in a Tier 2. I just get the feeling that people are kind of hovering around Tier 2 and Tier 3.

If it just goes in as a Tier 3, and it's not acknowledged that it actually qualifies as a Tier 2 and why we're considering it a Tier 3 this time, I think we're missing an important precedent for these types of models, because this is a sophisticated model, and it's a using a sophisticated platform, and we just would feel better if some of the data inputs got a little tighter, a little more informative.

KEVIN MCCARTHY: I think that's a reasonable approach. I think this is an instance where the data available are sort of -- It's a two-and-a-half, and it would be easy to -- I mean, we could come up, as many people have been, with rationale for why it should go in one or the other, and so, given that it sounds to me like the committee is split, I think this is a reasonable way to say that we acknowledge, on a strict reading of the tier control rule, that it would qualify. However, we have these reservations, and, should those data inputs improve in the future, it would certainly be a clear Tier 2, but, for now, it's a 3, and I agree with you.

RICHARD APPELDOORN: Graciela, someone was trying to type up that phraseology, and maybe Jason -- Maybe, first of all, you could blow it up, and, secondly, maybe Jason could give you what he said initially.

JASON COPE: So far, that looks great. It qualifies as a Tier 2, based on just the inputs. After discussion, and this is the important part here, and as long as this is true, the Southeast Fisheries Science Center and the SSC agree that, in the current form, the data make this more of a Tier 3 assessment, with the hopes that some of the improvements in the data would naturally elevate this to a Tier 2 assessment in the future.

Hopefully such a statement like this would also be -- It would promote such interest in getting the data better and those sorts of things, and so sort of prioritizing that sort of stuff in the future, or it could be used for an argument for that in the future, which would be great.

KEVIN MCCARTHY: I think this is also important for moving forward and distinguishing a little better what's the difference between a 2 and a 3, unless it's clearly that we were able to do something as a Tier 3 that had less data than this, but, where we have these multiple data sources available, maybe it's good to set this precedent that we've got to have pretty good confidence in it, in all of the available data, to move it up, and I think a statement like this better defines that.

JORGE GARCIA-SAIS: Quite frankly, I believe that there is a big -- We have got to be clear what we are really referring to, because, improvements in the data, what improvements in the data? I mean, I have been on the SSC for more than ten years and hearing about the uncertainties regarding the expansion factors in the Puerto Rican fisheries, and I have not seen any progress on that in the last ten years.

From my point of view, one decade after, it's that we consider

that a constant and forget about it, as a relevant source of uncertainty, or we get to the bottom of it, and then the clarification of the uncertainty associated with the expansion factors is probably more important than all of this that we are doing right now, because all of our fisheries data reliability, as Richard mentioned, is depending on that, and then we can't move anywhere, because we are uncertain, because of the expansion factors.

I mean, either we open -- We set it openly and accept that we have a barrier, in terms of our interpretation of the fishery data, because of the uncertainty in the expansion factors, or we forget about it and move along and consider that a constant that we'll never be able to figure out.

RICHARD APPELDOORN: All right, but, as Kevin mentioned, there actually has been substantial work done, and we had the pilot study done by Todd Gedamke's group, and then they were into the full assessment based on that pilot when the hurricane hit, and we're picking up after that, and that is going to generate both recommendations to how more reliably collect the landings data and the validity of the expansion factors, at least for the time periods that are being covered, and so that information is coming.

Kevin also mentioned that pilot programs are being designed, or might already be in place now in the Virgin Islands, had it not been for the current pandemic, and so we are making progress on these, but, yes, we don't have them now.

On the first line, before "qualify", it "technically qualifies", and it's based on the types of input data. If there is no disagreement with this statement, we can move on, and we'll accept that we're dealing with Tier 3, and then we can start talking about what our sigma min should be. I am not hearing any disagreement.

JORGE GARCIA-SAIS: Richard, I disagree. I believe that the statement is contradictory. The two sentences are contradictory with each other. In one sense, if you start reading, and it says, okay, well, it meets all the requirements of Tier 2, and then, in the next sentence, it says that, in the current form, the data is more a Tier 3, and so we need to explain that better. What in the current form -- If it's one way in Tier 2, what is the current form that it makes it a Tier 3, because, otherwise, it's completely contradictory, from my reading here.

Then, the improvements in the data, we have got to refer to specifically what kind of improvements, or at least what in general what is it that we're talking about. If not, it just completely

leaves you in the air.

VANCE VICENTE: I agree, and so it should read maybe as a moderate between Tier 2 and Tier 3 and leave it like that.

RICHARD APPELDOORN: We cannot leave it like that. We have to choose one of those things, because there is consequences down the line.

JASON COPE: Maybe to clarify this, and I think that's a very fair point, and so the "technically qualifies" is just addressing the fact that it has the data to qualify as a Tier 2. Once, through discussion with Southeast folks and the SSC, we agree that there is enough remaining uncertainty in each dataset, and then I agree.

I don't know, in a motion, if you need to list all those things, and, if we do, that's great, but I do think and agree that we should capture some of those specific points, and that may have already been captured in the review or whatever, but this idea of whether it's expansion factors or just basic catch monitoring and questions of whether those are good estimates, along with the length compositions, but, whatever the reasons for the length compositions being uncertain, but those are the reasons that we find it sufficient, or needful, at this point to consider this a Tier 3, and, with improvements, addressing those issues, this would fit better into a Tier 2 in the future.

GRACIELA GARCIA-MOLINER: Do you want me to continue typing? Uncertainty in the reliability of the catch data?

RICHARD APPELDOORN: Yes, finish typing.

GRACIELA GARCIA-MOLINER: Kevin, what is the other thing about not only the correction factor, but you mentioned another improvement in the data collection.

JASON COPE: Someone mentioned something about length compositions, but I don't know what that was.

KEVIN MCCARTHY: There was an issue with length composition particularly in the Virgin Islands, because it's not -- At least in some years, it has not been a random sample, and there hasn't been a survey design, and it's when the fishermen have requested to be sampled, and they are required to be sampled four times a year, and they arrange that with the scientists in either St. Thomas or St. Croix or St. John. I don't know if that's the current practice, but it has been the practice at various times in the past.

JORGE GARCIA-SAIS: For me, it reads much better now.

JASON COPE: Those were good suggestions. Thank you.

RICHARD APPELDOORN: Graciela, after the word "however", there should be the word "from". I am willing to accept this. I would have much preferred to just say the Science Center, in their experience, treated this as a Tier 3, even though it technically qualified as a Tier 2, and that would have been sufficient, because we're just accepting their recommendation, and let them justify why that is, but I am willing to accept this. Is there any disagreement now? Hearing none, we will accept that it's a Tier 3, and now we can move on to the question of sigma min.

Remember that, at the moment, we are treating this as kind of one discussion, but we will have to make a concrete statement that our decisions apply to all the islands, or we need to come up with differences among islands and the justifications for those. Does anybody want to put forth a recommendation or a motion on sigma min?

JASON COPE: Rich, can we build this out just a little bit? If we use Shannon's argument that a starting point is the Ralston, we then have this updated version that is arguably an improvement over that Ralston, the same sort of thing, but an improvement, and that would take you to 0.5 for Tier 1, and there are, in the document there for the control rule, built-in reasonings behind where you would have the default minimum, which was it times-two of that Tier 1 for the Tier 3? I guess what I'm saying is that would be the starting point of a minimum.

Now, from there, you could then build more into it, if you felt so inclined, but at least to build the argument to that point and then have a discussion, or do we need to have a discussion to even get to that minimum part before we start possibly building in more?

RICHARD APPELDOORN: I think we're talking about having a sigma min, and then we're talking about the multiplier on top of that, which, for Tier 3, is a minimum of two.

JASON COPE: So we're actually talking about the Tier 1 sigma min before we get to the multiplier.

RICHARD APPELDOORN: That's how I'm viewing it. If you have a different way of viewing it --

JASON COPE: No, it's getting to the same thing. I just skipped

that kind of first part, or I didn't skip it, but I just said -- I guess my proposal would be, just to build off of Shannon's argument, to use the Ralston et al., but now the updated version of that that actually does it for OFLs, with a sigma equal to 0.5. That would be a proposal to argue from.

RICHARD APPELDOORN: He mentioned the Ralston paper, but the improvement is the Privitera-Johnson and Punt paper, and so go ahead, Doug.

DOUGLAS GREGORY: Looking at the Tier 1, data rich, where sigma is introduced, it explicitly says that the buffer is applied to the PDF of OFL, the sigma, where it's determined from the assessment, and we're talking about using a different sigma now, and so, at some point, this control rule needs to be changed, or we're stuck with the control rule, and I'm not sure.

RICHARD APPELDOORN: My reading of this, and maybe you want to hear from Shannon and her experience, but, when we get to Tier 1, yes, maybe we will need to change the language of the control rule, in light of these new studies, but I don't necessarily see how the use of a sigma min is locked into something that can't be determined in a Tier 2 or 3.

SHANNON CALAY: Can we scroll up to Tier 1? We will have to review the language of Tier 1. Frankly, when Clay and I wrote the strawman argument for Tier 1, we were fairly far away from being able to use it, and so there may be a need to revise certain aspects of it when we approach Tier 1, but what Clay and I had envisioned is creating the PDF from the point estimate of the stock assessment and the sigma value selected by the SSC.

The PDFs that come out of our stock assessments are too narrow, and we know this to be true in the Gulf as well, and so what we were proposing to this SSC is to construct the PDF on OFL using the sigma min value. Now, it is possible that we did not talk about that in the context of Tier 1, and that's something we'll have to review.

RICHARD APPELDOORN: My recollection is we definitely talked about that in the context of the Ralston paper at the time that you and Clay were presenting this.

SHANNON CALAY: That's my recollection as well, and so ABC, as buffered by scientific uncertainty, and there's a Footnote 1, where the PDF is determined from the assessment, but where sigma is greater than sigma min, and so scientific uncertainty would take into account, but not be limited to, and it's not very

illuminating, by my recollection, from our first discussion of this, is that we would create that PDF from the stock assessment maximum likelihood estimate and from the sigma min determined by the SSC and not from bootstrapping the stock assessment, for example, which results in a very narrow PDF.

Basically, I do agree with Jason that 0.5 is a reasonable place to start for your sigma min value, and then you would apply the multipliers, as specified in the control rule, but recall that I am representing the Science Center, and I'm not on the SSC, and so please don't refrain from commenting if you have a different opinion.

GRACIELA GARCIA-MOLINER: I am not a member of the SSC either, but that's my take on that.

RICHARD APPELDOORN: Okay. Graciela, it's Ralston et al. 2011. I am reading this, when you say, "as per the ABC control rule Tier 3", that language is 2 or greater.

GRACIELA GARCIA-MOLINER: Well, I was just going to make it into another sentence and just separate the sigma and --

RICHARD APPELDOORN: I am just saying that, when people read the multiplier, it's not locking us into a specific value, but it's just locking us to a value that has to be greater than.

GRACIELA GARCIA-MOLINER: Okay. What is a value that you want me to use?

RICHARD APPELDOORN: We haven't specified a value yet. We're still on sigma min. If you want a justification, we would have to either refer back to the discussion, which will be on the record, or write something here, but this is obviously the most recent assessment of what reasonable values of sigma express a more complete understanding of scientific uncertainty, based on the best studied cases. I don't know if that needs to be in there, but that's basically the discussion we had that was coming out of that. Is there any opposition with this? The value has to be greater than or equal to two.

DOUGLAS GREGORY: I will have the same concerns that I voiced earlier.

RICHARD APPELDOORN: Do you have a basis for another value of sigma min?

DOUGLAS GREGORY: Do I have a basis or a recommendation? The fact

that this came from the Pacific Coast, and this new number of 0.5 versus 0.35 is based on incorporating recruitment trends and recruitment variability, and I think it makes this inapplicable for this lobster fishery. It may be appropriate for some other fishery in the Caribbean, U.S. Caribbean, but not for this lobster fishery. I think it's just not the right way to go.

RICHARD APPELDOORN: I think we're all open to an alternative, if you have one.

DOUGLAS GREGORY: If we're going to use the Ralston method, and I think the Science Center has adopted that over the years as their default approach, then the original Ralston of 0.35 or 0.36 as sigma would be more appropriate, given the recruitment differences between the lobster fishery, which has external recruitment, and clearly the egg production in the U.S. Caribbean goes to other Caribbean islands, and vice versa, and the environment is more stable than the Pacific Northwest, particularly in the last five or six years, when this updated study was done.

RICHARD APPELDOORN: Can you give Graciela a chance to put something on the screen?

DOUGLAS GREGORY: I am not making a substitute motion. I am just expressing my opinion and my probably lone opposition.

RICHARD APPELDOORN: I am trying to avoid making a motion here, and so I just want people to be able to see what you're saying, and I thought that you just made a really good argument.

JASON COPE: Can I just add a clarification, not the reasoning, like the external recruitment and all that, but the value of 0.36, and just a reminder that the new version of the Ralston et al. was able to, with the new species and the new time series and so forth -- It came up with same estimate of Ralston et al., 0.36, but, again, that was based only on spawning biomass, and the point of the new version is to actually calculate the uncertainty around OFL, which is what we really care about, and the Ralston et al. only did uncertainty, and so they only grabbed a portion of the uncertainty that we care about, and so the new one replicated what Ralston et al. did and got back to their 0.36, but then it showed why that was an underestimation for the metric that we care about, OFL, and so that would just be my only argument there.

The considerations of external recruitment and all those things, that's separate. The actual value though, I would argue that the new version is the Ralston version, but it's just better, because it's actually measuring what we care about, and it happened to

measure a sigma of 0.35 instead of 0.36, when you only look at biomass.

DOUGLAS GREGORY: I focused on recruitment because, in the abstract of the paper we were just provided, it basically says -- Like you said, because the OFL is a function of estimated exploited biomass and fishing mortality, we developed a new approach that bases the calculation of scientific uncertainty on projected spawning biomass, as in the past, and OFL is accounting for uncertainty in recruitment, as well as among assessment variation, and so that's why I focused on the recruitment differences.

JASON COPE: No, that's fine, and that was just put in there just to emphasize the fact that these weren't deterministically-calculated equations and that they actually brought into the calculation the dynamics of the population, and I understand your argument saying that could have increased the amount of uncertainty being estimated, and that's totally fine.

I guess all I'm saying is going back to 0.36, based on Ralston et al., they also were taking into consideration recruitment variability and stuff, but just differently, and, again, the current one replicated that value that they got out using recruitment variability.

They still get 0.36, but they're just showing that, when you do that, it's an underestimation of what you care about, which is OFL, and so I think the value you want to put in there being lower than 0.5, and I understand why you're arguing that. The value of 0.36 though is, I think, not the metric we want to take it from, and so that wouldn't be a good value to use, but your argument absolutely still stands.

RICHARD APPELDOORN: Graciela, can you move the text up on the screen? To further this along, let's just, for the moment, accept Doug's rationale, and Jason's, which would suggest that we're looking at something in between -- The 0.5 includes other forms of uncertainty besides the recruitment issue, which would suggest that the 0.36 is not where we want to be, and maybe it's 0.4, and maybe it's halfway in between, and I don't know, but then I understood Jason to say that that value actually did include some form of variability in recruitment, and, if that was actually the case, then 0.5 is where we ought to be.

This is best scientific information, based on expert judgement here, guys, and so we're going to have to make a judgment at some point.

JUAN CRUZ-MOTTA: Based on the arguments for 0.5 and 0.36, and also based on the fact that we don't know much, I would like to support the idea of 0.5. Thank you.

DOUGLAS GREGORY: I realize that National Marine Fisheries Service is the final arbiter of best available science and how things will be done, and so I'm not pushing this as a substitute motion or anything like that, and I'm just putting on the record that I'm uncomfortable with applying this approach as just a general formula.

RICHARD APPELDOORN: Where I'm stuck is what is the difference between the first study and the second relative to the question of recruitment and how that's dealt with, and, if recruitment is incorporated into both of them, that suggests that a starting point might be 0.5. I am still open to doing something.

However, because of the question of this open source of recruitment and that consistency -- The fact that one or both of those studies were dealing with recruitment variability, I think Doug's point is that we actually don't have that, or at least the data suggests that we don't have that level of variability, and, therefore, an important component of uncertainty perhaps isn't that much of a problem here, and, therefore, we could actually drop sigma min below 0.5, and so, I guess back to Jason, how do these two studies differ with respect to recruitment, and if they're still dealing with it, is it a question of variability, and is Doug's approach still valid, in the sense of, if the recruitment is as little as the output is saying, do we in fact have a little less uncertainty than the data that was used for those studies?

JASON COPE: In my opinion, I guess -- Again, I think there's a couple of things, and let me answer the first question. The first question is about recruitment, and both studies looked at recruitment. The second one did projections forward like twenty-five years with recruitment variability.

In a lot of their stocks, they don't have massive recruitment variability, and so it's not like there's just huge amounts of variability being modeled, but there is definitely recruitment variability being projected forward, but I think the key result is that, whatever they did, if they only looked at spawning biomass, which is also affected, obviously, by recruitment, they were able to recover the value of 0.36 from the original Ralston, and so the real difference -- In the newest paper, the real difference is that they are using OFL as their metric to quantify uncertainty around, rather than just spawning biomass, and, when you do that, there are more things going into OFL, and so it includes the

uncertainty in spawning biomass and additional factors, and that's why you get this elevation to about 0.5, and so that's the difference there, and that's why the newer study is a more accurate or a more -- It's a more appropriate measure for what we care about, and so there's that issue.

Then, in my opinion, and, again, this comes back to the natural variability in the population creating uncertainty versus uncertainty created in the data and in the parameters, and, in my opinion, there is way more uncertainty, scientific uncertainty, being created by the uncertainty in catches, uncertainty in lengths, uncertainty in the values for the life history of the population than there is in the recruitment variability of the population, and I am talking about these west coast rockfish. There is more uncertainty there than what is being introduced by natural variability in recruitment.

With that, I think the bulk of the uncertainty, and, again, their estimate of 0.5, that is still an underestimation, because they are not incorporating into even that model specification uncertainty, and so it's a minimum, and so that's why I argue that, as important as recruitment variability is, and this is a very different system than where the study is coming out, and there's no argument there, I still think that variability is being overwhelmed by the scientific uncertainty in the data coming in, and then there is this other part that no one measured, which is the model specification error.

Again, that's why I lean towards the 0.5, even in a system with less natural variability, because of all of these other issues. I hope that answered some questions.

KEVIN MCCARTHY: I have got another bit of information to put out there. We're talking a lot about this recruitment signal, and we need to recall that that comes from the length comp of the landed catch. We don't have much information, if any, from the length composition of discards, what the undersized lobsters, what that length composition looks like. We don't have information on that, and so we're looking the length comps of the landed lobster, and so that may change our perception of what this recruitment variation actually looks like, and so that's something to keep in mind.

RICHARD APPELDOORN: Recall that selectivity was like the big issue coming out of the analysis, and so there's questions about -- Even though the model is -- They are predicted for Puerto Rico and one of the Virgin Islands, and they applied that to the other Virgin Island platform.

What I am hearing is basically people are supporting 0.5, and Doug has reservations, but remember that our minimum sigma is half the minimum sigma that the other councils seem to be using, and so we still have a lot of room to maneuver with if we think that we're being too harsh here. Am I hearing any strong opposition to Jason's comments, as typed by Graciela there in the three lines?

VANCE VICENTE: Not from my part.

RICHARD APPELDOORN: Then I would suggest that it seems to be that we've accepted that, by consensus, and this brings us to the fact that it's after four o'clock, and we still have to do two things. One is decide what our multiplier would be and then make a statement that we're either accepting these for all the island platforms, or we then have to enter into an island platform discussion.

For me, I will actually go to the last item first. While the data streams are somewhat different, and the sources of variability are different among islands, there are, I think, overall, equal amounts of scientific uncertainty. I will make a comment to that effect that, if you're talking about management uncertainty, I think there are in fact differences that the council might want to deal with, but I don't think, from the point of view of the scientific uncertainty, we're seeing differences in the amounts. I think some programs have different sources of uncertainty being more prominent than others, but, overall, I think they're similar. Anyway, our multiplier, is --

VANCE VICENTE: I would say "similar" amounts of scientific uncertainty. I would not say "equal".

RICHARD APPELDOORN: Okay. "Similar" is fine. In terms of the actual multiplier, what we heard, kind of from Doug and Reni, and I think from Walter, is that our multiplier should in fact be fairly low, and do any of them want to say, yes, let's make it the minimum, which would be two, or -- Remember that other SSCs are using four as their multiplier, but this is lobster, and we're not locking this in for every species we're looking at, and we're looking into, as Reni said, our best case.

JASON COPE: The four being used is also, just as a reminder to folks, is just absolutely arbitrary, and so, those places that do quadruple it under a Tier 3, it's not based on any measurement from anything, and so I just wanted to make sure that that's understood.

JORGE GARCIA-SAIS: Richard, what would be useful, in my opinion, to do would be to see where the multiplier is related to what is the actual catch or what is the actual landings the last couple of years, just to put us in reference, because, right now, it's difficult, without the numbers, to see what kind of multiplier, because it is kind of arbitrary. I mean, it's a number. That's just to put you in the context of whether you want to be more conservative, regarding the present level of catch, or what used to be the previous annual catch limit for the last five years or whatever, and I don't know where that multiplier would lead us to.

RICHARD APPELDOORN: Adyan I think had a graph, I think it was, actually, that showed percent reduction values for different values of P* and sigma.

JORGE GARCIA-SAIS: Yes, I remember that.

RICHARD APPELDOORN: Can we get that back on the screen?

ADYAN RIOS: I believe that this bottom-left figure is the one Rich and Reni were referring to.

RICHARD APPELDOORN: Correct. The bottom line -- Well, Adyan, you have these as sigma min. Were they then multiplied by something, or this is just the straight sigma min value?

ADYAN RIOS: This plot is showing initial sigma values of two-times sigma min, and so these are the sigma mins that would be multiplied by two to obtain these ratios.

RICHARD APPELDOORN: Right now, if we use the two multiplier to our 0.5, it's actually the top line that we would be looking at, correct?

ADYAN RIOS: Yes.

SHANNON CALAY: You can see that, the larger the multiplier, the bigger the buffer between OFL and ABC, but it's important to make this decision based on principles of science and not the desired outcome, because that really -- The role of the SSC is to try to determine the best estimate of scientific uncertainty, because remember there is another factor, which is the P*, which is the probability of overfishing, and that will be presented to the council, and so they will have an opportunity to also consider how much risk they're willing to take.

DOUGLAS GREGORY: I am little confused, and that's twice that Shannon has implied this is a council decision, but, if you go to

the next page of this presentation, and also in other documents we've got, it leads you to believe that the SSC is to comment or advise on P* and for us not just to ignore it, and it's right on the next page of this presentation, and so I need some clarification from council staff or somebody what is our role here relative to P*.

SHANNON CALAY: I can only comment on what the intention was of the Science Center when we set up this particular version of the tiered control rule, and, in this particular version, what we have already presented to the council in December is that it is their role to determine the risk of the probability of overfishing that they are willing to accept and that the SSC's role is to determine the width of the PDF on OFL. The way you determine the width is to determine the sigma value.

Now, when we set up the tiered control rule, we set it up, by definition, so that, as you go from Tier 1 to Tier 2 to Tier 3, the width of the PDF will increase, because the scientific uncertainty is less and less as you move from Tier 1 to Tier 3, and so that's why we set up the multiplier, and so, in Tier 1, the most data-rich assessment, we are saying that that will result in the narrowest PDF on OFL, and so we'll essentially use sigma min. Tier 2 is data moderate, and we're saying you have to use at least 1.5 times sigma min.

DOUGLAS GREGORY: That's not what I'm talking about. If you go to the very next page, and this is a Southeast Fisheries Science Center presentation, and I'm just saying that I am confused. I do understand, because we've been dealing with this for fourteen years, the difference between risk and uncertainty, and, for fourteen years, most of the councils, at least in the Southeast, have confused the two, and part of the problem is it's been difficult to get the councils to choose a risk level, and so, invariably, when they are pushed, they come up with a range, but they have, in the past, at least with the Gulf, asked the SSC for advice.

Now, if Graciela or somebody could turn to the next page of this presentation, I will explain my confusion, and I understand this process extremely well. I don't need to go through the tier system, and I understand what the Center's position is, and you just said that, but what is the council asking us to do? If you look at the presentation you gave to us, that's the source of my confusion. It's the very next page of this presentation, if somebody could turn to it, and then I will let it go. It's discuss and finalize SSC guidance regarding sigma and P*, and so are we not doing P* are we're only doing sigma?

SHANNON CALAY: This is assigned to the Caribbean Fishery Management Council. They have already specified that range, at their December meeting.

DOUGLAS GREGORY: That's the source of my confusion, and that's why I brought it up this morning. I wanted to clarify that.

SHANNON CALAY: My invitation was, really, just, because you are the science body, if you felt strongly that that range was inappropriate, it would certainly be within your responsibility to let them know, if you felt that there was some reason why that range was not appropriate, but that is the range that the Caribbean Council told us to calculate in December, and that range -- That's just what it is.

This slide may be confusing, but what we need to actually produce all the guidance that the Caribbean Council has requested is sigma min, the multipliers, and the assumptions for the recent landings history, and they we'll have the yield streams for OFL and ABC that we can present to the council at their next meeting from a range of P* from 0.4 to 0.45, as they have specified.

DOUGLAS GREGORY: Okay. Thank you.

SHANNON CALAY: They haven't made a determination of P* yet. That's what they have asked for, but we'll be prepared in case they ask for something else.

MIGUEL ROLON: If I may, for the record. Listen, guys. The council members, most of them do not understand this, and even you scientific members, members of the SSC, not all of you understand it very well either, at least from the impression I've been given for the last ten years.

What the council usually looks for is the guidance from the SSC of how much we can get away with, how much I can tell my fishermen that they can fish while, at the same time, making sure that we don't put the fish at risk of being overfished or suffering overfishing for the next thirty years. That's all they want. When they look at P* and all that, they say, well, okay, and so, if you say 0.4 is okay, or 0.45, then we will go with that, but, in essence, it's very difficult for the council members to sit there and figure out and project into the future what will be my contribution to whatever happens in the future with this fishery, am I going to put the fishery in jeopardy or not.

This sigma minimum and P* is still scientific jargon for most of

them, and so what we need you is what Shannon was saying, a range of P*, and the consequences, and maybe a little bit of what sigma minimum is, and so, aside from that, there's very little they can tell you.

It's true that MSA relies on the council to make a decision on the risks they want to take, and we cannot take let's say too much risk, and that's out of the window, and we cannot do that, but they need to know the consequences, and so my advice is to try to figure out a way that we can pass the information on the 23rd of June to the fishers and all the members of the council in a way that they can understand the consequences, and that's something that Tony Blanchard asked for, and then they can make a decision.

Otherwise, it will be taken by faith, whatever the scientists tell them that this is good for you, and they will go with it. Right now you are confused a little bit, from the discussion, of Tier 2 and Tier 3, and I agree with Reni that the first language was a contradiction, but, at the same time, this is what we have to work with.

Anyway, my two-cents worth here is just to try to make it in a way, similar to what Shannon is saying, that you will be presenting the ranges and the consequences of taking the P* versus the other to the fishers and to the council members, so that they can make a decision that they can support legally and scientifically, because remember that they are the ones who are going to make a decision in the management plan to adopt any of this. Thank you, Mr. Chairman.

RICHARD APPELDOORN: Thank you, Miguel. Can we go back to that previous slide?

GRACIELA GARCIA-MOLINER: Mr. Chair, you have Jocelyn D'Ambrosio asking for a turn to speak.

RICHARD APPELDOORN: Go ahead, Jocelyn.

JOCELYN D'AMBROSIO: Thank you. I don't have anything to add at this point. What I was going to say was covered in what Shannon and Miguel had said about the different goals, going back to Doug's earlier question and the points he was making as well, but thank you.

RICHARD APPELDOORN: Jason has a question, or has a comment, but I would like to point out to that graph that, just for -- You know where we are, and, if we were looking at the top line, and the council was to go anywhere between 0.4 and 0.5, they are looking

at a 10 to 20 percent reduction on the OFL. For any of the island platforms, that still gets them above where the ACLs were under the original management plans, and, if they -- That's at the 20 percent reduction.

At the 10 percent reduction, of course, they're substantially above that. They're not nearly as high as the Tier 4 ACLs that we had calculated for lobster before, but we had actually manipulated those to be fairly high. That's just so you have an idea of kind of where these values are falling. They actually seem to look pretty good, if we use that value of two, and so, Jason, go ahead.

JASON COPE: Just some more context on doing this whole P* thing. I mean, for me, there still is this weird -- There is this weirdness here, because, if you to the Magnuson-Stevens Act, it says the SSC is in charge of setting the ABC, and that is the charge of the SSC and no one else.

Yet, by putting it in this P* system, you hand over part of that equation to the council, which is the P* itself, and, yes, we're in charge of the scientific uncertainty, but we're also supposed to be in charge of setting that ABC, and so now this brings us back to this question of how much input should the SSC have on the actual P* value, and I argued earlier today that, at minimum, we should be safeguarding scientific uncertainty, and so keeping things like 0.4999 and that sort of nonsense -- Keeping these well away from that.

Now, how much more influence should we have? Other places have set 0.45 as that ceiling, and you can't go above 0.45. Okay. So the SSC sets a ceiling, and I do agree that it becomes a very strange situation for the council to now figure out what this number is supposed to be, because it does reflect risk tolerance, but how do you quantify that? How do you actually express that, and what does a risk tolerance of 0.35 mean versus 0.4?

I understand where people want more guidance here, and I understand why, and I understand why they would look to the SSC. If you look nationally, 0.4 to 0.45 is a very, very reasonable range to propose. Now, if the council just is looking mostly to maximize opportunity, it's going to be 0.45 every time, and that's never not going to be the case.

If there are other conditions in there, I'm not sure if there's a need to interact more with the council on this P*, to explain how this number could actually be devised and established, but I do feel like just throwing it completely over to them leaves them in a very awkward situation, and probably they would lean more on our

guidance, if we wanted to offer it, and, being new to the Caribbean SSC, I am not sure what other advisory bodies also provide statements on these sorts of things, but it may be an opportunity for the SSC to chime in on this very important part of this, so that we do avoid people just engineering what they want the answer to be and not what it should be, based on certain good principles.

RICHARD APPELDOORN: My two-cents worth is, first of all, for reasons that have been brought up by several people here, I would actually lean toward the value of two as the multiplier. It's a Tier 3 situation, but let's go back to now what's the benefits.

Well, we have two sources of data that we're using, and not just the one, and so it's actually better than a lot of our assessments might be in Tier 3, which would warrant a much larger, or at least larger, multiplier, and, with regard to the P* for the council, they are basically saying somewhere in this range, and I could see where we could say, okay, for Species X, you've got to be really careful, but, for Species Y, your risk there is much lower, and lobster is actually a case where, because of the large carapace length in particular, the risk of management failure there is a lot less than lots of other species where we don't have those kinds of extra things in there.

We have substantial closed areas, particularly in the Virgin Islands, that also protect a large part of the stocks as well, and so, when they talk about what their risk is, from the risk of overfishing, it's going to be different for different stocks, and it could very well be different for the different island platforms, and we can give advice on that, but I agree with Jason that I think the range they've chosen is pretty reasonable.

JASON COPE: Rich, I think you gave some really good examples on sorts of details that we could provide when delivering the sigma and delivering the multiplier, saying these are sorts of things that should be considered when choosing the P*. I think that was a really nice example, and it's something that we can probably do regularly. I should also say that I'm totally fine with two as a multiplier.

JUAN CRUZ-MOTTA: Can I ask a question? Jason, before, you said that perhaps, in your expert opinion, 0.5 was underestimated, and, if that's so, shouldn't we consider a multiplier bigger than two, and, if not, why?

JASON COPE: Great question. Yes, I do think that 0.5 most likely is an underestimate of the sigma, and mostly because of the lack of knowledge of a lot of our life history values, whether they

change over time and so forth, and so I absolutely do. Now, why don't we pick something more than two times the min? When it comes to how much more, I think it's underestimated, and, given that it's a data limited, how much more, I don't know.

The terms CV and sigma and interchangeable here, because these are mostly, I think, lognormal distributions, but a CV of 1.0 is quite large, and so I think I have found myself, even though I think we're highly underestimating the true uncertainty in the OFL, I think a CV of one, probably in most cases, covers a lot. A CV of 200 percent, if you did what everyone else is doing, where it's four times, that is an enormous amount of uncertainty, and so I just -- I don't know how much we're underestimating, and I guess I just am guessing, through my experience, that a sigma of one, or a CV of one, probably is a decent -- In this particular case, for lobster, it's probably a decent amount of uncertainty to apply to this management system.

That does not mean that I don't think that more research should be done and better data should be collected and so forth, and so just I wouldn't lock into that, but, from what we know now and what this assessment provides, I don't have a good reason to argue away, even though I think the sigma min is probably an underestimate, but I think this multiplication of it, which is providing even more scientific uncertainty, probably covers that uncertainty that I think the assessment is missing pretty decently.

JUAN CRUZ-MOTTA: Thank you. I am asking you the question, because I am one of those people in the SSC that qualifies in the category that Miguel just described, those that don't have much knowledge in this area, but, based on the reading that I was doing this morning and the values that are used in the presentation, my first take was -- Based on all this that we are listening, and that the P* is a decision of the council, my first take was that we should have a sigma of at least 75, but, again, in my inexpert view of the topic.

Then you said, no, let's do it at 0.5, and so I am saying all this is -- It feels like intuitive just to go for the biggest sigma that you can go for. Of course, that will be detrimental for the fishers, because it's less that they can fish, but I just -- I was just trying to explain why I asked you the question, and I was just trying to take into consideration all that variability that we cannot account for, but thank you, Jason.

JASON COPE: I want to say it's a really good question, and it's why other places have done two things. They have suggested not only a higher sigma for these more data-limited situations, but

also a lower P*, and so it's not uncommon to see a sigma multiplied by what the -- I'm sorry.

A sigma multiplied by some multiplier and a P* of 0.4, whereas a data-rich might use a lower sigma and a P* of 0.45, and so that is part of this discussion that could be made, is one of the uncertainties that the SSC has is -- Even if we feel that 0.5 is a relatively decent starting point for sigma for a data rich, we don't know how much it should be multiplied by, and, because of that, we may want to be a little more risk-averse in the choice of the P*, and so the recommendation could be, when it's a Tier 3, you would pick, at most, a P* of 0.4. When it's Tier 1, maybe you pick 0.45, and you go from there, and so you're dealing with it in two different ways.

That could be one way to communicate that to the council, because 10 percent is a pretty low buffer from an OFL, only 10 percent, and I'm not sure what the fluctuations in the fishery here is, but, if there is any worry that that could happen more than once in every four years, you should definitely be lowering that, and so that might be another way to communicate this. 10 percent is not much, even with a 100 percent CV put on the OFL.

RICHARD APPELDOORN: Right, but there's going to be an ACL below that as well and so hopefully the combination will avoid too much trouble. I was just going to point out the difference here between ourselves and the others councils relative to what the multipliers would be, and I'm guessing here, and so, Jason, you can correct me, but, generally speaking, you've got the best data from the fisheries that are the most important ones that you have, and the ones that are in Tier 3 are really going to be down there where it's not a big fishery and it's not that important.

Yes, it's being managed, and we don't know much about it, and so we'll say this, but the cost involved, because it's not a big fishery, isn't that high, and that's not the case here. This is our best fishery, and we're still down in Tier 3, and, therefore, dropping it with a multiplier of four, or something like that, I think is unreasonable, in comparison to what the other councils are doing, because their situations are much different, and, as you said, we don't really know what should be done, but we do have a very long history of lobster here, and it has withstood exploitation for decades and decades, and a high exploitation, relative to what the management measures allow, and it's still doing well, and so I don't think we're far off by maintaining that minimum of two.

JASON COPE: Those are really good like expert sort of

observations, because those count. Those are hard to work into assessments, but those are really important considerations when setting the risk tolerance.

One of the things that we face is that these might be smaller commercial fisheries, some of these ones that are data limited, but they are really big recreational fisheries, and they matter a whole lot to local communities along some of the states, and they even hold up what we call a live-fish fishery, and so they get these really high dollar per pound paydays off of these fish, and so they don't have to catch that much, but they start catching things which have very small locally -- Then local depletion starts happening.

You can get some really bad population dynamic carry-through in these small-scale fisheries with the combination of recreational fisheries, which are not well regulated or monitored, in addition to high-dollar, high kind of windfall sort of fisheries, and so, even our data-limited ones, they do actually have some really important financial connections to the local communities, maybe in a smaller scale than something that's like a coastwide fishery, and so we do face these really big challenges with some of our data-limited ones, different than lobster, but still significant.

DOUGLAS GREGORY: Would you consider a motion to the extent that says the SSC recognizes that the range of 0.4 to 0.45 is reasonable for the council to consider? That way, we're providing some guidance, but we're not picking a number.

RICHARD APPELDOORN: Yes, I would have no problem with that. I don't know if you want to put clarification that the actual values might depend on what protections are in place outside of the quotas.

DOUGLAS GREGORY: Or we could just address it each time we have a stock assessment, address it individually.

RICHARD APPELDOORN: That would mean we would want to now give them a value for the case of spiny lobster for the three platforms, and I am just looking, and it's like twenty to five here, and I would like to settle whether we're going to use a value of two as the multiplier first, and then we can talk about the guidance we want to go with it for P*, since we've kind of been going back and forth on those things. Does anybody have a problem with recommending the value of the multiplier is two?

JOE KIMMEL: I have no problem with that.

RICHARD APPELDOORN: I'm glad to hear from you, Joe. All right. Let's consider that a decision by consensus.

JASON COPE: Rich, just a question. My presumption is a lot of these decisions are made based on the fact that management is going to check in on this stock, not in ten years, but sooner than that, and maybe reconsider setting catch limits. If not, this is where that kind of changing sigma comes in, and I'm not suggesting a changing sigma, but, if the realization is that we're not going to look at this for another five years, that might be a reason to choose a bigger buffer or, on the other side, a lower P*, because of the not checking in so often, but, if there is the expectation that it's going to be checked in on in a couple of years or something like that, then I think that's better justification to have a lower multiplier and/or a higher P*.

RICHARD APPELDOORN: Basically, we look at the landings data every year, and certainly with respect to those that are over, or even approaching their ACL levels, but, if there was something where lobster landings were skyrocketing, or plummeting, that would cause us to look at something on a much shorter timeframe than we might be otherwise considering, and so we're always on the lookout to make sure that things seem to be running the way we think they're supposed to be.

JASON COPE: I mean, I guess there's a difference there between making sure that you're not overfishing according to the latest assessment versus getting more data and checking in and doing a new assessment, which may come in with a different whole scale of the stock and different dynamics, and it would update, with the most recent information, where you think you actually are, which might be very different than where you thought you were a couple of years ago, or five years ago, and, therefore, the trajectory the catches you would have set back then, if you knew then what you know now, could be different, and so that's that sort of --

That's a level of implementation uncertainty, I will call it, that is also a really important thing to consider if this is not going to be revisited, because we're assuming the median OFL value is unbiased, and all we're doing is saying that the uncertainty level is saying we want to make sure -- We want to stay away from it, because there's enough other uncertainty so we don't go over it, but, if it's starting with a biased OFL, which we would only know if we did another assessment, then we could get ourselves in trouble in the future.

That's just a consideration, maybe, to express to the council that, if this assessment is not going to be done in a few years, your P*

likely should be lower, to take that into consideration.

RICHARD APPELDOORN: Okay. Thank you. Of course, we get into that trap that you were mentioning where, if we're really worried about that, we want assessments all the time, and we don't have the people and the resources to do that.

JASON COPE: That's where I think we want to avoid this like explicit penalty on like every year it ratchets down the catch, because your assessment is becoming stale. I think you probably want to avoid that, but, as far as choosing the P*, a little more of a conservative P* might be warranted, if it's not going to be another five years until this is revisited, and just a blanket one. It wouldn't be as severe as that kind of ratcheting down, but it's at least acknowledging that we maybe need a little bit more of a buffer.

RICHARD APPELDOORN: So we're getting close to the end. Do we want to add, to this P* statement, what the SSC considers factors that the council should consider? Jason just mentioned the expected time to the next assessment, and I had mentioned other management measures, such as size limits and reserve protections, and closed seasons would be another type of thing. Some of those would -- Time to next assessment would drive it down, if it's long, and, if you've got good other management protections, that would perhaps let you be a little bit more confident and drive your P* up. Doug, you started this conversation. How does this look?

DOUGLAS GREGORY: It looks fine to me. In the first sentence, would it make more sense to change the word "recognizes" to "agrees"? It's just minor, semantics.

This is important, in that you're getting to the point where each stock, each life history characteristic of that stock, needs to be considered when the council chooses a risk level, and that's important, rather than just having a blanket risk level for everything, which is the way things were being done in the beginning, and so, yes, I like the extra wording.

RICHARD APPELDOORN: Graciela, you can just leave that as the life history of each species.

GRACIELA GARCIA-MOLINER: Do you have other considerations to include, any of the social or economic, et cetera?

JASON COPE: The one other thing that I had mentioned was coupling different tiers with different maybe starting recommendations for P*, and so, if something is a Tier 3, it wouldn't, by default,

also just be considered a higher P*. You might want to start from the lower one, and, if you have reasons, good reasons, why you want to raise that P*, that's fine, but maybe you start at 0.4 and go from there, rather than, if it's Tier 1, you start at 0.45 or something.

RICHARD APPELDOORN: Well, that would be more explicit, I guess. What I was thinking is that we had this range, and where you are in the range depends on these factors, and so you will be moving up or down that range without specifying an actual baseline that you then move up to, because -- Well, just leave it at that.

JASON COPE: I am totally fine with like a general guidance, just things to think about. That's fine with me.

RICHARD APPELDOORN: So, Graciela, that's not another consideration. That is another way of approaching it, and so it's not a point four. Just leave it as other factors.

JORGE GARCIA-SAIS: Richard, just for curiosity, do you know of anybody in the Caribbean doing some spiny lobster recruitment variability projects, studies, in those regards, that we could apply here, obviously?

RICHARD APPELDOORN: I would have thought that Florida, with their system of collectors, larval collectors, would be a good one. There's Cuba, but we don't have access to that, that has a big larval, or did have a very big larval collection program, and I remember a study, decades ago, by Scott Bannerot, in maybe Antigua, where he was showing that the influx of larvae was coupled with how close certain currents swung by the island, and so there was a variability factor with that, but I think he was talking about more short-term variability and not year-to-year variability. In other words, at some time during the year, currents came by and deposited the stuff, and I can't recall that, and it was an unpublished study.

There's been a lot of -- I'm not a lobster expert, but there are studies that have looked at the spatial scale of coupling of landings, and supposedly reflecting recruitment, and those scales were large, like eastern Caribbean versus western Caribbean, but I am not really familiar with any studies that have really looked at it. I would think Florida would be the case, just based on the intensity of fishing there. The catch each year is probably a reflection of the number of lobsters recruiting into the legal size range.

JORGE GARCIA-SAIS: I am just bringing it up because, if that the

kind of information that will improve our ability to model lobster fisheries, we should make that recommendation to the council as well, and my impression is that we have a very healthy recruitment of larval panulirus.

Every time that we put anything in the water, we have a lot of recruitment of lobster larvae into those surfaces, and, actually, I was pretty much in contact with the study that Stacy Williams is doing on getting recruitment of diadema urchins, and one of the main limiting factors of getting the larvae, the settlement larvae, of the urchins is actually predation by lobster, predation by lobster larvae, and it's just the pelagic larvae recruitment into the benthic habitat, and the panulirus is just the most important predator, and all the synchronizing of the sediment studies have to be done in accordance to the rate of recruitment of lobster, and so it is a very dynamic, very active situation that there is there, and so there is an active recruitment dynamic of the lobster in our waters, at least on the south coast of Puerto Rico.

Remember what happened with the mariculture in Culebra, and one of the unexpected outcomes of that mariculture experiment was that the net was just millions and millions of lobsters in it, because of the surface and the food availability, and it became loaded with lobster recruits, and so that's something just to think about. Sometime maybe the council would be interested in sponsoring or furthering that kind of lobster recruitment study, since it is the most important fishery, and that might be an important piece of information to have in our drawer.

RICHARD APPELDOORN: SEAMAP tried to approach this by looking at collectors, but the effort that they could afford to do was much lower than what was needed to get reliable estimates.

KEVIN MCCARTHY: I don't want to -- Since we're coming right up against five o'clock, but just two comments. We're not looking at larvae, per se, but we've got a couple of projects that will be starting up down both in Puerto Rico and in the Virgin Islands looking at some of the size compositions of the smaller lobster, and that might provide some indication of recruitment to the fishery, rather than recruitment into the area by larvae.

The other thing that I wanted to bring up, just before we run out of time, is I don't want to leave Adyan hanging, and so were we okay with those assumed landings that she used for the projections for 2019 and -- Well, I guess we have 2019, but for 2020, or did we want to revisit those, given what's going on right now with fishermen maybe not getting out there, and so that's something to -- If we want to give her homework, and I'm not suggesting that we

do, we need to decide what that's going to be, or decide that we're okay with those assumed landings for 2020.

SHANNON CALAY: If the SSC, for example, was concerned that 2020 landings might be much lower than what Adyan assumed, because of COVID, for example, we could run a sensitivity analysis where we assume that 2020 landings were half of those from 2019, and we could just show you results from that. It's not necessarily more probable than another model, and we would have to decide what we did with that results, ultimately, but, if what you're interested in is seeing the effect of a lower landings in 2020 than what was assumed, I suggest we just keep it simple and ask her to do one sensitivity run.

RICHARD APPELDOORN: I think that's a good idea, because I don't think we know what the landings are going to be. I recall a comment from Matt Kammann, I think it was, who has left the conversation here, regarding some SEAMAP communications, and he commented that the fisheries, at least in St. Thomas, were going quite well, because the fishermen were allowed to go out, and I guess they were essential workers, and the people -- They weren't going to restaurants, but they were all eating the fish at home, and so I don't know what data he was basing that, or whether it was just his gut feeling, and so we don't know what those landings are going to be island-to-island.

One would expect, perhaps, that landings are going to go down, because of the lack of tourist trade, and that might be substantial as we go into the year, and so doing a sensitivity analysis might be a good idea, and so why don't we make that recommendation?

SHANNON CALAY: So, for all three island platforms, you would like to see a sensitivity run where we reduce the 2020 landings to half of what was observed in 2019, and is that sufficient? I mean, is that good?

RICHARD APPELDOORN: I think that would be a really good idea, because the question is going to always come up, and so, if we have that, we can say, look, here's a drastic cut, and it only had this amount of impact, or, yes, it blows everything up, or something.

SHANNON CALAY: Okay.

VANCE VICENTE: You may want to add the earthquake effect, the January 6, 2020 magnitude 5.8, and 6.4 on January 7, and so it's not only the COVID. I mean, this started a little bit earlier than that, and, to that, you may add the previous years of the

northeastern storms, as well as Hurricane Irma and Maria, and it's a sequence of unexpected stochastic events.

SHANNON CALAY: You are, of course, correct, but the reality is that one can envision any number of possibilities, and it's just too numerous for us to try to quantify, and so I think what we need to do is we can run a very limited, like one or two, sensitivity runs, and I would prefer not to run any that are unnecessary, but what we can do is update this assessment any time we receive new landings, and that just requires a council request.

VANCE VICENTE: I understand, but, for example, the earthquake sequence paralyzed the south coast fisheries, and, I mean, fishers were simply just not going out, while the COVID was more holistically global, and it affects the north coast, south coast, east coast, west coast, and whatever. It's just to stratify the effects of the magnitude of these events.

RICHARD APPELDOORN: I think cutting the landings in half gets you a pretty good idea of what the impact of a drastic reduction is going to have on the outputs and recommendations of the model, and so the cause of those declines is actually irrelevant, in the sense of how the model performs.

VANCE VICENTE: It's not irrelevant. How differentially these stochastic events affect -- For example, Winter Storm Riley, a nor'easter, affected strictly the north coast, and the earthquake sequence affected the south coast, and so we have to understand how it -- I think it's relevant.

RICHARD APPELDOORN: The model is for, in this case, Puerto Rico as a whole, and it doesn't split out coasts, and so those reductions are just blended into the overall total landings. Yes, it impacts the fishermen and the fishery in those regions greatly, but it doesn't impact the model output.

VANCE VICENTE: I know. I understand, but let's not forget that we have that specific information, okay?

RICHARD APPELDOORN: That's fine with me. We do have the hurricane impact in there, because that data is included in the assessment.

SHANNON CALAY: That's correct. All right. I think Adyan has marching orders for tonight, and we can look at that soon, maybe tomorrow morning, and I don't want to put any pressure on her, if that isn't possible.

VANCE VICENTE: Okay, but I have to take my dog down, and this is

important. Bye.

RICHARD APPELDOORN: All right. It's after five. Graciela, the recommendation was the 50 percent lower landings, specifically.

GRACIELA GARCIA-MOLINER: Okay. So, tomorrow morning, whenever you're ready, and remember that I think that Jocelyn said that we could go with amending the agenda as we move forward, and so do you want to begin with this, or should we give Adyan some time and do this in the afternoon?

RICHARD APPELDOORN: I would like to give Adyan some time. I am not even sure -- Well, yes, let's give her some time, and we'll start at ten o'clock with the conceptual models.

GRACIELA GARCIA-MOLINER: Okay.

RICHARD APPELDOORN: All right. Thank you, everybody.

(Whereupon, the meeting recessed on May 18, 2020.)

- - -

May 19, 2020

TUESDAY MORNING SESSION

- - -

The Scientific and Statistical Committee of the Caribbean Fishery Management Council reconvened via webinar on Tuesday morning, May 19, 2020, and was called to order by Chairman Richard Appeldoorn.

RICHARD APPELDOORN: We will start the meeting, please. Welcome, everybody. This is the SSC meeting, day two. We have already -- Well, before we get to the status of the agenda, let me take a roll call. Again, I will do the SSC members first and then everybody else. Joe.

JOE KIMMEL: I'm here. Joe Kimmel, SSC member.

RICHARD APPELDOORN: Walter.

WALTER KEITHLY: I'm here, SSC.

RICHARD APPELDOORN: J.J.

JUAN CRUZ-MOTTA: J.J. Cruz, SSC member.

RICHARD APPELDOORN: Tarsila.

TARSILA SEARA: Tarsila Seara.

RICHARD APPELDOORN: Kevin.

KEVIN MCCARTHY: Good morning. Kevin McCarthy, SSC.

RICHARD APPELDOORN: Vance.

VANCE VICENTE: Vance Vicente, SSC member, present.

RICHARD APPELDOORN: Doug.

DOUGLAS GREGORY: Doug Gregory, SSC, present.

RICHARD APPELDOORN: Reni.

JORGE GARCIA-SAIS: Good morning. Reni Garcia, SSC.

RICHARD APPELDOORN: Jason.

JASON COPE: Good morning. Jason Cope, SSC.

RICHARD APPELDOORN: I believe that's all the SSC members. Oh, Churchill.

CHURCHILL GRIMES: I'm present.

RICHARD APPELDOORN: Thank you. Let's throw the others in. Liajay.

LIAJAY RIVERA: Buenos dias. Liajay Rivera, council staff.

RICHARD APPELDOORN: Graciela.

GRACIELA GARCIA-MOLINER: Graciela Garcia-Moliner, council staff. Buenos dias.

RICHARD APPELDOORN: Bill Cordero.

BILL CORDERO: Good morning, everyone. This is Bill Cordero, your trusty pseudo staff language interpreter.

RICHARD APPELDOORN: Iris.

IRIS OLIVERAS: Iris Oliveras, council staff.

RICHARD APPELDOORN: Carlos Farchette.

CARLOS FARCHETTE: Carlos Farchette, council member, top of the morning to all.

RICHARD APPELDOORN: Ricardo Lopez.

RICARDO LOPEZ: Good morning. Ricardo Lopez from Puerto Rico DNR Fisheries Research Lab.

RICHARD APPELDOORN: All right. Bill Arnold.

BILL ARNOLD: I'm here.

RICHARD APPELDOORN: Thank you. Sarah Stephenson.

SARAH STEPHENSON: Good morning. Sarah Stephenson, NOAA Fisheries.

RICHARD APPELDOORN: Okay. Guillermo Diaz.

GUILLERMO DIAZ: Good morning, everybody. Guillermo Diaz, Southeast Fisheries Science Center.

RICHARD APPELDOORN: Michelle.

MICHELLE DUVAL: Michelle Duval, consultant for the council on the strategic planning project.

RICHARD APPELDOORN: Okay. Other Michelle Scharer.

MICHELLE SCHARER: Good morning, everybody. This is Michelle Scharer.

RICHARD APPELDOORN: Okay. Alida Ortiz.

ALIDA ORTIZ: Buenos dias. Alida Ortiz, Outreach & Education Advisory Panel.

RICHARD APPELDOORN: Shannon.

SHANNON CALAY: Good morning, everybody. Shannon Calay, Southeast Fisheries Science Center.

RICHARD APPELDOORN: Jocelyn.

JOCELYN D'AMBROSIO: This is Jocelyn D'Ambrosio, NOAA Office of General Counsel.

RICHARD APPELDOORN: Christina Olan.

CHRISTINA OLAN: Buenos dias. Christina Olan, council staff.

RICHARD APPELDOORN: Stephanie Martinez.

STEPHANIE MARTINEZ: Good morning. Stephanie Martinez, Southeast Fisheries Science Center.

RICHARD APPELDOORN: Orian.

ORIAN TZADIK: Good morning, everyone. Orian Tzadik, Pew Charitable Trusts.

RICHARD APPELDOORN: Miguel Rolon.

MIGUEL ROLON: Miguel Rolon, council staff.

RICHARD APPELDOORN: Adyan.

ADYAN RIOS: Good morning, everyone. This is Adyan Rios, Southeast Fisheries Science Center.

RICHARD APPELDOORN: Skyler.

SKYLER SAGARESE: Skyler Sagarese, Southeast Fisheries Science Center.

RICHARD APPELDOORN: Francesca Forrestal.

FRANCESCA FORRESTAL: Francesca Forrestal, Southeast Fisheries Science Center.

RICHARD APPELDOORN: Nelson Crespo.

NELSON CRESPO: Good morning, everyone. Nelson Crespo, DAP Chair, Puerto Rico.

RICHARD APPELDOORN: Matt Kammann.

MATTHEW KAMMANN: Good morning. Matt Kammann, DPNR, Fish and Wildlife, St. Thomas.

RICHARD APPELDOORN: Raquel Holcman.

BILL CORDERO: Raquel Holcman is part of my staff, and this is a training event for her.

RICHARD APPELDOORN: Thank you. Maria Lopez.

MARIA LOPEZ: Good morning. This is Maria Lopez with NOAA Fisheries.

RICHARD APPELDOORN: Okay. Marcos Hanke.

MARCOS HANKE: Hello, everyone. I am here.

BILL CORDERO: Another trusty language interpreter.

RICHARD APPELDOORN: Okay. We have three callers. Caller Number 3.

JULIAN MAGRAS: Julian Magras, DAP Chair, St. Thomas/St. John.

RICHARD APPELDOORN: Thank you for joining us, Julian. We missed you yesterday. Caller Number 2. We're only getting kind of static background.

KEVIN MCCARTHY: Rich, I think I'm Caller Number 3. I think Julian was Caller Number 2.

RICHARD APPELDOORN: Okay. There's a Caller Number 5.

MATTHEW SMITH: I don't know if that's me or not. This Matthew Smith, Southeast Fisheries Science Center.

RICHARD APPELDOORN: That must be you.

MATTHEW SMITH: Okay. So that's me.

RICHARD APPELDOORN: That seems to be everything. Helena, can you identify yourself?

GRACIELA GARCIA-MOLINER: Yesterday, she was having problems with the microphone, but I see her name here in the list.

RICHARD APPELDOORN: All right. Let's proceed to the agenda. Is that what we have on the screen, Graciela?

GRACIELA GARCIA-MOLINER: Yes, and we modified the date, to move it from down below, and so you have a question-mark for the lobster update, and Shannon and Adyan are on the call, and so they might want to tell us if that's happening now or at a later date, and then we just moved the goals of the meeting to begin today, and then you have to let us know if you want to make any changes to

the times for today, what you want to do about Wednesday that you only have it marked for the morning, and so you might want to extend it into the afternoon, and then, Thursday and Friday, you also have the meeting on Friday up until -- On the 21st, you have all day, and, on the 22nd, you only have ten to noon. If you want to add the afternoon of the Wednesday or you want to make changes to the timeframe, this would be a good time to do it.

RICHARD APPELDOORN: Well, okay, and so we had a number of people who said they had to leave by four, and so we might try to strive to finish off today at 4:00, but I think we will need Wednesday afternoon, and is that a problem with SSC members?

VANCE VICENTE: No, but, Richard and Graciela, tomorrow, I have a medical appointment at 10:00, and it's apparently important, and so I have to be there between 10:00 and probably until 11:00 or 11:30 or so. Once I get back, I will get back to the meeting.

JORGE GARCIA-SAIS: I'm good.

JASON COPE: I have two other meetings scheduled during the off time that we had, but I will just -- We will see how that -- I think one would be during maybe lunch, and the other one is a little later, and so we'll see how that works out. If I have to drop out for an hour, then so be it.

KEVIN MCCARTHY: I can make Wednesday afternoon, but I've got a meeting from 12:30 to 1:30, and so I would like to start back up in the afternoon at 1:30.

RICHARD APPELDOORN: You're talking Wednesday?

KEVIN MCCARTHY: Correct.

RICHARD APPELDOORN: Okay.

JUAN CRUZ-MOTTA: That's fine with me.

JOE KIMMEL: It's fine with me. I'm retired.

CHURCHILL GRIMES: Likewise. It's fine with me, the Wednesday afternoon.

TARSILA SEARA: It's fine with me.

RICHARD APPELDOORN: Okay. Let's amend the agenda that we will start back in on Wednesday afternoon after 1:30.

BILL CORDERO: Can you please say what time you plan to end on Wednesday?

GRACIELA GARCIA-MOLINER: Do you want to go until 4:00 or 5:00?

RICHARD APPELDOORN: 4:00.

GRACIELA GARCIA-MOLINER: Today, do you want to end at 4:00 p.m., or keep it as 5:00 p.m.? I mean, you will have a quorum until that time, and so, even if people have to leave for an hour or so, that's fine.

RICHARD APPELDOORN: Well, yesterday, we were scheduled to go until 4:00, and we went to 5:00 anyway, and is that something we can decide on the fly, because the discussion yesterday was such that we wanted to finish that discussion part.

GRACIELA GARCIA-MOLINER: Okay, and so you will continue until you feel that there is a good time to stop.

RICHARD APPELDOORN: Correct. Shannon and/or Adyan, can you answer the question about when would be convenient for you to present the update?

ADYAN RIOS: I think right after lunch would be a good time.

RICHARD APPELDOORN: Okay, and so can we put that agenda item then or just say after lunch, and would that be sufficient? Technically, you have us running 10:00 to 12:00 and then stopping, and you need to have an afternoon reflected in there.

GRACIELA GARCIA-MOLINER: If you see, there is a 2:00 to 3:00 p.m., and so you need to scratch that May 19 10:00 to 12:00, and so delete that, because this will continue in the afternoon, and you want to come back -- Do you want to take a 12:00 to 1:00 break?

RICHARD APPELDOORN: Well, more or less.

GRACIELA GARCIA-MOLINER: Okay, and so a 12:00 to 1:00 lunchbreak, and so, Adyan, do you think you'll need an hour or a half-an-hour, and so 1:00 to 2:00?

ADYAN RIOS: I would say an hour, to be safe.

GRACIELA GARCIA-MOLINER: Okay, and so 1:00 to 2:00 will be the update. That's the lobster update. Okay, and so discussion continues on the conceptual model, so we know that -- Is there anything else that you need to change for today? After the update,

you will continue with the discussion on CMs?

RICHARD APPELDOORN: Yes.

GRACIELA GARCIA-MOLINER: Then we've done Wednesday also, and so May 20 already has the afternoon continuing discussion. On Thursday, you have it divided like that, and then, on Friday, do you want to end at noon, or do you think that you might need the afternoon, also?

RICHARD APPELDOORN: Well, I'm thinking we probably need three more days, but I think we should wait on that decision and see how we progress.

GRACIELA GARCIA-MOLINER: Okay, and so, if there are no other changes, then we'll save this as the annotated agenda, modified agenda, for today.

RICHARD APPELDOORN: We have a comment from Miguel, who says that any SSC member who hasn't put in their financial statement cannot vote, and so I don't think we would have any votes coming up here, but just a reminder that everybody needs to get their statements in.

GRACIELA GARCIA-MOLINER: Okay, and I don't see any other comments.

RICHARD APPELDOORN: The first item is going to be the intro, which I'm giving.

GRACIELA GARCIA-MOLINER: That's correct. Do you want to be made the presenter, or do you want us to move the slides, et cetera?

RICHARD APPELDOORN: You can move the slides.

GRACIELA GARCIA-MOLINER: Okay. We will set up your presentation.

FINALIZE THE GENERIC ECOSYSTEM CONCEPTUAL MODEL SUMMARY 2019 MEETING - CHAIR PRESENTATION TO CFMC 168 AND NEXT STEPS (18:37)

RICHARD APPELDOORN: I am going to give just a quick review, to get us all on the same page and for this who are listening in who haven't been involved in that, of where we're going and where we are currently, and hopefully set out our tasks for today.

We are reviewing the conceptual ecosystem model that we're trying to develop, and we're first going to look just a little bit at the overall model and then some examples of the sub-models and showing

how these connections are being made. We have those connections between the models and within the sub-models, and all of this is being done within the program called Mental Modeler, and that program integrates what I am calling arrows, and we can draw arrows between boxes to show what is affecting what, but that is integrated with a spreadsheet that then scores that arrow, and, by the same token, we can work on the spreadsheet, and it will draw the arrows in the box, and we can go back and forth in the program with that.

There are eight sub-models, and each sub-model has a variable number of components to it, and I have put the current level in parentheses there, and, if you want to make the calculations, we're looking at potentially over 62 million connections that could be made, and that's just in one direction, and connections can actually go in each direction, and so this is not a trivial exercise that we're trying to do here.

This is where we were not last time, but the previous time before that, and so this is the slide that I had shown at the last council meeting, and what you're really seeing is most of the connections between the sub-models, because the ones within the sub-models are too fine to be able to pick up here, but the point of showing this is basically we have the system divided into two areas.

Kind of on the upper left is the socioeconomic components, and on the lower right is the natural system, and so the natural system has habitat and water quality and marine ecosystem components and abiotic factors, and the more socioeconomic and cultural aspects are incorporated into fishing socioeconomic and cultural drivers, competing uses, and land-based sources of impacts, and so we're trying to be fairly comprehensive in this generic model.

This is another look at where we are now, and, again, these are the lines going between the sub-components now, and you're not seeing the lines within sub-components. This is just to give you an idea of the complexity of some these boxes, versus some of them are fairly simple, some of the sub-models, but there are connections throughout, and where are we going to? That's that next slide.

I think this kind of summarizes that things will look like when we're done, and so just an example, two examples, here of how we're integrating between the drawing of arrows and the spreadsheet, and so this is the fishing sub-component, or sub-model, and you can see there are ten components in that now, as it exists at the moment anyway, and let's take a look at something like fishing gear.

It has arrows going to commercial fishing landings, recreational fishing landings, derelict fishing gear, fishing mortality, and discards and bycatch, and so there are five arrows there. Whether this holds up, we'll see. I would have thought that maybe fishing gear would affect fishing mortality and that that would affect landings, but that's to be discussed when we get to that box, and so this current model is reflected in the spreadsheet, and that's the next slide.

You can see that the columns and row headings are the components for the model, but, if you're reading who impacts who, you read across the spreadsheet, and so fishing gear, which happens to be the top one, as we see, is affecting derelict fishing gear, fishing mortality, discards and bycatch, and then recreational and commercial landings. If you were to read down, you find out who is impacting you, and so like, for fishing mortality, that's impacted by fishing gear, derelict fishing, discards and bycatch, et cetera.

You see, in this particular case, all the numbers that are there are zeroes, and so the zeroes are in boxes for where there is a line, and the committee has yet to assign direction and magnitude to those interactions, and so this is a component that has not been fished, and all the components have not been finished, but this is one where we started drawing lines, but we did not get to the point of assigning weights to those lines or directions, and so something can positively affect another component, or it can negatively affect another component, and so the sign can be either positive or negative, and the magnitudes are scaled low, medium, high, or 1, 2, and 3.

Here is another simple one for water quality, and, here, we can see, for instance, light penetration is affected by five different components, and turbidity is affecting light penetration, but it's also affected by algal blooms, and so let's go to the spreadsheet. I think there's actually somewhat of a difference between the drawings and the spreadsheet here.

If we look across say turbidity, in the middle there, we can see turbidity is affecting algal blooms positively, because there might be materials that fertilize algal blooms, causing that turbidity, but it has a strong negative impact on light penetration. If you look at the suspended sediments, it says those are affecting turbidity, eutrophication, and water toxicity.

As suspended sediments go up, those values also go up if turbidity, in particular, is being strongly affected, and so that's how we

read these graphs. If you want to know what is affecting turbidity, then you look down, and so turbidity is affected by suspended sediments and by algal blooms in the current version of this.

In an attempt to move forward on this, each sub-model was assigned to an SSC member, and they were asked to give a brief overview of things, and so a summary of what the sub-model is, what its current status is, in terms of filling things out, what are the connections that are there, what needs to be done, where do we need to go, and that's the pending discussion, and some recommendations, if they can, on where connections should be made, or perhaps taken away, from where we were before, and generally to lead the discussion in us filling out the either diagrams or spreadsheet. That's my intro presentation. I think Liajay had some slides on Mental Modeler, and is someone going to walk us through those?

MENTAL MODELER REVIEW

GRACIELA GARCIA-MOLINER: Yes. She will present one example from the Mental Modeler, the way that the weights and the direction that you have come up with to date look like, and this is because none of the sub-models are finished, and so, once you finish all the recommendations that you are making, then the model can be filled, and that's the idea behind you working on the Excel file, which is probably much faster than in the Mental Modeler, and so we'll just give you an example, if she can pull up the Mental Modeler and one of the sub-models. There is a little bit of delay, because the internet in Puerto Rico is not as fast as it should be, but we will give it a try. This is just a picture, right?

LIAJAY RIVERA: Correct. This is a screenshot.

GRACIELA GARCIA-MOLINER: So give me the Excel file that they fill out first, please. Thanks. This is what Richard presented earlier, the Excel files that you each have received, and we have all of what you have done up to date in here, and you have used 1, 2, and 3, low, medium, and high, which, in the Mental Modeler, actually doesn't work like that, and so we just put 0.33, 0.66, and 1.0, so that it would show positive and negative relationships, and that turns into the matrix of the Mental Modeler.

That is the manipulation that you have to do for the Mental Modeler, because it's just really much faster, and that turns into -- This is what it would look like when you have it completed, and the ones that you received, the original ones, had all these question-marks, because you have to add the value to the Mental Modeler, to see what is the weight of the connection between one

and the other, and so the blues are positive, and the red are negative values, and then the size of the arrow will tell you the weight that you have given to that connection, how strong of a connection you have made.

Richard, do you want to actually see the Mental Modeler working right now, because these are just screenshots, and this is what we have that you have provided to the staff and turned each of the sub-models into this Mental Modeler pictures, but we do have the Mental Modeler, per se, that we can go ahead and show you the weights and the direction.

RICHARD APPELDOORN: Was that not the spreadsheet that you just showed us?

GRACIELA GARCIA-MOLINER: Yes, but, in terms of actually moving the weights or anything else -- This is just for presentation purposes, but we actually have access to changing any weights, as soon as you give them to us. Jason has a question, and then I have a question about positive and negative values.

JASON COPE: Just a clarification, maybe just for my benefit. Later, I will be doing the fishing sub-model, and I'm thinking, if an arrow is positive, does that mean it increases whatever it's connecting to, and the negative means it's decreasing the effect?

I guess positive and negative -- Positive, in mathematical terms, is it increases something, but we could also think of positive as doing something good, versus doing something not good, and so just a clarification. If something is connecting to something that's positive, that means it's increasing the effect? Whether that's good or bad, in qualitative terms, it's increasing the effect, and is that correct?

RICHARD APPELDOORN: That's correct.

JASON COPE: Thank you.

GRACIELA GARCIA-MOLINER: I mean, the idea now is that each of you would have a presentation on where we are, in terms of that Excel file that you started filling out at the last meeting, and then review all that you have done to date, and we can then get the information from the Excel file going to the Mental Modeler and show you what it looks like once we have put the values that you've come up with during this meeting, and so that's what we have for -- This is just an example, and do you actually want to go into the Mental Modeler right now and do some manipulation, or do you want to go into the fifteen-minute presentations?

RICHARD APPELDOORN: I think I would like to go into the presentations, because we're going to get to the Modeler at some point.

GRACIELA GARCIA-MOLINER: That's correct.

GRACIELA GARCIA-MOLINER: Okay, and so do you want to do them in the order that you have them in the agenda, beginning with the ecosystem components?

RICHARD APPELDOORN: There is two ways we can do this. One would be to hear all the presentations, and then weigh into everything, and the other one is to hear a presentation and weigh into that topic, and I don't know if anybody has a preference on that.

GRACIELA GARCIA-MOLINER: For practical purposes, for the staff, it would be better if we do one at a time and then review everything at the end, but that's the prerogative of the SSC members.

RICHARD APPELDOORN: I think I might choose a different order than what's on the agenda, just because it might be better to work some of the simple ones first, but we have the agenda, and, if anybody has been hoping to catch things in that order, we should probably stick with that. Marine ecosystems is first, and is that correct?

GRACIELA GARCIA-MOLINER: That's correct, and do you want each SSC member to do the presentation themselves and become a presenter and do this -- Like marine ecosystems would be J.J., and what's your preference?

JUAN CRUZ-MOTTA: For me to be the presenter.

GRACIELA GARCIA-MOLINER: So we can turn over the control to you, or we can show your slides and you can tell us when to move on.

JUAN CRUZ-MOTTA: Let's see how it goes with you guys showing the presentation. Thank you.

GRACIELA GARCIA-MOLINER: Okay. Hold on a second. Let's put it in the context. There you go.

PRESENTATIONS ON EACH COMPONENT FOLLOWED BY DISCUSSION TO FINALIZE CONNECTIONS, DIRECTIONS, AND STRENGTHS

MARINE ECOSYSTEM (38:57)

JUAN CRUZ-MOTTA: Thank you, Graciela. I was debating whether to go first or not, but I guess somebody has to go first and be the

guinea pig with this process. Then I decided, okay, let's do it, because I realized this component was pretty much worked, and, I mean, we have advanced, and so all the connections inside the model have been worked, or decided about, during the last meeting, and what you see now is what the model looked like when we started talking about it at the last meeting.

However, when you start putting the numbers that we talked about, the magnitudes between the elements of the model, we pretty much got this model worked out, and the model is composed of these twelve elements. As you will see at the end of this short presentation, they are closely related to -- Obviously, these are related to other models, but, in particular, to the habitat model.

It has twelve elements, and most of those elements, as you will see later, are connected in a bi-directional way. There are a few sections where the relationship is unidirectional, and so that made our lives simpler, in this case. What else can I tell you about this component?

I don't know, Richard, but how do you suggest we go about it? Is it step-by-step of what we did or perhaps -- I will have a go, and, if anybody has a suggestion in the way to do it, please stop me, and we will change gears, or we can pedal back, and we will see how it goes.

Anyhow, this was the original model, and then the next slide -- This is an explanation that I just put in there for the people to read when looking at the presentation, for my fellow colleagues at the SSC, but I can explain all of that as I go through the next slide.

This is -- I didn't animate it correctly, but, anyhow, I animated these slides so that we could look step-by-step at the different connections that we talked about. Whenever you see a continuous line, this is a connection that we have already decided on, and we also -- I also included the magnitude of that relationship, and I wouldn't like to go in and explain each relationship, because it will take a long time, but I will try to go slowly.

If there is a connection that you disagree with, or a number that you disagree with, just stop me, but those numbers are basically the numbers that we talked about, and so pretty much we reached consensus last time, but perhaps there is something that you will say -- If there is something that is really bothering you, if you say, no, it shouldn't be three, and it should be one or zero or whatever, then just speak up, please.

I tried to do this with the reef fishes in the middle, as a central node, for all the relationships, only because that is closely related to the fisheries component and the habitat component. You will note that reef fishes has, in this case, a positive influence, as defined before by Richard, on those four elements of coastal birds, cetaceans, coastal pelagics, and highly migratory species. Also, there is a relationship between those four boxes and reef fishes, but, however, the magnitude was not the same. Any comments so far on this?

RICHARD APPELDOORN: You just have a one for marine reef fishes affecting coastal birds?

JUAN CRUZ-MOTTA: Yes.

RICHARD APPELDOORN: What was the rationale for it just being one? Is it that coastal birds are also eating other stuff? I mean, there are lots of birds, like the wading birds that are picking up invertebrates off the bottom and things like that, and then there are things like pelicans, which are obviously eating fish, and so if you could just explain that one.

JUAN CRUZ-MOTTA: I didn't look at the -- Sorry about this, Rich, but I didn't look for the justifications in the verbatim transcriptions, and, when I did this exercise, I used the numbers that we decided and that we input in the Excel sheet, and I want to make a comment about this.

Please note that it might be a typo as well. I discovered a few typos, mistakes, in the data sheets. Like, for example, two relationships that were both positive and then, obviously, one should have been positive and the other one negative, and so I don't know the justification for the one, but precisely the intention of this exercise is to pick on those and then, as a group, decide if we're happy with one or change that to another number, or would you rather me go and then go back and do the homework and come back with the justification for all the lines that we set up there? What would be your suggestion?

RICHARD APPELDOORN: I'm actually happy just to know that that number came from our discussions before, and you're right about the directions. My recollection is, when we were discussing this, especially early on, that we were not specifying directions, and so that could be not a typo, but just we never got that far.

VANCE VICENTE: Richard, I am just trying to remember what comments in our discussions, during our last meeting, we suggested in any way that coastal birds would have a negative impact on reef fishes,

and why reef fish have a positive impact on coastal birds. I mean, the specific statement of that negative between coastal birds and reef fish, I don't remember exactly what we said, and I don't remember.

JORGE GARCIA-SAIS: I remember that we said that there are some fishes that will eat the birds, but the species that I was thinking of was crevalle jacks, and the species does not occur here, but I still believe that there is some interaction between fishes eating birds, and for sure sharks do sometimes, and so there is an interaction, but, if anything, I would put one or 0.5. It's very small.

RICHARD APPELDOORN: I think you're confusing this. It's fairly simple. Fishes are the food supply for some coastal birds, and so that's a one, going toward coastal birds, and coastal birds eat reef fishes, and so that depresses reef fishes, and so that's why it's a negative-one. I would argue that maybe the impact of fishes to coastal birds ought to be a two, because the impact to the birds I think is stronger than the birds have on reef fishes.

VANCE VICENTE: I think that Reni's point -- I mean, it was taken, but we decided that we were not going to give any type of significant weight to it, because it normally goes the other way around, and that's my recollection.

JUAN CRUZ-MOTTA: Sorry, Vance, but can you repeat your point? I lost you.

VANCE VICENTE: What I'm saying is that Reni's point on the crevalle jack feeding on birds is that it was discussed, and it was taken, and it was well taken, but then I believe that we agreed that we were not going to give much weight to it, because it's like a circumstantial type of event, and it's rare and not a standard trophic level exchange, and, I mean, that's my recollection.

JUAN CRUZ-MOTTA: Thank you, Vance.

ORIAN TZADIK: Rich, can I maybe clear up this point?

RICHARD APPELDOORN: Go ahead, Ori.

ORIAN TZADIK: From the minutes from the last meeting, I think the distinction here is that these are reef fishes that you're talking about, and you guys made the distinction between reef fishes and forage fishes, and so, right here, you have Reni saying I think it's a three, and, I mean, coastal birds live off reef fishes, but

then you pointed out that you want to separate inshore forage fishes from reef fish, and then you guys agreed that it would be a one.

RICHARD APPELDOORN: Thank you.

JUAN CRUZ-MOTTA: I wanted to clarify, because this is an animated slide, and there are some boxes that haven't appeared yet, and, actually, all those four boxes on your left, infectious disease, turtles, manatees, and invasives, they were not supposed to be appear yet, and I wanted to do this step-by-step, and so there are boxes here that haven't appeared yet.

RICHARD APPELDOORN: Okay, and why don't you proceed then?

JUAN CRUZ-MOTTA: Okay, and so would you like to change one for two on the relationship between coastal birds and reef fishes?

RICHARD APPELDOORN: No, not in light of Ori's comments about our discussion last time.

JUAN CRUZ-MOTTA: Okay, and so then, basically, this is what we were just talking about, the inshore forage fish, and we said they have a positive effect on the reef fishes, and they are basically the food supply for reef fishes, but then we didn't, and this is the first case of a dotted line that I wanted to bring to your attention, but we don't have that line yet, and we said it's zero, that there was no relationship there, and so I would like to hear from the rest of you, to see if we should put a number in that relationship.

RICHARD APPELDOORN: Well, yes, we should. Reef fishes are, obviously, impacting the forage fish population.

JUAN CRUZ-MOTTA: Anybody else on proposing a magnitude of that relationship?

JORGE GARCIA-SAIS: J.J., how I see it is that forage fishes are a composite of different kinds of fishes, all of which at some point may affect reef fishes, but not all reef fishes, and, for example, among the forage fishes, you have a lot of estuarine species, including all the anchovies and the sardines, for example, and those are pretty much estuarine, and they have their own food web over there, and then they probably affect or serve as food for migratory pelagics and coastal pelagics and that kind of thing, but not your typical reef fish.

I mean, the grouper typically doesn't eat the sardine. The

groupers and snappers don't feed on sardines and anchovies, which are the typical forage fish, and, rather, reef fishes tend to have other types of forage fishes, like it could be other reef fishes like gobies, for example, and that kind of -- Reef fishes, in my opinion, from my perspective, reef fishes, demersal reef fishes, tend to eat a lot of smaller demersal reef fishes.

The coastal pelagics are the main predators of what you're probably referring to here as inshore forage fishes, which I pretty much consider that you are talking about coastal estuarine fishes, including sardines and anchovies, and I may be wrong, and it's part of your discussion over there.

JUAN CRUZ-MOTTA: If I summarize your position, you are proposing that that line shouldn't exist, correct?

JORGE GARCIA-SAIS: If it exists, for me -- I mean, if you are talking, if you are defining, inshore fishes, and you're thinking about sardines and anchovies and the likes that are typically coastal estuarine fishes, then I believe that it should be, at maximum, a one, because your demersal reef fishes, coral reef fishes, or even reef fishes, typically do not feed on these coastal pelagics, I mean, these coastal estuarine forage fishes like sardines and anchovies.

JUAN CRUZ-MOTTA: Thank you, Reni. Does anybody else have an opinion on this relationship?

JOE KIMMEL: I agree with Reni that, the inshore forage fishes and the reef fishes, they are connected. Reef fishes do prey on some forage fishes, depending on the species, but I like the dotted line, but I would give it a one as a score.

JUAN CRUZ-MOTTA: Thank you, Joe, and so we have Rich that said, yes, there should be a line, and then Reni said, if there is a line, it should be one, and Joe said one as well. Any other opinions?

RICHARD APPELDOORN: I think, based on Reni's comments, that the input of forage fishes into reef fishes is not as high as the three. This gets down to what we're calling reef fishes versus coastal pelagics, and, the coastal pelagics, I think we were thinking about the big scrombrids.

JORGE GARCIA-SAIS: Jacks.

RICHARD APPELDOORN: Yes, jacks and those kinds of things that are primarily out near the shelf edge, but do come into the reefs to

forage.

JORGE GARCIA-SAIS: That is my point, Richard.

RICHARD APPELDOORN: No, I get your point, and so I am good with a one on the dotted line, but I think I would reduce the three on the solid line to a two.

JUAN CRUZ-MOTTA: A quick question for Graciela and Liajay. If we do make changes on these numbers, or add numbers, are you taking notes from that?

GRACIELA GARCIA-MOLINER: Yes, but it will be following the verbatim minutes to give you input on that, and Sarah, I believe, is going to be doing the Excel, but we are taking notes, and this is completely recorded. Everything that you see on the screen and everything that you say is recorded, and so we can always go back to this, but the Excel file should be amended as you speak, and we'll present that to you back, so that you remember what you've done.

JUAN CRUZ-MOTTA: I would like to bring to everybody's attention one question and one comment, a question by Marcos Hanke. He is asking whether the forage species includes shrimps and crabs. From what I -- I don't remember from our discussions whether we included invertebrates on those forage species, and then Matthew Kammann makes an interesting point that it is hard to say whether predation can have positive or negative effects if we do not take into consideration the relative effect of competition, and then what he is referring to here, I guess, and, if not, Matthew, please correct me, but it's to the positive indirect effects. If I eat a Species A that is competing with B, then that's a positive indirect effect on B, right? Colleagues from the SSC, please correct me if I'm wrong, but, in this case, we were trying to picture only the direct relationships.

RICHARD APPELDOORN: I think we can be as expansive as we want, but a lot of this competition is going to take place within a component and not between components, and so it would have to be something unusually strong for us to even consider it.

JUAN CRUZ-MOTTA: Also, I would like to add, Matthew, that, eventually, we will do -- We will work on quantitative data for these models, and at least to review the versions of these models, and each one of those boxes is actually a matrix, and it's not a single variable, and we hope that we can model it, the whole matrix, and, by doing so, the potential biological interactions that may occur within those matrices, but that's work for the

future. It is my understanding here that we're only trying to establish potential relationships, direct relationships, among these boxes that you are seeing in the slide.

JORGE GARCIA-SAIS: Maybe a suggestion. Instead of calling them inshore forage fishes, you can maybe catalog them as inshore forage specie, and that would include invertebrates. That way, shrimp and crabs will fix in that box.

JUAN CRUZ-MOTTA: That sounds really interesting, and I would agree, and would anybody oppose that?

RICHARD APPELDOORN: What's the missing box?

JUAN CRUZ-MOTTA: There is no missing box. Instead of calling that inshore forage fishes, to call it inshore forage species, so we can include shrimp and crabs.

GRACIELA GARCIA-MOLINER: In the definition of the Magnuson-Stevens, fish include shrimp and crabs, et cetera, but you can call it whatever you want.

JUAN CRUZ-MOTTA: Thank you, Graciela. I think then that we're good, and you are actually answering Marcos's question that I was not able to answer before. Thank you, Graciela.

RICHARD APPELDOORN: Plus, we have a crustacean box.

JUAN CRUZ-MOTTA: Not in this model.

GRACIELA GARCIA-MOLINER: Sometimes you had included in your definition of inshore forage fishes -- Maybe there is a breakdown of the groups that you included, but, in this last Excel file that we sent, that's the way that it was left after the last SSC meeting, and so, if you want, under that description of inshore forage fishes, that should include crustaceans and any other of the groups that you've been talking about.

RICHARD APPELDOORN: Well, reef fishes could be fishes and shellfishes. The big question is where is conch and lobster falling in. They are very important components here, and so, if they're embedded in reef fishes, and shrimps and other things are embedded in forage fishes, that's fine, to risk using an expansive term for "fish". If we're leaving this to actual fish, then we need something for like benthic invertebrates.

JUAN CRUZ-MOTTA: Give me a minute. I'm trying to open up the habitat model to double-check something. Give me one second,

please. I was thinking about lobsters and conch when working on this model, and, also, species like diadema, which are important invertebrates, but I don't know if that would be related to the box that says corals or seagrasses or mangroves in the habitat model.

RICHARD APPELDOORN: Well, it's a good question.

JORGE GARCIA-SAIS: What I was going to say is it depends on how generic you want to be, and I had the same kinds of questions during the land-based use sub-model. It's how generic you really want to be, because, as Graciela pointed out, reef fishes include just about everything, and it probably includes conch and lobster as well, and, if you push it a little bit more, you can probably fit the coastal pelagics into reef fishes, too.

Most reef fish references, as you've seen, will include coastal pelagics. HMS, that would be a separate thing, because those are mostly oceanic and migratory, but the coastal pelagics are typically included within reef fishes.

The thing is that, when you look at the box, then the relationship with the other things would be something like some yes and some no, and so that is kind of like the difficulty in making these assessments. It's that, when you make such generic boxes, there is a lot of variability within the box, and then we don't know what applies and what does not, and that's kind of like the hard thing about this.

RICHARD APPELDOORN: Well, neither one of these, or any of these boxes -- Well, I guess, like manatees is a separate box, but, when you talk about reef fishes versus coastal pelagics, there is not a hard line there. There's a fuzziness, and you can look at coastal pelagics almost out to something like dorado and wahoo, but more like the sierras and things like that, which are not really coming inshore that much, versus say some of the jacks and some of the other scrombrids.

Then you have some that move around a fair amount, and so there's no hard line here about when you go from a reef fish to coastal pelagics, but the reason things like turtles and manatees and highly migratory species are there was because they are specific components that the council has to deal with, either because they have input into those things, or those things have been put to the council, or because there are other laws in effect here, and so cetaceans and protection of endangered species, like turtles, as well have impacts, in terms of what management, on what fishing activities, can be done, because of the protections afforded on

them because of their status, and so the coastal pelagics is then trying to deal with those things that are more truly coastal pelagic and not the ones that are strongly moving into shall we call it the reef environment, but, if it's really something that's doing a lot of stuff in the reef environment, we're going to call that a reef fish.

VANCE VICENTE: Richard, regarding the larger herbivores, the turtles and manatees, I know that we're asked to consider them in all of our recommendations and modeling. Unless we see something within the reef fish box, and not forage, but the reef fish box, that competes in some way or modifies significantly the habitat, the diet, of the turtles or manatees, which I know of no specific reef fish, except reef fish invertebrates, which would include diadema and the like, which could interfere with a turtle and manatee's forage behavior, then I would see some connection, but, at this point, I don't know how to link these protected resources to this stage of the discussion.

RICHARD APPELDOORN: Remember that, in this case, and in the case of a lot of the abiotic factors, they are grouped in the sub-model because of basically the heading of the sub-model, but most of their connections are actually outside that sub-model, and so this is going to be really obvious with the abiotic factors.

A lot of the abiotic factors don't interact with each other, but they do interact with a lot of the other components through the other sub-models, and so habitat effects are certainly a factor on turtles and manatees, and so they're going to interact with the habitat model, but they're a component of the marine ecosystem, and so that's why they're listed here.

VANCE VICENTE: Okay, and so we agree. Okay. Thank you.

JUAN CRUZ-MOTTA: Okay, and may I suggest two things? First would be to finalize the numbers between reef fish and inshore forage fishes that we agreed on and other invertebrates, as defined -- Like Graciela sent the documents for crustaceans, and mollusks are included in term "fish", and so that will solve the problem.

Just for Ori and the people taking notes, I just wanted to see if we all agree, and then the relationship between the forage fishes and reef fishes will come down to two, and then there will be a relationship between reef fish and inshore forage of minus-one, and do we agree on that?

RICHARD APPELDOORN: In light of our understanding of the inshore forage fishes, I would leave the connection as three. There is a

lot of benthic feeding going on that feeds into reef fishes.

JUAN CRUZ-MOTTA: Thank you, Rich. Then I will rephrase myself, and I will correct myself. It would be three and minus-one, and do we agree on that, or is there any other comment?

JORGE GARCIA-SAIS: Another comment is that I have a little confusion between what is inshore and what is coastal. Isn't that the same? If it's the same, then the strong relationship must be between coastal pelagics and coastal forage fishes. Then, if it's like coastal pelagics, it's a predator of both reef fishes and coastal forage fishes.

The relationship between the reef fishes and the coastal forage fishes is low, and it's small, because there is many, many reef fishes that are not even carnivores, and you have a lot of herbivore reef fishes, a lot of omnivores, and a lot of reef fishes that will never eat a sardine, and they are demersal, and they do not fish in the pelagic realm, and they just fish on the bottom. They fish on crabs and on worms and shrimps and things like that, and so that concept of inshore forage fishes, which I feel in my mind what you are thinking about, massive amounts of sardines and anchovies, and those are -- The strong relationship there is for coastal pelagics and not your typical reef fish.

That is how I see it, and the thing is that, the more generic you make these boxes, the higher the variability terms, in putting of the lines, and, at some point, I can tell you that reef fish have probably arrows going both ways with every one of these model components.

JUAN CRUZ-MOTTA: Reni, as I said before, there are other boxes missing here, and, also, there are relationships that I haven't shown yet. For example, between inshore forage and coastal pelagics, that's coming up. We are still on the central node of reef fishes. About this relationship, what numbers would you say we should use in this model for the relationship between inshore forage and reef fishes?

JORGE GARCIA-SAIS: If we are saying that reef fishes are not coastal pelagics, then the connectivity within forage fishes and reef fishes I believe to be a one. It all depends on what you define it as, because these boxes are big, and they need definitions. They need definitions of what is an inshore fish, because, you know, for you, it might be something, and, for me, it might be something else.

RICHARD APPELDOORN: Let's call it inshore forage species. That

is including the shrimps, all the benthic things that groupers and grunts are eating and things like that.

JORGE GARCIA-SAIS: Okay. That I believe, because -- You may know it, but the typical Joe doesn't know that a crab is inside that box. 99.9999 percent of everyone that will see this will never guess that a crab is inside that inshore forage fish.

GRACIELA GARCIA-MOLINER: Okay, and so the suggestion would be to make inshore forage fishes to inshore forage species, and then we'll make a note of everything that you mentioned thus far.

JORGE GARCIA-SAIS: That helps, because it allows you the flexibility to think that it may not be only fishes.

RICHARD APPELDOORN: Okay. If you haven't seen Graciela's comment, she says, according to the Act, "fish" means finfish, mollusks, crustaceans, and other forms of marine animals and plant life other than marine mammals and birds.

JORGE GARCIA-SAIS: That's a --

GRACIELA GARCIA-MOLINER: We would edit the PowerPoint presentation and change fishes for species and add the numbers right here, as you're going along. J.J., would you like us to do that?

JUAN CRUZ-MOTTA: Yes, and, basically, what that involves is going out of the presentation mode and make the change and then go back and start animating everything back again, if that's okay.

VANCE VICENTE: Richard, maybe, in that box with reef fish, you could specify reef finfish, and then maybe include the reef fish invertebrates and other stuff in a separate box, and that might clear things up a little bit, and I don't know.

RICHARD APPELDOORN: I think this is going to be a long day.

VANCE VICENTE: Richard, did you get to hear me, or were you talking, or were we not connected?

RICHARD APPELDOORN: My comment was definitely because I heard you.

VANCE VICENTE: I didn't get any answer, but I thought that including reef finfish would make a lot of difference for our discussion.

RICHARD APPELDOORN: My comment was this is going to be a long day.

VANCE VICENTE: Okay.

CHURCHILL GRIMES: My comment is I agree.

RICHARD APPELDOORN: J.J., the figure that's on the screen now, can you continue your presentation, just working off that image? That's the one they can edit.

JUAN CRUZ-MOTTA: Yes, and I'm waiting for it to come back to the animation mode.

RICHARD APPELDOORN: That's not what I was asking. What they had up on the screen was the full model, the filled components with the lines drawn.

JUAN CRUZ-MOTTA: That's correct, yes.

RICHARD APPELDOORN: So can you work off of that one, because that they can modify as we go. This is your PowerPoint.

JUAN CRUZ-MOTTA: The thing is there are so many boxes and connections that I thought it would be easier to go as we are doing now, but, if you want me to have a go at the other one, I am happy to try.

GRACIELA GARCIA-MOLINER: We are taking notes on the side and editing the Excel file at the same time, and so we're doing that outside of the presentation, and so it's up to you.

JUAN CRUZ-MOTTA: You tell me what you want to do, look at this or go through the animation that we can look at each. You tell me. It's up to you guys.

RICHARD APPELDOORN: I think I could work off of this figure, as long as we pay attention to what box we're talking about.

CHURCHILL GRIMES: What is the significance of the red line versus the black?

JUAN CRUZ-MOTTA: There is no difference at all. It's just, when I was working on this, there were so many blue lines that I started to get confused, and so the last interactions are -- I changed colors so I wouldn't get lost, but there are no differences between blue and red. The only differences are between continuous lines and dotted lines, and that's all.

RICHARD APPELDOORN: Okay. I see the problem. You're working off of your presentation, but we're trying to see this one at the same time, and is that it?

JUAN CRUZ-MOTTA: Okay, and so we have now -- I would like them to focus on the relationship between forage species and coastal birds. It has a magnitude of three and minus-one, and is that okay?

RICHARD APPELDOORN: That sounds good to me.

JOE KIMMEL: I will agree with that as well.

CHURCHILL GRIMES: I agree.

JUAN CRUZ-MOTTA: Okay. Thank you. Then the relationship between forage species on the top to cetaceans on the bottom-right corner, and it's three and minus-two.

RICHARD APPELDOORN: Which is the three, and which is the minus-two?

JUAN CRUZ-MOTTA: It's difficult to see it in this version.

RICHARD APPELDOORN: That's why I'm asking.

GRACIELA GARCIA-MOLINER: Do you want us to bring the Excel file up?

JUAN CRUZ-MOTTA: For me, it's really hard to point and say which is three here and which is minus-two, and that's why I animated the presentation, Rich, because then you could see what I'm talking about.

RICHARD APPELDOORN: Yes, but I'm assuming you know which one is which.

JUAN CRUZ-MOTTA: Yes, but I cannot show you here which one is what.

RICHARD APPELDOORN: I just want to know is the line going from inshore forage to cetaceans the three or the minus-two, compared to the line going from cetaceans to inshore forage?

JUAN CRUZ-MOTTA: From forage species to cetaceans is three, and from cetaceans to forage species is minus-two. Does anybody have a comment on that?

JOE KIMMEL: I mean, I don't know what the number should be, but those numbers seem high to me, considering we're dealing with cetaceans, which are large, offshore things, for the most part, and inshore forage species. There is interaction, I'm pretty sure, but I don't know what the strength of it would be, and I don't think it would be a three in one direction though. It would probably be maybe a two and a minus-one, and I don't know.

VANCE VICENTE: Remember that under cetaceans we're including the porpoises and the dolphins, the bottlenose dolphins, which are all -- Most of them are coastal.

RICHARD APPELDOORN: The bottlenose dolphin is by far the most abundant cetacean around Puerto Rico, and it is feeding largely on fishes, and it's inshore. Something like 80 percent of the individuals are found within five kilometers of the coastline.

JORGE GARCIA-SAIS: They do go into the mouth of the bays, and dolphin feed on inshore forage species like sardines, mostly sardines, and, actually, almost in every single embayment of Puerto Rico, there is a family or a group of dolphins that feed on the flux of sardines in and out of the estuary.

JOE KIMMEL: I agree, and I know that the cetaceans, the bottlenose dolphins, they come into the area right behind my house, and what they're eating primarily are mullet and pinfish and stuff like that, but the inshore forage -- I guess mullet and pinfish are considered inshore forage species by some, but --

RICHARD APPELDOORN: Well, there's also a connection to the reef fishes, and so I don't have a problem with a three, but I would think the minus-two might be a little high, and I'm not sure that the cetaceans are greatly impacting the inshore forage species, but there may be some species where they do, but, as a group, I'm not so sure.

JOE KIMMEL: I know that when charter boat fishermen are fishing in an area, and they begin to see dolphin preying on fish, they will sometimes just pick up anchor and go somewhere else, because the dolphins do -- If they don't eat the fish, they will scatter them all around, or cause them to be more secretive and hide, and so they're harder to catch, and so they will oftentimes pick up anchor and go to a different area.

RICHARD APPELDOORN: But that's for the forage guys or for their impact on reef fishes, which also occurs?

JOE KIMMEL: It's for the forage species there. The cetaceans on

forage species, and cetaceans will cause the forage species to take shelter and hide, and so people that are fishing, charter boat fishing, will leave the area for some other area, and so what I'm saying is the cetaceans do have a -- I guess it's a negative relationship to inshore forage fishes, but I just don't know what the level should be.

RICHARD APPELDOORN: Right, but, to clarify, your charter fishers are fishing for forage fish?

JOE KIMMEL: No. They're usually fishing for redfish, spotted seatrout, and snook, that kind of stuff.

RICHARD APPELDOORN: So what you're saying is, because they're coming in and feeding on forage fishes, all fishes are scattering, or hiding?

JOE KIMMEL: Exactly.

RICHARD APPELDOORN: Thanks.

JORGE GARCIA-SAIS: Joe, your concern is whether dolphins are making a significant impact on the inshore fish populations?

RICHARD APPELDOORN: Yes.

JORGE GARCIA-SAIS: Well, I would agree that minus-two is high, and I don't think that -- These are selected species that are typically abundant in very high amounts, and the dolphins are -- Their numbers are not in the hundreds, and so, at max, you're probably talking about dolphins associated with each bay, and that is high. I mean, I am exaggerating a little bit. The most we've seen are five or six, and so what kind of impact may five or six dolphin have on our selected forage species population? I think that I would leave it -- Probably downsize it to one, because they do have an impact, but it's not an impact that would determine the size of the population, in my opinion.

RICHARD APPELDOORN: If we could downgrade that minus-two to a minus-one, I think that captures the discussion. J.J., go ahead.

JUAN CRUZ-MOTTA: The three stays a three? That's a question.

RICHARD APPELDOORN: Yes.

JUAN CRUZ-MOTTA: Now let's focus on the relationship between forage species and HMS, highly migratory species. That is on the top and the bottom, and it has a two going from forage species to

HMS and a minus-one between HMS and forage species. I assume you are happy with that and there are no comments?

RICHARD APPELDOORN: No, that's not a good assumption.

JORGE GARCIA-SAIS: Just a question. Is the king mackerel included in HMS?

RICHARD APPELDOORN: That's why I'm being silent. I'm trying to think about whether we had that as a coastal pelagic or highly migratory, and I think it would be a coastal pelagic.

JOE KIMMEL: It would be a coastal pelagic.

CHURCHILL GRIMES: That's what they are normally considered.

JORGE GARCIA-SAIS: I believe that the relationship is a little bit lower, and the strongest relationship with HMS would be mostly on other offshore forage species. If the king mackerel is included within HMS, then it's stronger, because the king mackerel will come to feed on sardines and anchovies. Otherwise, you are talking about offshore fishes that may have some interaction with inshore forage species, but it's low, and I would leave it at one, at max.

You know, if we're talking about wahoo, about dolphinfish, about marlins, tunas, that kind of thing, there is an interaction, but it's much smaller. What would probably drive the interaction to be stronger would be king mackerel. If that's a coastal pelagic, then I would take it down one click.

RICHARD APPELDOORN: I was thinking of eliminating any connection between HMS and inshore forage species.

JOE KIMMEL: Thank you, Rich. I was just getting ready to say the same thing.

CHURCHILL GRIMES: I agree with that, too. It either needs to be very small or not at all.

JORGE GARCIA-SAIS: I would leave it at one, because wahoo and dolphinfish, they would -- They know that sardines are coming in and out of bays and submarine canyons, like we have on the south coast at Guayanilla and Guanica, and, if we start fishing on those submarine canyons, you would get highly migratory species there feeding on sardines, and so I know the interaction is there, but it's not like -- I would leave it at a one.

JOE KIMMEL: Reni, I think HMS is defined by the Magnuson Act, and

I don't remember exactly what it says, but I don't think wahoo and dolphinfish, mahi-mahi, I don't think they're included in the HMS category, and I think HMS is reserved for many of the sharks and the billfishes.

GRACIELA GARCIA-MOLINER: The tunas and the swordfish, and so dolphin and wahoo are not HMS.

RICHARD APPELDOORN: They are coastal pelagics.

JORGE GARCIA-SAIS: Okay, and so the interaction then is zero, for me, because those are the ones -- What about tunas, because you have some tunas, blackfin tuna and yellowfin tuna, that will come close to the shelf in areas, where there are submarine canyons and things like that, to feed on sardines, but that is about it. If you are removing -- If wahoo and mahi-mahi are not considered HMS, then the relationship is even probably limited to -- It's probably going to be limited to tunas and some marlins. Some marlins eat on mullet, and mullet do go out, and they are considered inshore forage species, fishes, but the interaction is lower. It's low.

There is -- Because marlin would eat -- They would come, especially considering sailfish. Sailfish will come and eat on mullet and sardines, and so the interaction I know exists, but, once you remove mahi-mahi and wahoo and king mackerel, then it's much lower.

RICHARD APPELDOORN: Accepting Reni's comments, I think my inclination is to just drop out the connections, just to simplify the model, for no other reason than that. Yes, there are cases where these things are occurring, but, if they're not even significant enough to warrant what we would consider low interaction, should we consider it at all, and so I'm still thinking that we should drop them.

JOE KIMMEL: I agree.

CHURCHILL GRIMES: I agree.

JUAN CRUZ-MOTTA: So, basically, if I delete the line going down that says two. Also, that one.

RICHARD APPELDOORN: It's actually both lines.

JUAN CRUZ-MOTTA: So that means that HMS don't feed on forage species.

RICHARD APPELDOORN: It's saying not to a significant degree. Yes, there could be situations, but do we really want to make the model

more complex than it has to be?

JOE KIMMEL: You do have a connection between HMS and offshore forage fishes, and so they do feed on prey in the offshore, HMS I'm talking about.

JORGE GARCIA-SAIS: One more comment. For what is in my mind, it's that, for example, white mullet spawn offshore, and they have offshore spawning migrations, and it is known that billfishes will -- They know that. Billfishes know that mullet have offshore spawning migrations, and they do go and target mullet for feeding, and that's why white mullet was used as bait for decades, for many decades, in the HMS fisheries, and so there is a connection. If you want to disregard it, fine, but the connection is there.

JOE KIMMEL: When the mullet, which live most of their time in inshore areas, they do move offshore for spawning purposes, but, when they're offshore, they're offshore forage fishes, and so I don't think we've missed the mullet at all, or put them in the wrong category right there, but, like we said before, dolphinfish and wahoo are not in HMS. If they're in any of these boxes, they're probably in, and it's probably not labeled the way -- Well, I don't know how it should be labeled, but coastal pelagics is probably the closest box that they would be in, the dolphin and the wahoo, and there is a connection there between offshore forage fishes as well.

JUAN CRUZ-MOTTA: Should I go the next connection?

GRACIELA GARCIA-MOLINER: Let me read this for the record, Mr. Chairman. You have Jocelyn D'Ambrosio's definition of HMS from the Magnuson-Stevens on the chat.

RICHARD APPELDOORN: Go ahead and read those.

GRACIELA GARCIA-MOLINER: Regarding Joe's comment about the definition under the MSA, it defines "highly migratory species" as tuna species, marlin, oceanic sharks, sailfishes, and swordfish, and then there is a list of the species by name that is provided in the MSA.

RICHARD APPELDOORN: That's for the tunas, the list.

JOCELYN D'AMBROSIO: Yes, and only certain tuna species are defined as HMS.

JORGE GARCIA-SAIS: Including little tunny?

RICHARD APPELDOORN: No, little tunny is I think a coastal pelagic.

JORGE GARCIA-SAIS: Okay.

JUAN CRUZ-MOTTA: Rich, Marcos Hanke is asking for a turn to speak and clarify.

RICHARD APPELDOORN: Go ahead, Marcos.

MARCOS HANKE: Thank you, everyone. One thing that is included on the HMS are some species, many species actually, of shallow-water sharks that interact with the inshore forage species very strongly, and, also, there is some of the juveniles of HMS that come to the inshore forage species, and that interaction -- I don't think that is minor, for the reasons that I am expressing, and there is other reasons too, and you should consider the HMS definitions that Jocelyn provided, and it's the correct ones, but I just want to highlight that there is a list of species managed by the HMS, and for sure sharks, that we have to take into account, like the Caribbean -- There is a sharpnose, the Atlantic sharpnose, the blacknose, spinner sharks, and there are many others that are managed by HMS. Thank you.

RICHARD APPELDOORN: So a fair number of the sharks are also going to be under the coastal pelagics as well, and so HMS is talking about -- Under Jocelyn's comment, it's highly migratory species, and including oceanic sharks, and so the coastal sharks are going to fall under coastal pelagics, and does that change your comment, Marcos, about the interaction between HMS and forage species?

MARCOS HANKE: It doesn't change much, because it's a little confusing that, if you're going to use the term "HMS" as the ones that HMS regulates and interacts with, that includes those species of shark, and, if you're going to use that label of "HMS" generically, that definition of what you mean by HMS has to be very clear, to avoid confusion in the future. From my perspective of seeing this, it's very important to consider all the species that are managed by the HMS if you're going to use the box as the ones that are managed by the office. Thank you.

RICHARD APPELDOORN: That's why HMS is there, and so, if you're saying, from the point of view of some of those shark species that would be in HMS and not coastal pelagics, then we should put those linkages back up.

MARCOS HANKE: One more point, Richard. We do catch sailfish and yellowfin tuna on smaller sizes, on the juvenile size, mixed with the blackfish and the little tunny on the shallow waters too, and

it's not a very rare event to happen, and that's just one extra point for the group to consider.

JOE KIMMEL: Just an aside that the HMS is actually not managed by the council, any of the councils, and National Marine Fisheries Service has management responsibility for that.

RICHARD APPELDOORN: But you're retired from them. So is there opposition to basically undoing our deletions?

JORGE GARCIA-SAIS: I would leave the line with a one.

RICHARD APPELDOORN: Okay, and so, Liajay, can you like undo? Now we want to change that two to a one. Excellent. J.J., back to you.

JUAN CRUZ-MOTTA: Thank you, and thank you, Marcos. I think it was important to leave those lines in there. Okay. The following connection is between forage species at the top and coastal pelagics. Those are the lines going on a loop around the slide. That's a minus-two and two. It's the same magnitude for both directions. Any comments or suggestions?

JOE KIMMEL: I think you've got that one right on, and I couldn't argue with that. Somebody might have problems with the strength, the two or one, but I think two probably is okay there.

RICHARD APPELDOORN: Yes, I would agree with Joe. I'm not sure how strong these would be, but I think, given the uncertainty, two is kind of a good place to be.

JORGE GARCIA-SAIS: I think that two is okay on the direction from inshore forage to coastal pelagics, and I believe that two is a little bit high between coastal pelagics and inshore. I am not sure if the impact of coastal pelagics on inshore forage species is as strong as two, and maybe it's a one-point-something, between one and two, but I'm not sure if it's two, but, if you want to leave it at two, that's fine with me.

RICHARD APPELDOORN: I think, generally, you would have an asymmetry between a forage species and the predator, because, in most cases, a forage species is serving a number of predators, even in the context of these different boxes, and so each predator would not have the same impact on the forage species, perhaps, as the forage species would have on the predator, in the sense that we're lumping forage species into one box.

The forage species box is serving a number of other boxes, in terms

of supplying food, and so each box that is consuming forage species has perhaps a lesser impact, unless the predators are consuming other sources that just the inshore forage species.

JORGE GARCIA-SAIS: That was my point, and so I would put it as a one, because I don't think that coastal pelagics will have such a strong effect on the forage fish. Forage species will be serving as energy for many other species, and, because of their sheer numbers, their population size, I do not think, would be determined upon predation by coastal pelagics, in my opinion. I mean, there is an energy transfer, and that energy transfer I think is more a one than a two, but that's just my opinion, and two will also work. It makes the point, but I don't think that the point is so strong as to be considered a two.

RICHARD APPELDOORN: Anybody else want to weigh-in on that?

VANCE VICENTE: If I may, I would like to discuss the three squares of turtles, manatees, and exotic/invasive species regarding reef fish. If I recall correctly --

RICHARD APPELDOORN: Vance, we're not there yet.

VANCE VICENTE: No, but there's a connection to reef fishes between exotic/invasive, and, if you don't want to discuss that now, okay. Fine.

RICHARD APPELDOORN: I'm talking about the connection between coastal pelagics and inshore forage species. That's the topic.

VANCE VICENTE: All right. No problem.

JOE KIMMEL: Reni, I don't know what the relationship strength should be, but I don't disagree. It could be a two, or it could be a one, and so I will go with either one.

RICHARD APPELDOORN: I think, in light of the comments that I made and the comments that Reni made, that maybe that minus-two should be a minus-one, and then J.J. will move us on to the next box, or the next connection.

JUAN CRUZ-MOTTA: Okay, and so --

RICHARD APPELDOORN: We want to make that minus-two a minus-one.

JUAN CRUZ-MOTTA: The next connection that I would like you guys to focus on is the one between offshore forage fishes and cetaceans. That's a relationship of three between the forage

fishes and the cetaceans and a relationship of minus-one between the cetaceans and the forage fishes. Any comments?

RICHARD APPELDOORN: I like it.

JORGE GARCIA-SAIS: That's good for me.

JOE KIMMEL: Same here.

CHURCHILL GRIMES: Yes, I agree.

RICHARD APPELDOORN: Next connection, J.J.

JUAN CRUZ-MOTTA: The next connection is between HMS and forage species. That's a relationship of minus-one from HMS to forage fishes and then, from forage fishes to HMS, it's three.

RICHARD APPELDOORN: This is talking about the offshore forage fishes.

JUAN CRUZ-MOTTA: Yes, and HMS, and I repeated that twice, and so sorry. Liajay, could you do me a favor, please? Could you delete those two red lines going from HMS to forage fish, please?

RICHARD APPELDOORN: No, I don't think you want to do that.

JUAN CRUZ-MOTTA: I repeated it twice, Rich. Do you see the blue line at the bottom going to -- It's doing like a curve, and it's just that I repeated that connection twice.

RICHARD APPELDOORN: So you want to delete not the red line, but the blue ones.

JUAN CRUZ-MOTTA: Right, the blue one and not the red, and we'll have them all the same color. Delete whatever you want, Rich, and that's fine. It's the same.

RICHARD APPELDOORN: You're talking about the connection between HMS and offshore forage fishes, correct?

JUAN CRUZ-MOTTA: Yes.

RICHARD APPELDOORN: The line between those two -- I see. You have a curved line at the bottom also connecting, and is that --

JUAN CRUZ-MOTTA: Yes, and I repeated the connection twice.

RICHARD APPELDOORN: Sorry. I missed that.

JUAN CRUZ-MOTTA: If you want to delete the blue one, that's fine.

RICHARD APPELDOORN: I would delete the blue, because I like your idea of having colors that are different, to allow us to follow them easier.

JUAN CRUZ-MOTTA: Rich, whatever you recommend that speeds up the process. Liajay, the numbers that you're going to delete are those. Exactly. Thank you. We have a relationship of three from forage to HMS and minus-one from HMS to forage.

RICHARD APPELDOORN: Yes, I think that's good.

JOE KIMMEL: Same here.

JUAN CRUZ-MOTTA: Okay, and the following relationship is between coastal pelagics and forage fishes.

RICHARD APPELDOORN: Offshore.

JUAN CRUZ-MOTTA: Thank you. That's very important to clarify. thank you. Coastal pelagics to offshore forage fishes is minus-one, and from offshore forage fishes to coastal pelagics is three.

JORGE GARCIA-SAIS: I think that one, from my point of view.

JOE KIMMEL: I like it.

RICHARD APPELDOORN: Yes, so do I.

CHURCHILL GRIMES: I agree. I think it's okay. It's good.

JUAN CRUZ-MOTTA: Okay, and so the next one is between offshore birds and offshore forage fishes. It's minus-one from birds to offshore forage fishes and three the other way.

RICHARD APPELDOORN: I think that's the same situation as we've been seeing before, and so I agree.

JOE KIMMEL: Same here.

JORGE GARCIA-SAIS: Same here.

JUAN CRUZ-MOTTA: Then the next connection is between coastal birds and --

JORGE GARCIA-SAIS: J.J., just a second. Just to clarify, on the

previous interaction, what I understood was that we were going to take it down to a two, because offshore birds also eat on inshore forage species, and that's my point of view. Coastal birds do not only feed on offshore forage species, but they feed also on inshore forage species.

JUAN CRUZ-MOTTA: Yes, but I think it's a good -- It's a valid point, but the only thing is, at this moment, we don't have any connection between offshore birds and inshore forage species.

JORGE GARCIA-SAIS: Okay, and we should have, because, for example, birds, like frigate birds, it's an offshore bird, but it would feed on inshore forage species, and it will not be just a low probability interaction. They actually look for that. They will even follow boats to feed on the bycatch, and some of that on the bycatch would be considered forage species, and they would eat on sardines, and they would eat on all the estuarine-derived forage species. The connection is there, and it would be a shared energy flux to offshore birds, and so that's why I would take it -- I mean, in my opinion, I would take down one notch, the three, and leave it at two and establish a connection between offshore birds and inshore forage species. Maybe it's a one level.

RICHARD APPELDOORN: I think I would leave it as a three, because, if you're talking about the booby and the thing like that, which are really feeding offshore, those I think -- I mean, I agree with your comment on the frigates, but there are other species that are important, where that really is a three, and I would leave it as such, but I also agree that we need a connection between the inshore forage species as well.

JORGE GARCIA-SAIS: Okay. No problem.

JUAN CRUZ-MOTTA: Anybody else that wants to comment on that idea?

JOE KIMMEL: I don't have any problem with Rich's idea and establishing a link between offshore birds and inshore forage species, but, in every other case between the different categories, there are two connections, a positive and a negative, and so I don't know if we need to draw two connections, one one way and one the other, and give them both ones, and I don't know.

JUAN CRUZ-MOTTA: There is also a comment by Ricardo Lopez. Rich, is that okay, if Ricardo expresses his opinion?

RICHARD APPELDOORN: Yes, and I would like to hear that, because Ricardo is one of the experts on the feeding of offshore birds.

RICARDO LOPEZ: Thanks, and, as far as I know, the only offshore bird that directly feeds from inshore fish species is the brown booby, and only few individuals from the flock do that. Most of them feed offshore. As Reni said, yes, the frigate bird might feed inshore, but it's opportunistic, and it's not as common as feeding offshore, and that's my comment.

VANCE VICENTE: I totally agree.

RICHARD APPELDOORN: Okay, and so how do we translate that, first of all, in our offshore forage fishes to offshore birds category? Do we want to stay with a minus-one and a three, which I would support?

VANCE VICENTE: I agree with Joe. I mean, when you see different numbers in the different iterations of the arrow, that implies that we do have some scientific information on stomach content analysis, and we have some ornithologists who know about these populations and the frequency of their feeding behavior and that, and I don't know whether they should be different numbers unless we really have some significant scientific information.

RICHARD APPELDOORN: Well, I might put this one back to Ricardo Lopez, but, with the exception of something like the frigate and the other one he mentioned, and was it the brown booby, that these offshore pelagic birds are entirely dependent on the offshore fishes, because that's where they are feeding.

JOE KIMMEL: I think that's right, and, if we do draw connections between offshore birds and inshore forage fishes, I wouldn't give it a score in either direction greater than a one, and maybe they should be these dotted lines, and I'm not exactly sure what they are, but, to me, they indicate something unusual.

JUAN CRUZ-MOTTA: Just to clarify, Joe, the dotted lines were relationships that were not there last night, but perhaps would be good to think about them, and please note that, in this slide, we only have two blue dotted lines and three red ones, but we haven't got to those. We haven't got there yet, and so, for example, the dotted line between reef fish and inshore forage species didn't exist, but then we considered that it should be there. That's what the dotted line means.

RICHARD APPELDOORN: I am thinking that we're leaving the minus-one and three okay, but the next step is to draw lines from offshore birds to inshore forage species. The value of that would be a one, maybe.

JOE KIMMEL: That's what I would put down.

RICHARD APPELDOORN: The question is are offshore birds, in that feeding, having an impact on the inshore forage fish population, big enough that we need to worry about it?

JORGE GARCIA-SAIS: It's insignificant.

RICHARD APPELDOORN: I would tend to agree with that, and so we would not put a line going the other way.

JOE KIMMEL: I agree myself.

RICHARD APPELDOORN: Okay. I think it's coming back to you, J.J., but I'm going to right away question the connection between coastal birds and offshore birds.

JUAN CRUZ-MOTTA: That is actually the next connection that I wanted to draw your attention to, between coastal birds and offshore forage species. We said that it was minus-one between coastal birds and offshore forage species.

RICHARD APPELDOORN: J.J., the lines are not drawn correctly. The lines are going from offshore birds to coastal birds, and so they have to actually go through offshore birds down to offshore forage fishes.

JUAN CRUZ-MOTTA: Sorry. I didn't understand that, Rich. Could you repeat it, please?

RICHARD APPELDOORN: The line is coming down from coastal birds and offshore birds, and they are supposed to end at offshore forage fishes.

JUAN CRUZ-MOTTA: That's the relationship that I want to draw your attention to. Does that answer your question, Richard?

RICHARD APPELDOORN: Well, yes, but I'm still going to call out the other one, but now I know where we're focusing.

JUAN CRUZ-MOTTA: Going down, from coastal birds to offshore forage species, it's minus-one, and, going up, there was no relationship, but then I drew the dotted line to ask you, all of you, if we should include that one, and now that Ricardo and Nelson have made comments on birds, it will be interesting to know their opinion on this.

RICHARD APPELDOORN: Well, you can't have a minus-one going in one

direction and not have something positive going the other way, and the way that we have been discussing predator-prey relations is that going the other way would have to be an equal or greater value.

JUAN CRUZ-MOTTA: That's what I thought, Rich, and that's why I added the dotted line. It wasn't there, and I agree with you that it should be there, but I will leave it to the rest of you to comment on that.

JORGE GARCIA-SAIS: I think that the relationship is not significant. If anything, it may be like -- Like Ricardo said, it's opportunistic, and I don't know. Maybe Ricardo should comment about this.

RICHARD APPELDOORN: Reni, I'm not sure which arrow you're talking about.

JORGE GARCIA-SAIS: Between coastal birds and offshore forage fishes. I mean, in my mind, there is a pelican going to eat a flyingfish, trying to eat a flyingfish.

RICHARD APPELDOORN: I don't know whether some of the gulls might forage offshore, but we would consider them coastal birds.

JORGE GARCIA-SAIS: I think that the relationship is very, very -- - If anything, it's opportunistic or whatever. Ask Ricardo, and I believe that he's probably the only one here qualified to answer that.

RICHARD APPELDOORN: Ricardo, you have put up a couple of messages, and why don't you just get on voice and let us know what you're thinking?

RICARDO LOPEZ: Thanks again. Pelagic birds, or offshore birds, are usually very big, and they can fly up to 100 miles in a day, and so definitely they are more likely to feed on an inshore bird like vice versa. It's very rare. If we are talking about marine birds, it's very rare, other than seagulls, that birds will be feeding on offshore birds. I had in my notes that we are not talking about different kinds of eagles, right, and we're talking only about marine birds, and so I would suggest not to put plus-one and minus-one, and I don't think that is fair, although those are opportunistic behaviors, mostly.

VANCE VICENTE: Ricardo, I have a question, and this is regarding birds and fish, respectively, whether it's coastal or offshore or nearshore or whatever, but we know definitely that coastal birds,

oceanic birds, shorebirds, I mean, they depend on fish, and so there is a positive relationship of a three or a four for the birds, but the impact of the foraging behavior of birds on the biomass of the populations of sardines and flyingfish, I don't have any information on that, and that's very important to explain the backward arrow.

I mean, what is the true effect on the fish population, because at least I know of very, very few studies that have been done, by making birds regurgitate and things like that, but I am worried about -- We know that birds are getting a benefit, but the impact on the population, on the biomass, of the forage fish -- I mean, do we know anything about this? I don't know.

RICARDO LOPEZ: Generally speaking, the impact of these offshore birds on the biomass of fishes and squids is very low, if any.

VANCE VICENTE: Okay. I agree. I would agree on that, and so that's very important when we think about what the reverse arrow number should be.

RICARDO LOPEZ: I agree with you that that is very important to establish the numbers, and, again, what I was trying to clarify is that, if you are going to make a relationship between coastal birds and offshore birds, I don't think it's one to minus-one, and you need probably a very low number, but it's more -- It's a higher number of offshore birds opportunistically feeding on coastal birds, in Puerto Rico mostly.

RICHARD APPELDOORN: Yes, but your comments are really kind of saying there is some opportunistic behavior there, but it's really not what is driving things, and maybe we shouldn't have connections there at all in either direction.

RICARDO LOPEZ: Yes, sir. I don't think that what they do will change any of the populations.

JOE KIMMEL: I think that's a great idea, to just take the lines away connecting coastal birds and offshore birds.

RICHARD APPELDOORN: Coastal birds and offshore forage fishes.

JOE KIMMEL: My mistake.

RICHARD APPELDOORN: Liajay, the lines you were just marking in red, delete those. I would like to take a lunch break soon. J.J., is this a convenient spot, or can we get rid of the connection between coastal birds and offshore birds, which I don't understand?

JUAN CRUZ-MOTTA: That's the next one.

RICHARD APPELDOORN: I don't see any connection at all, but I'm willing to be educated on that.

JUAN CRUZ-MOTTA: I don't remember why we used that connection, but perhaps competition between offshore and coastal birds, and, Ricardo, is that possible?

RICHARD APPELDOORN: Competition would have been minus-one in both directions.

RICARDO LOPEZ: There is no competition among those two groups, and, even within the offshore birds, the competition is mostly in moments where there is a big biomass of squid available, and what I am trying to say is that they use resource partitioning for feeding and nesting, and so they have dealt with this evolutionary, and they don't have much competition among them, unless you have a lot of fishes in front of you, and then everybody goes at them like a Happy Meal.

JORGE GARCIA-SAIS: Ricardo, what about in the nesting behavior? Does any coastal birds feed on the eggs of the offshore birds that reproduce in the islands or somewhere in those offshore rocks and stuff like that? I mean, what I'm worried about is mostly the feeding of coastal birds on the eggs of the offshore birds.

RICARDO LOPEZ: I don't know of any bird species in Puerto Rico, a strictly coastal bird, that will do that.

JORGE GARCIA-SAIS: Thanks.

RICHARD APPELDOORN: So let's eliminate those lines.

RICARDO LOPEZ: The pearly-eyed thrasher, which is not a coastal bird, but you can find it on the coast, will do that.

VANCE VICENTE: Frigate birds, I have never heard of any cannibalism or carnivorous behavior on other birds, that I know of. I know monkeys do have an impact in Desecheo Island on bird species, but, from bird to bird, I agree with Ricardo.

RICHARD APPELDOORN: We are not going to add a monkey box to this. Thank you.

RICARDO LOPEZ: Other than the seagulls -- Seagulls can do that, but, again, seagulls are kind of a hybrid. They are offshore and

inshore, and they can move, but they will opportunistically feed on eggs of other birds, but it must be small eggs and not big eggs, as the offshore birds eggs.

RICHARD APPELDOORN: Okay, and so I'm recommending two things. One, we eliminate those lines and the values. Then, after that, I'm recommending that we break for lunch.

JOE KIMMEL: I agree on both accounts.

JUAN CRUZ-MOTTA: I agree.

VANCE VICENTE: I second the motion.

JORGE GARCIA-SAIS: What time are we coming back?

RICHARD APPELDOORN: We'll come back at 1:30. Liajay, delete those values, and we will come back at 1:30. Thank you, all.

(Whereupon, the meeting recessed for lunch on May 19, 2020.)

\- - -

May 19, 2020

TUESDAY AFTERNOON SESSION (146:45)

\- - -

The Scientific and Statistical Committee of the Caribbean Fishery Management Council reconvened via webinar on Tuesday afternoon, May 19, 2020, and was called to order by Chairman Richard Appeldoorn.

RICHARD APPELDOORN: We're back on. Thank you, all, for being prompt in getting back after lunch. We are going to continue with this sub-model, and so, J.J., take us to the next box.

JUAN CRUZ-MOTTA: The next connection is right at the bottom, between HMS and cetaceans. That is a one and minus-one. Any comment?

RICHARD APPELDOORN: Just so I'm interpreting this correctly, cetaceans are eating presumably like juvenile HMS, unless it's a killer whale, and, therefore, they are impacting the HMS, and that's kind of what that says?

JUAN CRUZ-MOTTA: Yes.

RICHARD APPELDOORN: I know nothing about what these would do, and I know there are interactions on the coastal pelagics, but, on the highly migratory, in the sense that if some juvenile stages, in particular, are getting into the environments around here, then there could be some impacts, but, while we do have killer whales and false killer whales, and I don't know if dolphin -- That would take a really small pelagic, but their numbers are not a lot, again, except for dolphins, and so I'm not sure, from my understanding, how strong this would be, and so that's my comment.

JUAN CRUZ-MOTTA: Any other comments or ideas?

JORGE GARCIA-SAIS: I don't know of any relationship, and I'm not sure if it's significant in any way. Maybe it's opportunistic, and like sometimes dolphin may feed on juvenile mahi-mahi, and HMS is not mahi-mahi either, and maybe some kind of tunas, and I don't know, but it's probably very small, if any.

JOE KIMMEL: I kind of agree with Reni and Rich that I don't know much about these two boxes here, but I suspect that there would be little connectivity there, and so I don't know if we want to keep the lines there or not. What do you think?

JUAN CRUZ-MOTTA: So that is a suggestion of deleting the two lines, Joe and Reni?

JORGE GARCIA-SAIS: I would get rid of them.

JOE KIMMEL: Yes, I agree.

CHURCHILL GRIMES: I think I agree with that, also.

JUAN CRUZ-MOTTA: Perfect. Liajay, please delete those two lines. Thank you. The next relationship is between coastal pelagics and cetaceans. It's a one in both directions, one and minus-one. It's a similar argument as before.

RICHARD APPELDOORN: This one I would agree with. Like I said, there are, as I said, the dolphin populations are the ones that really dominate, and not just bottlenose, but spinner dolphins, et cetera, are working, or can work, in the areas where coastal pelagics could be eaten, and then you have the larger ones, like the killer whales and the false killer whales, which have been documented around here, and some actually filmed, trying to feed on dorado, and so I think that's probably occurring, but I don't think it's a big thing. The density or abundance of those larger cetacean species is not high, and so I think it occurs, but a one

and minus-one would be a size that I would want to go.

JUAN CRUZ-MOTTA: There is a comment by Michelle Scharer on the topic, and I don't know if that's okay if Michelle chips in.

RICHARD APPELDOORN: Well, the comment reads that pilot whales prey on dolphinfish, and, again, there are pilot whales around Puerto Rico, and they are not overly abundant, but they are definitely around, and so I think maybe the -- I still think one and minus one is a reasonable approximation, and you could even argue that cetaceans really aren't making that much of a dent on the coastal pelagics, and, therefore, we wouldn't even include that, but I'm willing to go with one and minus-one.

JOE KIMMEL: I will agree with that.

CHURCHILL GRIMES: It sounds right to me, also.

JORGE GARCIA-SAIS: There is some kind of connection, and I'm okay with one and minus-one.

RICHARD APPELDOORN: Okay. Next one.

JUAN CRUZ-MOTTA: The next one will be the little one between coastal pelagics and HMS. It's one in each direction.

RICHARD APPELDOORN: I agree with the connection, but I don't really know what the strength should be. We know that some of like the billfishes are feeding on dorado, and probably wahoo, if for no other reason than satellite tags start behaving weird once they are eaten by another predator, but, like I said, I don't know what the strength of those should be.

JUAN CRUZ-MOTTA: Any other comment or opinion?

JORGE GARCIA-SAIS: The connection is there, but probably not more than one and one.

JOE KIMMEL: Let's go with one and one. I like that.

RICHARD APPELDOORN: It sounds like a mandate.

JUAN CRUZ-MOTTA: Okay, and so we'll leave it as it is, and then the next one is the infectious diseases and reef fish, and it's in only one direction, minus-one.

RICHARD APPELDOORN: Considering that reef fishes includes a lot of other things, I would be okay with a minus-one.

CHURCHILL GRIMES: Are you thinking about urchins or something like that?

RICHARD APPELDOORN: Well, there's urchins, and there is a disease of lobsters that is going around, and there is some parasite of conch, and there is parasitic infections of a number of species of fish that occasionally get large, but I don't know whether they actually kill anything.

CHURCHILL GRIMES: There's a lot of research at different life stages of amberjacks.

JORGE GARCIA-SAIS: There's a fungus infection on fishes, particularly jacks, and so I would leave it there as minus-one, and it's good to have it.

RICHARD APPELDOORN: Okay. J.J., next one.

JUAN CRUZ-MOTTA: The next one is the relationship between infectious diseases and turtles, and, if you want, we can tackle turtles and manatees at the same time, but let's do turtles. It's minus-one.

VANCE VICENTE: I think that minus-one may refer to the fibropapilloma, which occurs in the chelonid turtles, and I don't know of any other infectious diseases that affect the sea turtles, that I know of. In any event, in the Caribbean, it's very, very minor.

RICHARD APPELDOORN: I am willing to leave it as one. The only person I think who might be able to add anything would be Michelle, if she wants to type in a comment, but, Vance, what you said is what I know.

VANCE VICENTE: That's what we discussed in the last meeting.

RICHARD APPELDOORN: For manatees?

VANCE VICENTE: The data that I have seen for manatees is stranding data, them being attacked by boats and jet-skis and getting trapped in nets and things like that, but, from a disease itself, the only thing that I mentioned regarding manatees, other than stranding events, were algal blooms in the Gulf of Mexico of toxic dinoflagellates, which their toxin gets picked up in the air, and it has killed, in one instance, 200 manatees, and then it happened again, killing 300 manatees. They just got intoxicated by the chemical produced by the dinoflagellates, but that's not an

infectious disease, and so it's not relevant.

JOE KIMMEL: I'm not a manatee person, and I'm not an infectious disease person, but, in the area that I live in, south Florida, we have quite a few manatees, and many of them have these propeller strikes on their back, and, occasionally, you will see one with a lot of fuzzy goo around it, and so that's a source of infectious disease, but I'm okay with infectious disease and one.

JUAN CRUZ-MOTTA: Is it safe to assume that you're all okay with one?

JORGE GARCIA-SAIS: Maybe we should just delete the line, because nobody here knows anything about that.

JUAN CRUZ-MOTTA: Reni, can you say that again?

JORGE GARCIA-SAIS: Why don't you leave the dashed line, like we don't know, because, frankly, within the group, nobody has any knowledge about that.

VANCE VICENTE: I agree, but it should be noted that we have to look into that, like checking the data of the Caribbean Stranding Network and the rehabilitation lab and things like that, and they might have information, and so we might take notes that there is no relationship, or very poor, but it's just that we haven't done the research.

RICHARD APPELDOORN: Well, we solved that by giving it a value of zero, and so the line stays in, and there's a number in the box on the spreadsheet, but it remains uncharacterized, which I suppose you could call it a minus-zero, because we know the direction it would be.

JORGE GARCIA-SAIS: I am googling it, and there are some fungal infections in manatees, and there are some other kind of infectious diseases in manatees in Florida. There is a parasite found in manatees, and there is infectious diseases in manatees.

RICHARD APPELDOORN: On the other hand, that's Florida, and we're doing a Caribbean model, and we don't have those big red tide problems that they have, particularly on the west coast of Florida, that are really impacting the manatees, and so I'm not sure if Florida is the right model for us.

VANCE VICENTE: Right. Plus, we don't have those large 2,000-individual aggregations and things like that, and so our population, I think, runs around 200, versus 2,000 in the Gulf of

Mexico.

RICHARD APPELDOORN: Well, for our coastline, that's actually respectable. Can we leave this as a minus-one, and will be acceptable with that?

JOE KIMMEL: I like it.

VANCE VICENTE: I'm okay.

JORGE GARCIA-SAIS: I'm okay with that. I would have preferred to put a dashed line, but that's okay.

JUAN CRUZ-MOTTA: Just a clarification is the dashed lines were lines that I used myself, and it was not some part of some agreement that we reached about -- It was used to show things that perhaps we should think about it, and so --

JORGE GARCIA-SAIS: I was thinking about just acknowledging that it's temporary until we get more information about this subject.

RICHARD APPELDOORN: Well, why don't we leave the minus-one and the line there for the moment, but have a note, for those who are actually working with the model, for us to come back to that, potentially. Would that work?

JUAN CRUZ-MOTTA: Yes. The next point that I wanted to bring to your attention is related to a question or a comment made by Ricardo Lopez about the coral disease, and that was the intention of using those lines at the top and whether we should consider a relationship between this model and the habitat model, in relation to infectious diseases, because, for corals, we know that's a big issue.

RICHARD APPELDOORN: Well, it has been with diadema, although I guess what we're left with is the aftermath of that, but, yes, there are a number of things going on, both with infectious diseases and invasive species, that are going to have impacts on habitat.

I would like to also talk about infectious diseases towards cetaceans, because, as someone was alluding to, and I think it was Vance, there are a lot of strandings that happen around Puerto Rico, and I think a lot of these are thought to be due to problems of disease, and I'm not sure.

A lot of those are not necessarily species who are resident around Puerto Rico, and they both seem to be from individuals that had

problems someplace and drifted to Puerto Rico, and so we don't know what the catch basin is, if you will, for the strandings, but a lot of them are associated with some kind of disease or parasitic infection, and so should we have a line going from infectious diseases to cetaceans?

JUAN CRUZ-MOTTA: Based on the arguments that you said, I would say yes, but does anybody have an opinion on that or agree or disagree?

JORGE GARCIA-SAIS: If we have one for manatees, why not cetaceans as well? It's more or less the same kind of information, very little, but there is the possibility that there is, and I don't think there's a big difference between the two.

JUAN CRUZ-MOTTA: Any other opinion on the topic?

VANCE VICENTE: Well, maybe a little less than one, if it's possible, because at least there are no records from any massive kills from the infectious disease on cetaceans. I mean, any of these large animals is going to have some kind of a parasite either stuck to it or internally, like sharks, for example. They have a lot of parasitic internal worms and stuff like that, and so it's okay if we have minus-one, but it can be less than minus-one, or simply just a line.

JORGE GARCIA-SAIS: I would give it the same thing as for manatees. Make a note and come back afterwards, when we have more info.

GRACIELA GARCIA-MOLINER: Do you want the connection between infectious diseases and cetaceans? Correct?

VANCE VICENTE: Yes.

JUAN CRUZ-MOTTA: If we put a line, we should put a number on it, which I guess would be the minimum, minus-one.

VANCE VICENTE: Any of these factors, like infectious disease and species, if we don't have any evidence that it affects the species, or whatever taxon it is, at a population level, I don't know whether it should be considered, and I don't know. I mean, if we have some data that any of these factors have had some significant, measurable impacts at a population level, and, individually, we will find something.

The effect of parasites in fish, how often do these get those isopods, and do they affect the population and their feeding behavior and their reproductive behavior? If not, I don't know

whether to include it or not, unless the purpose, the main purpose, of these models is to include as many things as possible and then, maybe later on, discard some of them or intensify some of them.

RICHARD APPELDOORN: I agree with everything you said, and the question right now is, for these arrows that we're not sure about, is to come back to them when we have some information, and the information may tell us to get rid of the arrows, because it is a question of not does it occur or not, because, at some level, all the stuff happens, but is it something that's happening, or could happen, in our jurisdictions that would be effective at the population level.

VANCE VICENTE: I think at our level, at the stage that we are in, it would be simple to ignore it completely. At the same time, if we know that there have been cases, and in some locations there have been some significant effects of any of this infectious disease on some species, at least we considered them, and I think not having them maybe is also bad, especially with this ecosystem broad approach.

RICHARD APPELDOORN: If we want to keep them there as a placeholder, we just put a zero there. If we really think this is not going to pan out regardless, we should get rid of the lines.

DOUGLAS GREGORY: My only concern is this is the first time I've heard reference to population impacts, and that could restructure a lot of these lines, and so there are strandings, and there are diseases and things that cause strandings, and so there should be some connection there.

JUAN CRUZ-MOTTA: I understand then that we should leave the line with minus-one, despite the fact that we don't know much about it, as pointed out by some of you.

RICHARD APPELDOORN: I think we can leave them that way now, and I was actually emailing Grisel, to get her view on the role of infectious disease and cetaceans and manatees, to see if she can shed some light on that with a response, but, right now, I would say let's just leave them and move on, noting that we want to come back to this.

VANCE VICENTE: I agree.

RICHARD APPELDOORN: To Doug's comments, yes, there has to be some impact that is either occurring, or could occur, should our water quality go down, and that induces bad immune systems, and, therefore, infectious diseases can be more rampant or something

like that, and so we have to think of those scenarios, so that, when you're putting other boxes in the system, we like to know whether this possibly, in the future, could lead to something serious.

If there is a viable connection, even though the effect may not be strong now, if it's something that could be, then I think we would want to be conservative and have it in the model.

DOUGLAS GREGORY: I agree, and it just could be that we're not familiar with certain box connections ourselves, but somebody else in the system, as this model gets developed and shared with other agencies, could speak more intelligently about some of these connections, and then they will be changed, so I think we're kind of the -- Either we or the advisory panels are the first shot at this, and so I tend to want to be more inclusive than exclusive at this early stage.

RICHARD APPELDOORN: I think those are all good points. J.J., take us to the next connection.

JUAN CRUZ-MOTTA: Thank you. The next connection is between turtles and coastal pelagics. We said, in the last discussion, that that was a positive relationship of one.

VANCE VICENTE: The relationship that I see between turtles and coastal pelagics is predation by dorado and large fish, which are known to be the major predators of the juvenile chelonids and non-chelonids, when they are in their pelagic state.

RICHARD APPELDOORN: Right, and this predation also includes the coastal sharks, reef sharks, et cetera.

VANCE VICENTE: Yes, definitely.

JUAN CRUZ-MOTTA: Based on that comment, then the line should be --

VANCE VICENTE: The other way around and negative. I mean, that's the only way that I see it. Coastal sharks, with the earlier studies on the feeding habits of Caribbean reef fish regarding the sharks, especially the tiger shark, the main diet was hawksbill turtles, and so, even at an adult stage, there is predation happening by larger pelagics.

RICHARD APPELDOORN: Yes, but I think the tigers fall under HMS, because they are very wide roaming, like inter-ocean roaming.

VANCE VICENTE: Yes.

JORGE GARCIA-SAIS: There has got to be quite a predation on the just recently-hatched turtles, as they come into the water, and there has got to be a lot of predation by perhaps coastal pelagics on them, and birds, too.

VANCE VICENTE: Exactly. I agree. By the way, I still see the arrow from coastal pelagics to turtles positive, and it should be a negative.

JUAN CRUZ-MOTTA: Thank you.

RICHARD APPELDOORN: Then are we saying that those coastal pelagics aren't significantly benefitting from that predation, because, if they do, then we need a line going the other way.

VANCE VICENTE: Yes.

JORGE GARCIA-SAIS: It could be. I mean, I don't see any other potential interaction, other than predation.

JUAN CRUZ-MOTTA: Perhaps the juvenile turtles is not the main item of the coastal pelagics, and I would say even a very small fraction of the diet. Perhaps, because of that, we don't consider the other line.

JORGE GARCIA-SAIS: I don't have any direct evidence of that, but I believe that it's potentially feasible. I mean, it's feasible that they would be eating on those sources of food. As we know, with coastal birds, there is the same potential, with coastal birds feeding on recently-hatched turtles, sea turtles.

RICHARD APPELDOORN: Yes, I would agree with that. Are we considering jellyfish as coastal pelagics? I actually hope not, but --

JORGE GARCIA-SAIS: That would probably be under reef fishes, Richard.

RICHARD APPELDOORN: Well, we have a habitat connection, if you will, for the sponges, which would fall under, I guess, reef, or coral reef, or something like that, and so I don't think I would make the connection within this box, and I'm sure where the jellyfish fall.

VANCE VICENTE: We're not discussing interactions between pelagics, reef fish, et cetera, with habitat yet.

RICHARD APPELDOORN: No, we're not. We're just exploring where things should go, given that, and so I am willing to leave what we have there now, with coastal pelagics having an impact on turtles, largely through the juvenile stage, but I would also agree that the coastal birds would also have that same relationship, and there would be the question of whether coastal birds are getting enough benefit out of that predation that we should have two lines.

JUAN CRUZ-MOTTA: Rich, so what would be that line between birds and --

RICHARD APPELDOORN: Coastal birds and turtles.

VANCE VICENTE: That's a good connection. I mean, it does happen. The herons and frigate birds, if the hatchlings are swimming close to the surface, but we have to remember that this is seasonal, and this is during the hatching time.

RICHARD APPELDOORN: I don't know much about this, in terms of what is happening in Puerto Rico and the Virgin Islands specifically, but, in other parts of the world, this is not an opportunistic thing, and this is an important part of the diet of birds in these hatching seasons, and so I would think there is lines going both ways there.

VANCE VICENTE: I agree, and the key number is one in 10,000 hatchlings survive, and so these predators are having a significant effect on the sea turtle populations, more than the other way around.

RICHARD APPELDOORN: Yes, and, if you want to affect a population, the way you can do it most effectively is by modifying the 0.00X value of the mortality rate at the very early stages, and so it doesn't take a big change in mortality rate, when you're dealing with large numbers, to end up with a big adult change, and so lines going both ways, please. Go ahead, Sarah.

SARAH STEPHENSON: Just for the Excel spreadsheet, would you put a negative-one from coastal birds to turtles, but then a positive-one from turtles to coastal birds?

RICHARD APPELDOORN: Yes. That's the way we've been handling it. I don't know whether the magnitude should be the same. It's not my area of expertise. I think clearly coastal birds are an important predator right at the hatching stage, and they're an important food source for the birds right at that season, but how these are affecting the impact of the populations overall, I don't

know. If coastal birds were taking eighty out of a hundred turtles before they even hit the water, they're having a real big impact, but I don't know what the numbers are.

VANCE VICENTE: The number that is normally mentioned is that, of 10,000 turtles, only one survives, and so --

RICHARD APPELDOORN: Right, but what's the main source of predation on that? Is it birds or fishes, and, if that's the case, then our minus -- If it's just fishes, then maybe our minus-one from coastal pelagics to turtles is way too low.

VANCE VICENTE: No, it's everything. It's from the birds and the crabs also, the ghost crabs, and they also prey on that, and then when, finally, the hatchling makes it offshore, into the sargassum beds and everything, there they get preyed upon by dorados and other pelagic fish, and significantly. I saw a video, and I think it was at the last meeting, and one of the fishers showed me a dorado which he opened up, and we counted twenty hatchlings of the leatherback turtles, and so it's across-the-board, and it goes from birds to crabs to estuarine fish to pelagic fish, sharks and dorado, and who knows if whales.

RICHARD APPELDOORN: So can we translate those comments into numbers, magnitudes, of low, medium, high?

VANCE VICENTE: I don't know. It depends on the location, and I would just leave one number until we get more data, get more information.

RICHARD APPELDOORN: What numbers are we leaving then? The minus-one from coastal pelagics to turtles and coastal birds were -- We don't have a number up, but one and minus-one?

VANCE VICENTE: I would go for minus-one for all of them for the time being, would be my suggestion.

RICHARD APPELDOORN: Okay. I got a response, a very short response, from Grisel on the issue of infectious diseases, and so I asked her if cetaceans in Puerto Rico and the Virgin Islands are really susceptible to diseases or parasites and the effect that they're causing and the degree of mortality, and I said that I'm thinking of kind of strandings, and her answer was yes.

She said that source of mortality is higher than watercraft impacts, and I can tell you, from her studies on dolphin, that watercraft impacts are in fact very significant, and so she's offering to try and dig down some numbers, but I think she just

told us that those are significant interaction between infectious disease and cetaceans and manatees, and so leave those, and, in fact, that make infectious disease to cetaceans and manatees as minus-ones, at least.

JUAN CRUZ-MOTTA: Okay. Should we go to the next one then?

RICHARD APPELDOORN: Please.

JUAN CRUZ-MOTTA: That is the last box that we haven't looked at, which is invasive species, and then the first connection is between invasive species and manatees. The relationship is minus-one.

RICHARD APPELDOORN: Here we're talking about invasive seagrass, I would imagine.

VANCE VICENTE: Yes, and that's what we discussed at the last meeting, and you gave a lot of emphasis to halophila stipulacea, and I don't know if we were clear on the long-term effects of the -- The impact would be if those halophila mats persevered for a significant amount of time and it causes chronic light suffocation, and the seagrass -- The storage organs, the rhizomes, would eventually burn out, and it would be a substitution, but then, whether halophila stipulacea has a lower nutritional value.

I don't know of any study that says that halophila is bad for turtles or bad for manatees, but it's just a different type of diet, and it's probably not as reliable as turtle grass, which is a permanent case-selected species, and it does survive even in sub-tropical areas and after winter, because all the leaves die out, but they have a very well-developed rhizome mat from which they can survive until the winter is over and until surface temperatures increase, but I don't know whether that substitution in the diet is negative or positive or neutral, from that very strict standpoint as a food source.

There is evidence that halophila stipulacea, if it has remained in some locations for a long enough period, a long-term period, that it can actually wipe out Syringodium and Halodule, and so there is a transformation in the autotrophic sources of that system, in that aspect, and so I'm not saying it's good, but I'm saying it's -- How are we going to deal with this, regarding the manatees and the turtles? We don't know what percent of the seagrass bed, of the turtle grass beds and Syringodium and Halodule beds, have been affected significantly by displacement of Halophila stipulacea. I don't know, but I know that locally it has been reported to be important.

RICHARD APPELDOORN: I have a question about how we want to handle this. The first way is the way we're doing it, where this -- If this invasion would affect manatees and also turtles in the same way, but is that a direct impact? Do we want to do it that way? The alternative is that we have arrows that connect from invasive species to seagrass, and then seagrass connects to manatees and turtles.

JUAN CRUZ-MOTTA: Rich, the purple circle that you see in the slide was meant to draw attention to that point, whether the relationship was direct or was through an element in another model. In this case, that would be habitat.

JORGE GARCIA-SAIS: The invasive species is the seagrass, and so it's direct. It's not through a seagrass, but it's that the invasive species is the seagrass.

RICHARD APPELDOORN: Yes, but it's changing the habitat to itself, if you will, and --

JORGE GARCIA-SAIS: Yes, but it not only changes the habitat from one seagrass to another seagrass, but what's happening is that it's changing the habitat from sand, where other seagrasses were not being able to colonize, and this invasive species is able to colonize spaces and depths that were not previously available to other seagrasses to grow on, and so, actually, we're probably looking at an increase in overall distribution of seagrasses to deeper areas, to more extensive areas, within the otherwise sandy bottoms and things like that, and so it's not only one seagrass for another that is the consideration. There is much more into it.

RICHARD APPELDOORN: Yes, and all that is hard to capture with these lines.

JORGE GARCIA-SAIS: Halophila has been detected down to more than a hundred feet. Just last year, we saw it at a hundred feet.

VANCE VICENTE: That's true, but, also, there's a problem there, because some people cannot distinguish between Halophila decipiens and Halophila stipulacea, and Halophila decipiens, I have found it, and it grows steadily and permanently at 110 feet, and so the question regarding stipulacea is how big is the problem, and until I see data that, okay, 80 percent of the shallow sandy bottoms have been inundated by Halophila stipulacea, versus other species, I don't know how big the problem is. As far as I know locally, it's important. In Culebra, it is a problem, but --

JORGE GARCIA-SAIS: Vieques, Culebra, Fajardo is overwhelmed by stipulacea, overwhelmed.

RICHARD APPELDOORN: Certainly in the Lesser Antilles, that's been the case too, at least up until the hurricanes, which probably blew off a lot of it.

JUAN CRUZ-MOTTA: Listening to the arguments, I would suggest leaving the relationships there with a minus-one, as we agreed last time, and would that be okay?

VANCE VICENTE: I agree.

JOE KIMMEL: I like that, J.J.

RICHARD APPELDOORN: Since we don't know any better at the --

JORGE GARCIA-SAIS: I am not sure if it's negative. I am not. Frankly, you can leave it there, and it's fine, but my opinion is that we don't know. What if the turtles and the manatees, in the long run, may be benefiting from a larger distribution of seagrasses, even though it may not be as nutritious, which we're not sure either here, within this group. Nobody has come up with a reference or anything like that, and so the relationship is there, but whether it's positive or negative or two or three or four, I don't know.

VANCE VICENTE: I don't know, and I suggest leaving it at minus-one, just because of the fact that it's a different habitat, new habitat, and so it's a change. With a minus-one or a zero or -- But just the fact that it's different, maybe it has a higher probability that it's bad, but maybe not.

I mean, there have been other invasive species in the world, and whole coast of California, for example, has -- The Zostera, one of the species of Zostera, was dominant along the west coast of the United States was displaced by Zostera japonica, which is a species from Japan, and there wasn't a very big issue for many years, because it was a substitution, but it basically played the ecological function of a seagrass, but then, just recently, it was found that the changes that occur in the substrate was not beneficial for some species of clams, and so now they have decided that it's not good, but it was in the very long run, long-term monitoring studies that they have done with Zostera japonica.

Just the fact that it's different, I would just put a minus-one, because there is displacement of climatic species, and the climatic species is Thalassia testudinum. The other species are Halodule

wrightii and Syringodium filiforme, and, of course, Halophila decipiens, and they all get displaced in the long run by the dominant turtle grass, and this Halophila stipulacea may provide the same surface area for primary production, but it may not play the functional role of trapping and binding the sediments, because the oldest species of Halophila have a very, very thin rhizome and very, very, very thin and sparsely distributed roots, and so it doesn't hold the soil together as well as the other ones, and so I don't know. I would put a minus-one, and that's my suggestion, but I will listen to other opinions.

RICHARD APPELDOORN: No, I think that's a good idea. You know, I can't think of any invasive species that came in and had a positive impact, because most species are geared to what their native environments were as they grew up evolutionarily. One could say, okay, lionfish came in, and there's much more to eat for the other fishes, but they don't know to eat lionfish, and so it doesn't have that role, and it may be getting that later, but I think Vance is right that, in the absence of information, the weight of experience says that it's going to be a negative impact.

JORGE GARCIA-SAIS: Well, just one final comment, and then I won't say anything else, but it does have a very positive impact, in terms of the ichthyofauna, that you see that, at depths were previously it was sandy, according to the benthic habitat maps, and then you go down, and there is a big seagrass bed there, Halophila stipulacea all over, and it's full with the fishes that are characteristic of seagrass beds, and so, for those species, their answer would be that it is a positive thing, because, otherwise, they wouldn't be there.

VANCE VICENTE: Reni, there is a paper on reef fish recruitment on Halophila stipulacea beds, the turtle grass and Syringodium and Halodule beds. If I remember correctly, the Halophila stipulacea does not prevent or diminish reef fish recruitment, and that was an article that was relatively recent, but I can find it, and I can dig it out for you.

JORGE GARCIA-SAIS: I'm not saying that. What I'm saying is that, where it was previously sand, now there is Halophila stipulacea. Where there was previously no fish, now there is a lot of fish.

RICHARD APPELDOORN: I think the point is well taken, but we don't know what the long-term consequences of that might be. It may in fact not have any, because, once they start getting too big to be in the seagrass, they don't have the higher canopy that the Thalassia provides, and maybe, in the end, it's not good for them. It's invasive now, and we're going to have to wait and see what it

looks like, and models are there to guide thinking and be modified when we learn more information. I think we have a consensus.

JORGE GARCIA-SAIS: The fishes that dominate the stipulacea environments are not juvenile fishes. We are talking about blueline parrotfish by the racer fish, the green racer fish, and things like that, they are very, very, very abundant, and there are very dense aggregations of these wrasses and parrotfishes in the seagrasses, and they attract other predators, such as, for example, jacks and the likes. That is what happened, and it's a whole food chain, a whole food web, that is being based on the productivity of these Halophila stipulacea to grow in otherwise previously abiotic areas, and that's what I am talking about.

RICHARD APPELDOORN: Well, we haven't got to the impact of reef fishes yet, and so I don't think this is going to affect either the turtles or manatee discussions, and so I think we leave those as they are.

The problem we have with invasive species to reef fishes is we only have one line, and, as you're pointing out, if you're talking about invasive seagrass, maybe, for some species, this is having a positive impact, and then the species at -- So that would maybe go to inshore forage species, and then the reef fishes are feeding on those, and so there's a positive impact there, and then you could have lionfish, which are definitely having a negative impact on a number of species, and we only have one line that we can deal with, and so we have to kind of look at overall effects on what's the really dominant thing we're looking at to our knowledge base now, and things might change, or we've got to make a more complex model to handle important processes that are in opposite directions between individual components.

JUAN CRUZ-MOTTA: So, in summary, should we leave minus-one for manatees and turtles or not? What I hear is that most of you believe that should leave minus-one, correct?

RICHARD APPELDOORN: Correct.

JUAN CRUZ-MOTTA: Okay, and so would you like to go to the following one, which is invasive species affecting reef fishes, and, actually, that's the last line. My recollection of the discussions we had last time is that was mainly related to lionfish.

RICHARD APPELDOORN: Right, and Reni has just raised the possibility, based on direct observations, that there actually might be a positive benefit from more seagrass from the invasive species, and so this is what I'm saying, is that the impacts of

different invasions could go one or the other, depending on the nature of those invasions, and we only have line that we're allowed to draw per box, and so we can have connections going both ways, but we can't have multiple lines going in the same direction, and, yes, we were thinking lionfish here, and I would say, until we have more information on the situation coming out of changing seagrass beds, or changing sand into seagrass, that we keep it the way it is, and, again, note that we're looking at dynamic systems and that these may need to be revised as we get more information, but, for lionfish, I think we have a very solid database to know what the impacts, at least the direction and whether it's positive or negative. Not hearing any other comments, I would say we go with that and we close this model for the moment.

JUAN CRUZ-MOTTA: I was about to say that, yes. One last comment is the instructions we were given is we also had to -- We also have to comment on the relationships between these elements and the other models. I have a question. How are you going to go about -- We took about two hours to discuss this model, and I guess that talking about the relationship between this and the other sub-models might take a lot longer, and I'm not sure how to proceed, Richard.

RICHARD APPELDOORN: I would like to postpone that until we go through all of them, and, if we can have all the components of the sub-models pretty much agreed upon, then, when we start drawing things across, we have a limited number of options about where we're putting things, and we don't have to invent new things. That process of looking across sub-models is going to be interesting, because we don't have -- It's going to be difficult to display everything, shall we say, in that regard, but that's how we'll have to work with it.

JUAN CRUZ-MOTTA: Thank you, Richard. That sounds very reasonable.

RICHARD APPELDOORN: Okay. At this point, I believe we were scheduled to go back to looking at spiny lobster.

SPINY LOBSTER UPDATE DISCUSSION (212:20)

ADYAN RIOS: Do you want me to just jump into it?

DOUGLAS GREGORY: I would like to get a copy of the revised presentation.

ADYAN RIOS: I'm sending it now. Just one second.

RICHARD APPELDOORN: I would like to invite Jocelyn to relay to

the group what she had emailed about the questions of how we are setting ABC in the absence of a fixed value from the council for P*.

JOCELYN D'AMBROSIO: Sure. Thank you. I had sent Rich a question earlier today, and I just was wondering if the SSC was prepared to recommend ABC, and know that there are two inputs that we've been talking about to come to an ABC recommendation, the sigma as well as the scalar for sigma, and then the P*, and so, yesterday, I thought we had a discussion indicating some initial thoughts around sigma and the scalar for it, but we recognize the council still hasn't set P*, and so my question was if the SSC needed to await that P* value and the council finalizing its risk policy before it was going to recommend ABC, because, as we also discussed, because the scientific uncertainty should be based on just general principles of the uncertainty and the information, if the SSC was prepared to say that the council -- That we have provided the uncertainty estimates, and so, whatever your risk policy following these uncertainty estimates is, would be our recommendation, and so that was my general question, is basically if you wanted to see the risk policy, or needed to see the risk policy, before finalizing the recommendation.

RICHARD APPELDOORN: As I understand that, we can -- If our recommendation for the uncertainty, scientific uncertainty, and the council will then -- It could then take that and match it with whatever P* value they want for the species/platform combo and then come back to us and say that would result in an ABC of this and do you agree with that, which would require us to get back together again to agree with that, or is there some other way where -- Well, I don't see there's another way, unless we choose the P* within their acceptable range, which, to me, is sort of -- I don't know if that's taking prerogative from the council, and so this is the legal sticky problem that I am not sure the SSC is in a position to solve, so much as somebody else.

JOCELYN D'AMBROSIO: I think there's a little bit of the chicken-and-egg problem, where the council is supposed to provide its risk policy, which is represented through the P*, and it hasn't yet set that, and so that makes it difficult then to have that final quantification of the ABC right now, and so, if you would like to see it again, with the understanding of the risk policy and provide that, a number of the recommendation, that's an option to say to the council.

DOUGLAS GREGORY: Given that the P* range is only five percentage points, we could send to the council, at this meeting, a range of five ABCs and say these are your ABCs relative to these five

percentage risk values, and then whatever the council chooses as the risk value has an associated ABC that we have pre-approved. That way, we wouldn't need to meet a second time.

RICHARD APPELDOORN: Does that work, Jocelyn?

JOCELYN D'AMBROSIO: Yes, I think that would work as well, and then, if they want to set a different risk policy, then it would come back, and so I think they were in the range of 0.4 to 0.45. If they chose something different for some reason, then it would come back to the SSC.

RICHARD APPELDOORN: Okay. That sounds like a reasonable approach. Having said that, Adyan, are you going to present?

ADYAN RIOS: Yes, I am.

RICHARD APPELDOORN: Go to it.

ADYAN RIOS: Here is a summary of what I have prepared for us to go over, and I, just moments ago, sent this presentation to Graciela. There might have been one slight misunderstanding, but I don't think it will have a big impact in the context of the conversation, and so we are going to be showing what I'm calling the three-year average base case, which is just the methods that I explained yesterday of deriving 2020 in Puerto and 2019 and 2020 in the USVI using recent period three-year means as well as a run with a 50 percent reduction, and I ran the reduction for 2019 and 2020. It might have been that you wanted it just for 2020, but the differences and the comparisons that we'll see I think would kind of cover both. Then we will be looking at OFL and ABC using sigma min of 0.5, a multiplier of two, and a P* from 0.4 to 0.45.

This is a version of the plot that I showed yesterday, and so just to let you know what data are going into these two model runs, and so we just have, again, the totals in black, and then the values used for each of those years. On the left here, the asterisk points to 2020 for Puerto Rico, coming from a three-year average, and 2019 and 2020 from the Virgin Islands, coming from a three-year average.

The alternative that we're going to be looking at and the OFL and the ABCs for, we'll look at that for the 50 percent for 2019 and 2020, and so the values here in 2019 and 2020 are 50 percent of what they were in this run, and that just shows you the full time series, for context.

Then we're going to start looking at the OFLs, and we're going to

be seeing a lot of plots with the two lines on them, and it can be confusing, and so I've tried to show it in different ways, and so, just to point to what we're seeing here, the OFL is shown by the squares, and the provisional values for the two runs are highlighted by the asterisk, and then the two runs shown in the two different colors, and what you see -- This is the same data, but just a different way of looking at it, to aid in the explanation.

For Puerto Rico, we see that the regular time series, the provisional years, and the end response in the model's projected OFL, and the three-year average version and the version where those two years are halved, within a few years in those projections, they converge towards the MSY, and that is sort of the intention of the projection.

In this case, it happens in two ways. By undershooting MSY, there's a bit of buildup, and then the model brings it towards MSY. In the blue run with the three-year average, there's a bit of an overshoot, but that's okay. Because this stock is not overfished, it's okay to undergo overfishing to get towards MSY. Because this is not a sustainable level, remaining at this level would not be sustainable. However, remaining at this yellow line, given the current model condition, is sustainable, and that's why, given whatever values we put in for the 2019 and 2020 years, convergence happens relatively soon for most of the models.

I will also just leave these here for a moment, and, again, this is the information, but it's just shown in slightly different scales over slightly different years, to help explain that situation, and so, for St. Thomas, the three-year average, and halving that results in a higher OFL in 2021, which converges towards the model's MSY, and the same is true in St. Croix.

That points to the semi-conclusion of unless the values are drastically, drastically different from each other in these two years, the implications within a few years are very small, and so, yes, there is an implication in that first year's OFL, as we see, but it quickly converges towards the MSY, and, here, we're allowing the model to just approach the MSY, and we could always just -- You could always just choose to have a stable level and revisit OFL.

Now we're moving towards ABC, and I have plots that show these differently, and so I know this will be a lot to cover, and maybe these plots don't look right, but they do show you the two runs in the two colors with the range of P* from 0.4 to 0.45, and, again, it just shows you that even these two versions that have a pretty

strong difference in the values for 2019 and 2020, a 50 percent reduction for this blue one, again, those models converge, and so these two solid lines show the OFL, and all these dotted lines show the ABC, given the different P*s. This table shows what the relationship between ABC and OFL are for those values.

Another way of looking at this same information is -- There's a third way that we'll look at that has a bit fewer lines on top of each other, but this table on the lower-left remains the same. The values here are kind of small, but hopefully you can zoom in if you are interested in knowing the exact values, but here we have 2017 through 2026, and we have the two runs shown in the red and the blue, and, instead of including all of the P*s, I have only included 0.4 and 0.45.

For context, I have added what the MSY of the model is in yellow, and you will see that the OFLs converge towards the MSY of the model, and I have added what the ABC on the books is in gray.

Here, they are overlaid, which is helpful for the purposes of comparison, but it might be a little busy as well, and so, here, they are not overlaid, and I think some of these conclusions are that the results within a few years are relatively insensitive to the values that are used for 2019 and 2020, as well as this is kind of the outcome carrying through the conversations that you have had concentrating on establishing reasonable scientific uncertainty.

Just one final thought is that the tiered control rule, as you have it, is set up to allow smaller buffers between OFL and ABC as data improves, and so, with that, hopefully you have this presentation open, or available to you, if you're interested in seeing it in more detail, and I will ask if you have any questions or want me to remain on any particular slide, or perhaps on the tables.

RICHARD APPELDOORN: I have a question. You have the -- Since we're not overfishing, these graphs are set up that there is some excess biomass that can be taken, and we start lowering values as the years progress, but I'm confused as to what we're recommending as an ABC, and isn't that a fixed number, or is that something that you're going to calculate for every year? In a practical sense of management, what's going to be driving the ABC value? Is it going to be constant level, or is there a mechanism to allow a change, so that we're not going in every year and setting a new value?

ADYAN RIOS: The ABC is a scalar, or OFL, and so it is reduced by

these percentages, depending on the sigma, the multiplier, and the P*, and so that's a method that requires, I guess, finalization, and the other thing that I should point out that requires finalization is what values to use for 2019 and 2020, to finalize that, in order to finalize the OFLs and, subsequently, the ABCs, which another reminder to make is that they can be revisited as you have more information, and so, as you have more information, moving into the future, about what the actual landings are in 2020, or 2021, that can be revisited to recalculate new OFLs, as well as to re-estimate the ABCs associated with those OFLs, given the method you decide.

RICHARD APPELDOORN: So we would not be recommending, necessarily, an ABC, but we would be recommending an ABC for 2021 and for 2022, and, somewhere around 2023, it starts stabilizing to a rather fixed value, and is that correct?

ADYAN RIOS: Yes. You would be able to choose the expanse of time over which you would like to establish -- It doesn't have to be through 2026 that you establish it, and it does flatten out eventually, and you may choose to only establish OFLs and ABCs for a few years initially. Jason, are you able to explain that better?

JASON COPE: I can give it a try. I mean, this is kind of like we were talking about yesterday, when you start overlapping the frequency of assessment. If you don't know what that is, you're kind of stuck in a place where you're going to project out X amount of years and take a look and see what it does, because you are then committed to one model telling you this is what the population looks like, and then, given a certain recruitment estimation into the forecast, which is what the forecast is doing, if you presume all that stuff is true, then this is how your control rule is going to work, and so it's pretty much that simple.

The question then becomes are you willing to let this sit for five or ten years, or would you rather try to go and deal with some of the data issues, and maybe improve your idea of where the stock truly is, in order to get maybe more up-to-date projections, and the other tricky thing here, what we run into a lot, is the assumption that you are going to be catching the full ABC every single year, and that's another thing that we talked about yesterday, was the fact that, if you have hurricanes and earthquakes and pandemics, all of these things can affect the opportunities to go out and fish and actually obtain a full ABC. If you don't get a full ABC, then your future projections are going to be overestimating how much is coming out of the population, and therefore what's going to be available for the future.

This is kind of a crossroads that you've hit, where you want to understand do you need to do a full model, a full stock assessment, every X many years, or can you just update this current model with the newest catch from the previous year, to make the forecast more representative of what actually was taken, and, therefore, you can update your forecast into the future that way, and we call those catch updates, and so they're basically using the structure of the model and just updating what was actually caught from the year before, in order to see what you might want to set for the future, rather than just letting the model roll ahead, and so there's a lot of these types of decisions that could be made by someone, and I think the SSC has a strong voice in that, but this kind of falls under the topic of stock prioritization and assessment prioritization and those sorts of things, but it's a good discussion to have, and I hope that helped and didn't add more confusion. I did have a question about the control rule, if I can get to it.

DOUGLAS GREGORY: That's all well and good for the future, and I believe that the Southeast Fisheries Science Center is working on a format for interim updates that would -- I think we would get updates if catches varied greatly from what were projected, and I think everybody would be interested in knowing that, the council and the Center and the SSC.

To me, I think our decision is do we go with the one-half of the average of the last two years trend, or the original trend, and then do we just present these two numbers, P* of 0.4 and P* of 0.45, or -- I guess that's a good decision between council staff and National Marine Fisheries Service, and so, to me, it's that straightforward. If it happens in the future, it can be done, all that can be done, without a lot of trouble, I believe, and so we could recommend a range of five years, or this entire range of six years, knowing that, more likely, it will change because of circumstances.

Now, in the Gulf, what has happened in the past, let's say if we just recommended a range of three years, and we didn't have a new assessment at the end of that three years, and we didn't do any catch updates, or interim updates, that ABC at the end of three years would stay constant until it was changed. Thank you.

VANCE VICENTE: Richard, I got a message from Julian, and he would like to make a comment.

RICHARD APPELDOORN: Go ahead, Julian.

JULIAN MAGRAS: The fishers never got back to the numbers where

they actually fished from the hurricane to present, and now we have all the hotels closed, and our numbers for lobsters are going to be very down, and so, when you're setting these parameters that we're looking at the numbers, we've got to be very cautious, because we don't know when we're going to recover from what's going on right now, and so I know our numbers are going to -- The lobster fishers are taking a big, big, big hit right now, and the guys that catch fish are doing okay, and so, when we're looking at the numbers from the hurricane to present, those numbers should be down, and so please take that into consideration when you guys are setting the parameters of the ABCs.

RICHARD APPELDOORN: Thank you, Julian. Nelson, can you give us how the fishers are behaving this year, in light of the pandemic?

NELSON CRESPO: Hi, everyone. It's really difficult. The fishermen are living day by day and trying to catch and to sell a little bit, as much as they can, but the market is really low, and it's very frustrating, because, for the volume that we used to catch and sell, now we are doing nothing. All the catches are going to be really low right now.

RICHARD APPELDOORN: Thank you, Nelson. Given those comments, back to the committee. The choice is going with the revised estimates and putting the scenario where there is a 50 percent reduction as the basis for calculating OFLs, and we proceed from there, or do we want to go with the scenarios as originally presented yesterday and those predictions, which don't have incorporated those kinds of reductions, in light of what Adyan presented, showing that these likely are not going to have really big impacts going down the road, because the projections are --

For 2019 and 2020, and we're already in 2020, and that's in the Virgin Islands, and Puerto Rico is just for 2020, and, by 2022, you're already getting pretty close to each other, and then there would be the question of whether there would even be the capacity to harvest -- Let's just say the market to harvest the extra load or not, coming out of the pandemic, and so is there a preference for one or the other, or does it really not make a difference, given the timeframes we'll be projecting out to?

VANCE VICENTE: I mean, this is where the catch per unit effort data is critical, and the question is has the catch per unit effort increased or decreased or been kept the same, I mean, if we want to get an idea about the earthquakes and the coronavirus and whatever.

RICHARD APPELDOORN: Well, I'm sure that Kevin can tell us that

maybe a year from now, because that takes that long for --

KEVIN MCCARTHY: The CPUE information is all derived from the same commercial logbook data, which is where we get the landings, and so that is available at the speed at which staff can enter the data, and the last update we got from Puerto Rico was that, as of I think yesterday, all of the landings data, and therefore all of the CPUE components, for 2019 have been entered, as of yesterday, and they are now working on the correction factor data entry for 2019, and so I'm not sure how long that process takes, but let's say in several weeks, or maybe a month-and-a-half, and I'm not sure, those data will be entered, because I don't think staff in Puerto Rico are working full time.

Anyway, once those get entered, we would have the landings information for 2019, which we could then -- Recall that the issue was that we had most of the data entered for 2019 in Puerto Rico, but we had to borrow one of the correction factors from -- We had to borrow the correction factors from 2018, and so, in a couple of months, it might be possible to have those updated numbers, and that doesn't help with a council meeting coming up soon.

In the Virgin Islands, I think they're making rapid progress to completing data entry for 2019, and there is no way to know what 2020 is going to be until the year is out, and Adyan here has shown 2020 with only 50 percent of the landings from an average of the prior several years, and so there's limited updating that we can do, other than getting a more accurate number for 2019, and we would still have to make some kind of assumption about 2020, if we wanted to update these yet again, and we couldn't do that now, because we're not quite prepared to do that, and we don't have all the data needed for 2019.

I would suggest that we could -- I don't know that there's any way to guess what 2020 is really going to be, and so, our estimate of landings that were half of prior years, I don't know whether that's a good guess or not, and, at this point, it's as good as any, perhaps, and so my recommendation would be to, at this stage, account for that, and everybody recognizes the low amount of landings that are coming in, at least for lobster right now, and how long that will go forward is anybody's guess, but I think we need to account for it in some way, and so I would suggest that what Adyan has done for today is probably more -- It reflects better what is actually happening than what we saw yesterday, when there hadn't been any effort in trying to account for the lower landings.

That's my two-cents' worth anyway, and, as far as the CPUE

information, we do -- One of the limitation of this model is that we don't have an index of abundance, and so we don't have a CPUE series in here, and those were not available, and that's been a research recommendation out of SEDAR, coming out of this assessment, and that has yet to be -- That work has yet to be done, and so we don't have a CPUE series, and I agree with you, Vance, that that's absolutely important, but we're not quite there yet, but this is what we have for this model moving forward, and I would recommend that that 50 percent reduction for 2020, lacking any other information, is a good estimate, particularly given the relatively small effect it has in those projections, as we can see from Adyan's graphs here.

VANCE VICENTE: Thank you. I just keep on stressing how critical it is, because, if there has been a significant decrease in fishing pressure, and fishing pressure has been an element in affecting the stock, and there is less fishing pressure, and the CPUE stays the same or increases, and that can tell you so much more about the stock, but thank you.

WALTER KEITHLY: I am just going to weigh-in on one point that Vance makes, or just made, and I'm not sure the CPUE is that useful in some of these fisheries in the U.S. Caribbean, and it may be more so with St. Thomas and St. Croix than Puerto Rico.

My rationale for saying that is that what we've been hearing over the last several meetings is that it's market driven, and fishermen will often go out with a specific order to fill. Given that to be the case, CPUE is largely going to depend on what orders the fisherman has prior to the trip. Thank you.

VANCE VICENTE: I disagree with you, but catch per unit effort is one thing, and the demand is another. It's how much you catch per hour, per time, per number of vessels, and it's independent, and so I disagree with you.

RICHARD APPELDOORN: Not the way we do that, because, normally, effort is by trip, and, whether you haul ten traps or twenty traps on your trip, depending on your order, it's still one trip.

WALTER KEITHLY: Yes, and that's while I was going to say. They have number of hours on the trip ticket, or the logbook, and, at least last time I looked at the logbooks, they were rarely filled out, and so the best you can do is your catch per trip, and, on top of that, it's often multiple species being harvested on a single trip, and so it's really difficult to get any accurate estimate of the CPUE.

VANCE VICENTE: Thank you, and I understand that, but another question is, is there any other fishery-independent studies during this period of decreased demand on the stock? I mean, otherwise, we're still empty handed.

JULIAN MAGRAS: Can you guys still hear me?

KEVIN MCCARTHY: Julian, hang on a second. I want to respond to Vance, please. The fishery-independent efforts would run into the same problems that everybody has with being able to be out there and doing work, and so, if it's a NOAA-led fishery-independent survey, the ability of people to get out in the field is currently very difficult.

We are not traveling, and a lot of the port sampling has been curtailed, and a lot of the observers have been curtailed, and so getting people out on the water during the COVID-19 sort of shelter-in-place kinds of activities is really difficult, and so seeing what's happening right now, in a fishery-independent way, or even with port sampling, it's been really difficult, because of limitations on what staff are allowed to do, and I'm assuming that's the same case for staff that are based in Puerto Rico and in the U.S. Virgin Islands, because what we've heard from them is that they're just -- The people are at home, and they're doing the best they can, but they're not getting out in the field much, but maybe that's going to change in the coming weeks, but that's what I have heard as of right now. You're right that it would be great to know what's going on, but it's hard to get people out there to find out.

RICHARD APPELDOORN: But catch per effort doesn't respond instantaneously as well, and those surveys, which actually we're hoping will provide some really good information, are done every two years, and so there is a lag, if you will, depending on which island platform you're talking about, relative to any specific event, as to what was going on before and after. Julian, go ahead.

JULIAN MAGRAS: I just wanted to comment, two comments, and I understand the catch per unit effort is made if you go out on a trip, but, in several instances that are happening right now -- Like, here in Frenchtown, at my fish house, the fishers here are only going out and harvesting what they think they can sell, and then they come in, and so, where we might go out and pull eighty traps, some of us are only going out and pulling forty traps, or fifty traps, depending on what we feel that we can move in the market.

There is no reason to bring in what we cannot sell, and then there

are a couple of groups of people here that are doing studies, or interviews, that have been interviewing the fishermen, and I know the group CORE is one of them that are coming and interviewing the fishers, to check on their sales and how often they are fishing, and so they are doing that study, and, also, right now, I know that Brent Stoffle is working on also doing a socioeconomic study here in the USVI also, to see what the impacts are on the fishers, and so I wanted to put that on the table.

VANCE VICENTE: Thank you, Julian, but, still, I thought that the fishers in St. Thomas and St. Croix were keeping a record of how much they catch in their traps, and so it doesn't matter whether you put fifty or a hundred. The important thing is what difference, or how variable, has been the catch per trap. We cannot lose that information.

JULIAN MAGRAS: If I pull forty traps, and I catch a hundred pounds of fish, what your breakdown is going to be is the estimate would have been 2.5 pounds of fish per trap, and that would give you a hundred pounds, and so do you understand what I'm saying? If I pull a hundred traps, and I catch 300 pounds, then it would be three pounds per trap. That's where you get those numbers from.

VANCE VICENTE: Okay. Got you. Thank you.

RICHARD APPELDOORN: So we are back to the question of which estimated data, landings data, we want to use. I thought we were kind of getting a consensus rolling on the updated estimates that Adyan just presented, using the proposed 50 percent reduction, and would anybody be against using those?

WALTER KEITHLY: I would be opposed to using the 50 percent reduction, only because it's just too speculative. I believe there probably has been some decline, but I am not willing to use any number such as 50 percent.

RICHARD APPELDOORN: I understand that, and remember that the difference goes away real quickly, and it could only be really taken advantage of if the markets and conditions are such that it would allow the extra fishing to go on to utilize that potentially extra buildup of resource. Does anybody else have a comment?

JORGE GARCIA-SAIS: Richard, maybe the fishermen can provide better insight about that percentage of difference.

KEVIN MCCARTHY: I've got another thought. Whether we go with -- I advocate some kind of acknowledgement that the landings are lower, based upon what we've heard from public comment and other

folks having anecdotal information, but, whatever we do, we can also recommend that the council request an update of these kinds of projections once we've got the data for 2020, and so that would be sometime probably this time of the year in 2021, which would allow for a reset of the ABC, and therefore ACL, before the end of the 2021 calendar year, because then we'll have the reports, and we'll know, as best we can, from the available data.

DOUGLAS GREGORY: I have a question, I think for Kevin. Why is the 2019 preliminary landings in Puerto Rico so high, 647,000 pounds, when, in 2016, it was 446,000?

KEVIN MCCARTHY: We chatted about this a little bit yesterday, and that's because -- I mean, I don't know that this is the answer, but it's possible that it's because we were borrowing correction factors from 2018 to use in 2019, because the 2019 correction factors are not yet available. I don't know if that's the answer, but it's certainly a possibility.

RICHARD APPELDOORN: Just a comment, Doug, is that the expansion factors tend to be very variable, and so it's very possible that it's the expansion factor effect. Go ahead, Reni.

JORGE GARCIA-SAIS: It's precisely on that point of the expansion factors. I wanted to know how variable those expansion factors have been. I mean, how much do they vary? Do they vary by 30 percent or 20 percent or 40 percent? What is the range of variation from year to year on those expansion factors, because it's so disturbing, in terms of the Puerto Rican fishery, and also in regard to the comparative analysis between islands.

I mean, it's such a huge source of uncertainty regarding everything about the landings, and I really wish that we could get a better handle of that, but at least tell me how variable is it from year to year, and I sort of at least hope that it would be kind of like a constant, but apparently it's not.

KEVIN MCCARTHY: It can vary among years, certainly, and I'm taking a look now, to see if I can find the answer to that question, and I can't guarantee it, since I'm not in my office these days, as most people are not, but I will see what I can find, and I will try and get back to you with an idea of the kind of variability that we see in those correction factors.

JORGE GARCIA-SAIS: What I am thinking is that -- My fear is that some of that variability is perhaps our sampling variability of the expansion factor, because, for example, people that -- In my opinion, that expansion factor, that variability, is just based on

our analysis of the expansion factor, because, otherwise, what you would think is that people that don't report never report, and that is constant from year to year.

The discrepancies between the true annual catch and what is reported is something that is associated with a number of fishermen, and this number of fishermen will never report, and it's not that they report this year, and the next year they report a little more, or a little less, and I don't think so. I think that this is associated -- The discrepancy between the real values and the reported values is something related with a certain amount of fishermen that will never report, and so it's kind of like -- I mean, isn't it more like a constant error and the variability that we see is only associated with our variability to measure the error? That is where I am, but I really wish that we could get a handle on that.

RICHARD APPELDOORN: That sounds like a good presentation that we would like to hear from maybe Daniel and his counterpart in the Science Center, on the source of variation that go into these things, and they do have two checks, and one is who is fishing versus who is not fishing, and therefore not reporting, but there is also the checks that are going through the reports coming out of the fish markets and are they matching what is supposedly going into them, and so I's complex thing, and I don't think we're going to be able to tease it out here.

If Kevin can track that down, to kind of give us an idea of the degree of variation, that would be fine, but I don't think it's going to help us address the question that we're dealing with right now. My recollection is that they don't do the correction factor every year, and it's like every two years, typically, and, yes, it can vary quite a bit, and they do it by coast as well, which allows a little bit more variability around the island.

JOE KIMMEL: I'm just looking at the chat box, and there's a couple of people that have asked to speak, and that was like five minutes ago, and so you might want to get on the chat box, to see what they want, and it was Sarah Stephenson and Jocelyn D'Ambrosio.

RICHARD APPELDOORN: Thank you, because my chat box has not been scrolling down as people have been --

JOE KIMMEL: And Marcos Hanke.

RICHARD APPELDOORN: Let me just go down and see what the recent -- All right. Sarah, do you still want to speak, followed by Jocelyn?

SARAH STEPHENSON: Yes, please. I have a question for Adyan, and it's regarding the slide before the one that is showing right now, if someone could go back one slide. You used preliminary landings for 2019 on the three-year average, like the original projections that you did, and then you used the three-year average, and so 2017, 2018, and 2019, to get 2020. This top-left graph, for 2019, it was preliminary data, and 2020 data was the average of 2017, 2018, and 2019?

ADYAN RIOS: Correct, and so --

SARAH STEPHENSON: I just wasn't sure if -- Then, when you go to the 50 percent reduction, you just took a straight 50 percent reduction for 2019, but then, for 2020, did you do the same thing, where you took the 50 percent reduction from the three-year average from the left graph?

ADYAN RIOS: Yes, and so the right graph shows 50 percent of these asterisks, and you are correct in that this value, which has 99 percent complete data, as reported for 2019, and that information was retained. However, we kept it in this exercise, because of the issue of the uncertainty with the correction factor as well, and so, as time goes forward, we'll know more about what exactly that correction factor was, but we don't expect the raw landings for that year to change very much. I think my explanation is that you were explaining it correctly is all.

SARAH STEPHENSON: Yes, that was it. Thank you.

RICHARD APPELDOORN: Jocelyn.

JOCELYN D'AMBROSIO: The only thing that I wanted to point out, which, of course, we all know, is that the Magnuson Act requires the conservation and management measures to be based on the best scientific information available, and so, as you're considering which year to use and where to stop, I would just think about how you view the information and if you think, given some of the uncertainties, that this represents the best available information or if we would look at earlier information.

With 2019, I have heard questions about expansion factors. In 2020, there has been discussion about assumptions about reductions in demand, but then Carlos Farchette, in the chat, is raising issues about demand in the USVI, in St. Croix, being high, and so I don't know if we need more discussion on that.

Then, in terms of timing, the only other thing I would point out

is that what we're working on now would be an amendment to the island-based FMPs, and those are still working through the process to be approved and implemented, and then we would start the process for an amendment to change the ABCs and the measures, the MSY and the OFL and the ACLs that derive from this process, and so it might be possible that, when those amendments are being prepared, we would have updated information that we could use, and you could say something like, depending on timing, we might want to update the years used, depending on the timing of the amendment.

RICHARD APPELDOORN: Are we looking at a scenario where the amendment could get through in 2020, or 2021, or, from your experience, how long is this process going to take?

JOCELYN D'AMBROSIO: Well, we haven't published a notice of availability for the island-based FMPs, and so, after that, it's ninety days before those would be approved, and then they're implemented in a proposed rule and a final rule, and that process hasn't taken place. The goal is to get those FMPs in place this year and then start the end of this year or the beginning of next year with the amendment process, and that could take maybe three months or more, three to six months maybe, and so it might be the middle of next year where that amendment would be finalized, and sometime in the beginning portion where it would be proposed.

RICHARD APPELDOORN: So, given that, we're talking about whatever ABCs we're generating here would not come out to be legally available until say mid next year, and would they then be able to be applied for that year, or would we have to wait for the next fishing year, if we're already halfway through it?

JOCELYN D'AMBROSIO: I think that they would apply in that year, especially the way the AMs work, where they look at the three-year average, and so I think they would take effect thirty days after the final rule, and then it would just be a matter of evaluating compliance with those ACLs over the previous three-year period.

RICHARD APPELDOORN: Okay. Thank you. Marcos, did you have a comment?

MARCOS HANKE: Yes, and I just want to share with you guys my experience with the industry, and I was helping the fishermen to collect some preliminary data with the lobster, and pretty much the majority of them report steady landings of lobster, increasing landings of lobster, and that applies for either small or bigger fishers, more professional fishers that do the different levels of understanding of the fishery, but, during the pandemic, it's important to highlight also that I was informed by the fishermen

that fishermen that sold to the supermarkets were less affected by the COVID.

They were affected, but not as much, because they had the market, and most of those people were the bigger fishermen, the ones that have all the permits and have the access to that market, but the majority of the small, traditional fishermen were very much affected, because there was no money to buy fish that are considered a luxury, like lobster, and no tourism, and they are the ones that create the restaurant activity and other related activities, and there was too much adversity to sell fish for the traditional fishermen to sell, and I heard numbers from 30 to 70 percent reduction on the market, and the majority of them said 30 to 50 percent reduction on the market, and that's something to highlight, that the Puerto Rico situation is very different than the St. Croix situation, the way the market responds after the COVID, and that is my comment. Thank you.

DOUGLAS GREGORY: Back to 2019, and that year is the highest estimate of the entire range of landings data we had for the stock assessment, and the only other year that seemed to be an anomaly was 2005, which was adjusted by the stock assessment people, because it was so high, and that was 772,000 pounds, and so it seems legitimate to me to reduce 2019 and 2020, and we've done it by a half, and so I would go with that, but it's hard to say how much to reduce it by, and I don't think 75 percent -- A 25 percent reduction or a 50 percent reduction would make a difference, given the projections we just saw.

I think the best available data is not to accept this 647,000 pounds for 2019, and the next highest year is 2018, which was 518,000, and, prior to that, only one year was above 400,000, and so 2019 definitely seems to be excessive, given the historical landings, and that's including landings prior to the major hurricanes of 2017.

WALTER KEITHLY: I would argue almost the opposite. If you had major hurricanes in 2017, yet you had higher landings in 2018, the second-highest landings on record by a certain amount, it may be, for whatever reason, that there is an increased demand in 2019, and I would have thought that, with the hurricanes and problems still on the island, I would have thought that 2018 landings would have been relatively low, and they are not, and they are final, and so, yes, I have problems with the 2019 landings, but I don't see any strong rationale to discount that last year. Thank you.

DOUGLAS GREGORY: If I could just respond briefly, and only once, and that is that, from what I have seen here in the Florida Keys

with the lobster fishery, there could very well have been a surplus of -- Not a surplus, but a higher abundance of lobster in 2018 because of the hurricanes of 2017, but it would be unlikely that the abundance would increase again in another year, but I will leave it up to the group.

WALTER KEITHLY: Again, that's extremely speculative. If they only harvested a portion of that surplus in 2018, there may be even more available in 2019, and, again, this is what all this discussion has been about on a varying ABC over time, is that we're drawing down from a surplus, or OFL, I should say, and we're drawing down from the surplus, and so the fact that you had high landings in 2018 may simply reflect the surplus of lobsters out there.

RICHARD APPELDOORN: Any other thoughts?

JASON COPE: I had a thought on a different topic, and it was something long ago, but I realized that this catch input needs to be sorted out, and so I can wait.

RICHARD APPELDOORN: It really comes down to, for the years that are being estimated, what do we think the best method is for that estimation, from a scientific perspective, and so this is not taking into account 2019 in Puerto Rico. That's not being estimated, and the question is what are we doing with 2020 in Puerto Rico and 2019 and 2020 in the Virgin Islands, and do we want to go with just the average of the last two years, or do we want to drop it 50 percent, which would be the situation, perhaps, now, and we don't know how long things are going to be closed, and so how things go in the second-half of the year is anybody's guess, but I don't think, from what we've been hearing in the news, that tourism is just going to come rocketing right back, and that is an important market for the fisheries, and so it might be a reasonable assumption that there's going to be significant declines in 2020 across-the-board.

Those are our options, and Walter seems to be against the reduction approach, and I haven't -- Doug seems to be for it, and I haven't heard much from anybody else.

KEVIN MCCARTHY: Could we move forward in the slides to -- Maybe it's the final slide.

JORGE GARCIA-SAIS: By the way, Richard, I have not expressed my opinion regarding this because I, frankly, don't know what to say, because of the uncertainty of the expansion factor. The 2019 data seems out of scale, and I am worried about that, and so I'm not

sure. I'm not sure if I believe that data.

RICHARD APPELDOORN: Right, and I think that concern is felt by a lot of people, but it's actually not affecting, or shouldn't be affecting, what our decision is versus 2020 in Puerto Rico. Now that there is this slide on the screen, is there a comment that goes with it?

KEVIN MCCARTHY: I am just trying to -- Maybe it was the previous one, but looking at the one that's got them layered on top of one another, and maybe it's the preceding slide, or maybe this is it. Again, I'm looking at the differences here, and I'm not seeing a -- I mean, I guess there is a fairly substantial effect for 2021 in Puerto Rico, if it's at 50 percent versus -- I don't know how much of that is driven by 2019 also being dropped by 50 percent.

The one place where it doesn't seem to have a huge impact is in St. Croix, and there's a fairly substantial impact in Puerto Rico, and St. Thomas/St. John is somewhere in the middle, and so I don't know if this is helping me get to a decision, because there's the added complication in Puerto Rico of dropping that number in half for 2019.

JASON COPE: Rich, would it be all right to restate -- I'm trying to figure out if we have two things that we're trying to think through or if people have come up with additional possible values for that one year of catch, but my understanding is there's an argument for reducing it by half, because of all the disruptions, and is the second one matching it to basically the status quo or how things have been going on, and just assume things are going to be kind of normal, and are those the two things that we're trying to choose from, or are there any additional ones that people have proposed?

RICHARD APPELDOORN: No one has proposed concretely any way anything other than those two options, and any other options probably would require Adyan to make another set of runs, but her point was, and I think it's well taken, is that whatever impact we're talking about is probably a two-year impact. After that, we're pretty much landing on the final value that's going to extend out into the future.

JASON COPE: And possibly just a one here, if it was updated next year, if we found out exactly what did happen and that was just put in and run really quick, and then maybe you would only have a one-year thing to deal with.

RICHARD APPELDOORN: Right, and this is without running next year's

data, and, as Jocelyn pointed out, this is still a year away, before becoming operational, at which time we would have the 2020, or something close to the full 2020 data.

JASON COPE: Right, and that's why I kind of feel like maybe that might be a more fruitful thing to focus in on, is if there is a commitment to making sure that this is updated with numbers. Then we don't have to suffer that two-year transition, and we would probably feel less worried about picking one of these numbers.

RICHARD APPELDOORN: Yes, and that was kind of my point, was is there really a difference here in picking between one of these two scenarios.

JASON COPE: I think, if we're committed to having it updated sooner than later, there really isn't probably a huge difference, and so I don't know, and that's a proposal for me, is to maybe -- It sounds like there is disruption this year, and so maybe you pick the lower number, and you go with that, with the commitment that you're going to actually update things as soon as possible to get a better idea of what's going on.

RICHARD APPELDOORN: I am not sure that we can commit to that. Jocelyn, does that require the council asking us to do that, or can we demand to have that update on our own?

JOCELYN D'AMBROSIO: I think the council would have to ask for updated recommendations, but, in your recommendations to them, you could note that you recommend updating this information and to reflect some of the assumptions that you've made here that might change, and so that's one way to handle it.

DOUGLAS GREGORY: How soon would we want an update, and we could ask Shannon if that's feasible, from the workplans they have for the Caribbean in the Southeast Center.

SHANNON CALAY: Updating projections is relatively straightforward. The only difficulty is that we would need some assurance from the data providers that their estimates are considered final, and, once we receive that indication that final estimates are available, the projections can be updated very easily, and so, from our perspective, the burden is on data provision, and maybe Kevin can tell you when he thinks the data might be available. He's more familiar with the data providers.

I did -- I was typing into the chat box, but I will just tell you, and, I mean, I think that, as long as you're willing to propose management advice, it shouldn't be a problem for you to say this

is the OFL and ABC yield streams that we have determined and then recommend to the council that this assessment be updated as soon as final landings are available. Then the council will send a request to the Science Center, and we'll put it on the calendar. Now, are you talking about updating the entire stock assessment or updating the projections?

JASON COPE: My thought was the projection.

SHANNON CALAY: That is very simple.

RICHARD APPELDOORN: That's essentially what Adyan did overnight, yes?

SHANNON CALAY: That's correct, yes. The trick is getting the final catch estimates from the territories through the Science Center, so that we can run the final projections.

KEVIN MCCARTHY: Given that the reality is, and this is not unique to the Caribbean, and this is true of everywhere, but getting landings, getting finalized landings data, takes a number of months into the next year, and we would expect that, and so I don't think it's reasonable to expect to have those numbers until around this time next year. However, since we're a year ahead of it, perhaps the Science Center and the council and the Virgin Islands staff and the Puerto Rico staff can come up with a plan on how to best facilitate getting those numbers.

It's a little more straightforward in the Virgin Islands, because there is not the additional burden of calculating these correction factors, and those are something that the Puerto Rico staff try to get every year, and sometimes they are unable to, for a variety of reasons, but so 2020, just to be -- Just so we're clear, 2020 might not have those correction factors, for obvious reasons. They may not be able to get people in the field to develop those correction factors this year, and so we would be again in the situation where we're borrowing information from the previous year and all of the uncertainty that surrounds that.

I think we could -- If we start early, and we maybe develop a strategy for how best to get those data entered and reduce the lag, as much as possible. Right now, if we were to get the data at this time, and that's about when I want to say the South Atlantic normally provides their data, and so we're not suffering an abnormal lag in data provision from the Caribbean.

It's just the nature of the business, but we could, given the importance of this, we could start working on that earlier, to try

and provide some support from the Science Center and maybe have the council make it -- Emphasize the importance of this kind of activity, at least for lobster, and they will want to enter all the data, of course, but let everyone work together and see if we can get something sooner rather than later in 2021.

RICHARD APPELDOORN: I am going to make this recommendation, and so I would like the committee's feedback on this. I am suggesting that we go with the original set of data as being the best that we have now, but that we would also be recommending to the council that this should be updated as soon as the 2020 data were available, in light of the comments received particularly from the DAP Chairs.

It was not read out, because my chat box had frozen, apparently, but we had a comment, long comment, from Carlos Farchette about the situation in St. Croix, and he was basically mimicking what others were saying about the reduction, and so I think we have some input from the fishing sector that is saying that 2020 looks like it's going to be different, and, therefore, the council should be requesting a revision of these estimates as soon as those data become available. How does that sound?

WALTER KEITHLY: That would be fine with me.

JOE KIMMEL: I would support your idea, Rich.

VANCE VICENTE: I also support the idea.

JORGE GARCIA-SAIS: It's fine with me, too.

JUAN CRUZ-MOTTA: I support the idea as well.

TARSILA SEARA: I think that makes perfect sense.

JASON COPE: I am fine with that, but just maybe a definition of the original data, just so that's clear.

KEVIN MCCARTHY: I agree with that approach.

DOUGLAS GREGORY: I am okay with it.

RICHARD APPELDOORN: To answer Jason's to be specific, it is the projections that Adyan presented yesterday that were based on I believe it was the three-year averages of the most recent catches.

JASON COPE: Thank you.

RICHARD APPELDOORN: If we do that, and I don't know if anybody can read the table, and I guess you can blow it up on your screen, our recommendations then for ABC would basically be that table, if I understand that this table is the original projection table, and is that correct, Adyan?

ADYAN RIOS: Yes, and it would be the left side of this table, and so the OFLs shown at the far left, and then the lower and upper ranges, and so the upper range of P* is 0.45, and the lower range of P* is 0.4.

RICHARD APPELDOORN: I need to blow these up, and so hang on, or if, Adyan, you can blow those up on your screen.

ADYAN RIOS: I believe I can.

RICHARD APPELDOORN: Go ahead, Sarah.

SARAH STEPHENSON: I just wanted to point out, and it's cut off on the table now, but the far-right column says ABC of 2012, but that's actually the ACL that came out of that 2012 amendment, just for clarification.

RICHARD APPELDOORN: Maybe it's good that we don't see that, but thank you. Adyan, can you explain the table again?

ADYAN RIOS: Yes, and so the projections start in 2021, because we have provisional values for the 2019 and 2020, and there are final values before, and the model provides the projected OFL, which all converge toward their respective MSYs within three or four years, and these values are all in pounds.

The ABC is calculated off of the OFL, and they follow the rule that utilizes the sigma of 0.5, the sigma min of 0.5, and a multiplier of two, and then, depending on P*, which we were discussing a range put forth previously by the council of 0.4 to 0.45, and the larger range of ABC values shown here are associated with the P* of 0.45, and the P* of 0.4 results in a lower range of ABC values, both of which are calculated off of the OFL. The same sigma and the same multiplier is used for all years and all models.

RICHARD APPELDOORN: So it's just the first two estimates there, the 0.5 P* of 0.45 and, equally, the 0.4 are the -- Those are the projections, and the rest of the table is something else.

ADYAN RIOS: Correct. The rest of this table is the different runs, and so this is the run with the three-year averages, and this here, starting with these notes saying "average 0.5" refers

to the run where the 2020 and 2019 values were cut in half, and so we are focusing on these three columns and not on the following three.

Then, just for context, I included MSY and ACL, but we don't need to focus on those. We do only need to focus on the first three columns, as far as the lower and upper range of what the ABC would be, carrying out the control rule, depending on the P*.

RICHARD APPELDOORN: So, as I understand the guidance from Jocelyn, we would need a table that has not just 0.45 and 0.4, but the values in between, and so we can say you have indicated to us that your P* is going to be between this range and that here is what your ABC is going to, depending on the actual value of P* that they choose.

ADYAN RIOS: Correct, and let's see if I scroll down here. This P* of 0.45 is 88 percent of the OFL. This P* of 0.4 is 78 percent of the OFL, and, as you have the values and can provide the table of what those values are at the different P*s at these increments, or more increments, if desired.

RICHARD APPELDOORN: Yes, because I think we will have to present the full table to the council, so there's no ambiguity of what the numbers are going to be.

ADYAN RIOS: I would be happy to provide an updated report to the document that I shared previously, to have that table, and to also just formally submit that through my supervisor to you all.

RICHARD APPELDOORN: I think I am happy with just the table, because that's what we have to present to the council. For a given year, for a given P*, this is our recommendation for ABC for each platform.

ADYAN RIOS: I could put that together and send you table as soon as today, and just double-check my work and make sure everything is right, but that is easy to produce and can be provided.

RICHARD APPELDOORN: All right. Thank you. At least for the rest of the committee, you're seeing the values here, and does this approach then seem valid, given this juxtaposition of having to do the ABCs without a specific P* from the council, that we give them, whatever you're going to take, this is what the ABC is going to be, and that's what that table would say. Is everybody happy with that approach?

JOE KIMMEL: It seems like to me that that's the most logical

approach.

JASON COPE: It's kind of the only way to do it right now, since this is kind of the first time, and it's been mentioned before that there's a chicken-and-egg thing going on, but it would be ideal if there was a more established way to determine a P* before a table like this is presented, because it does become a pick-and-choose what you want sort of a thing, but, as of where we are now, I think this is all we can do.

JORGE GARCIA-SAIS: Richard, I don't see the entire table here. Can you scroll it a little bit to the right?

DOUGLAS GREGORY: While the table is scrolling, I think Adyan might have mentioned this, but it's confusing to me where all the column titles have "Avg_0.5", even for the two where the landings were not reduced by half, and we've got a 0.5 for sigma, and we've got 0.5 for landings reduction, and so that needs to be separated out and made more clear, and I am just stating the obvious. Sorry.

ADYAN RIOS: No worries, and I understand that the labeling here could have been more clear, and I do apologize for that.

RICHARD APPELDOORN: The other thing is that I don't know how the best way to go about this, and maybe, again, Jocelyn can give some guidance, but this would essentially fix our recommendations for ABC, and is it possible for us to not show this to the council before they pick a P* value?

JOCELYN D'AMBROSIO: I think that you could say that you have the scientific uncertainty estimates and are prepared to recommend ABCs at the P* within that particular range and not show this table, but I think, either Shannon or Adyan, are you aware -- Did the council already ask for this anyway?

I know they wanted different projections, and they wanted different information in setting their risk policy, and so they might already have actually kind of wanted to see the outcomes of the ABC at various risk policies with different assumptions about scientific uncertainty, and so they're already sort of looking for the outcome, but, with respect to what you would show, you could not -- You could say, well, we have recommendations at this information and not show this, but my only point is I think they might have actually asked for this.

SHANNON CALAY: Yes, I can confirm that, Jocelyn. They did ask for this.

KEVIN MCCARTHY: To be clear, this whole table is not being provided. It's this OFL column and then the next two columns, correct, but you're going to fill out the between 0.45 and 0.40, and so, after that, the average 0.5 OFL, that column and everything to the right will not be in the -- Because that's a different run, and so that's not going to be included, because we've already decided on the run to the left.

SHANNON CALAY: That's correct. Only the run that the SSC based its decisions on, and I think the sigma value is SSC prerogative, and so, really, it's just the OFL and the P* values that the council specifically asked for, and the range that they specified was 0.4 to 0.45.

RICHARD APPELDOORN: What I have, just to recap, is that we are going -- Number one, we're going with the three-year average of the most recent landings for the projections, and we will then generate this table of ABCs, based on the range of P* values, and that this includes a recommendation to the council that a new analysis be done as soon as possible when the 2020 data are available, due to the sector inputs showing a potential significant decline in landings due to the pandemic. Any modifications or additions to that that we should consider? If not, Graciela, do we need to write up something on that, so we're all looking at exact wording?

GRACIELA GARCIA-MOLINER: I was typing away, and let me see if this is -- Let me share my screen. Hold on a second.

RICHARD APPELDOORN: Can we modify the first paragraph there?

GRACIELA GARCIA-MOLINER: Certainly.

RICHARD APPELDOORN: I would say the SSC agrees to use the three-year average of the most recent landings to project -- Should we call it potential ABCs or projected -- Adyan, are we projecting OFLs, actually?

ADYAN RIOS: Yes.

RICHARD APPELDOORN: Yes, and so OFLs.

GRACIELA GARCIA-MOLINER: For spiny lobster.

RICHARD APPELDOORN: For spiny lobster, yes.

GRACIELA GARCIA-MOLINER: For each, right?

RICHARD APPELDOORN: Yes, each platform. Using those OFLs, the SSC presents, or will present, a table of ABCs over the range of P* values provided by the council, and then you could put that 0.45 to 0.4. I think it's not as soon as possible, but, I mean, we're going to use that, but it's updated projections for spiny lobster for all three islands, to include the 2020 data, as soon as possible. That captures what I was thinking. Is that good for the rest of the committee?

KEVIN MCCARTHY: I think we don't want to limit the notion that we're going to update 2020 data. Recall that 2019 data are currently preliminary. What was used for the projections that Adyan just ran, those 2019 data were not final, and so we may want to indicate that those will be the final 2019 data, at that point.

RICHARD APPELDOORN: Well, the question here though is 2020, and I'm presuming that, once we have 2020, we will also have 2019, and so it's the 2020 data that we're worried about the landings being substantially below projection.

KEVIN MCCARTHY: Agreed, but a number of folks were concerned about the 2019 Puerto Rico landings, and so whether or not we need to address that specifically, and it doesn't matter to me one way or the other, but I'm just trying to be thorough.

RICHARD APPELDOORN: Well, my feeling is that it's the default condition of working with the 2020 data, is that we will have the 2019 final data, but I'm happy to leave it in.

JORGE GARCIA-SAIS: Richard, I suggest, in parentheses, that we insert what the three-year average is, what are the three years that we're talking about here, in the first sentence.

RICHARD APPELDOORN: Graciela, you might actually want to have that not inserted into that, but into a second sentence of that or a colon or something like that, since they're going to be different for Puerto and the Virgin Islands, and so, if you just put like a colon, then you can say PR 2017, 2018, and 2019. The Virgin Islands is one year back. I think you can just say "St. Thomas/St. Croix", so you don't have to duplicate, but as you wish.

GRACIELA GARCIA-MOLINER: Okay.

RICHARD APPELDOORN: Go ahead, Sarah.

SARAH STEPHENSON: I have a question about this sentence and what data gets used to actually make the projections. Is it just the three-year average, or is it the entire time series, and you're

using the three-year average to estimate 2020, and I guess that's for Adyan.

ADYAN RIOS: For Puerto Rico?

SARAH STEPHENSON: It would be I guess for all three islands. When you do the projections, do you just look at the years listed here on the screen, 2017 through 2019 for Puerto Rico, or do you use the entire time series, like you showed in the graphs, which starts much earlier than that and would go through 2019, and then, for 2020, you would use the three-year average of 2017, 2018, and 2019 to fill in landings for that for 2020, and does that make sense?

ADYAN RIOS: Yes, and so the full time series of final landings values, those are through 2018.

SARAH STEPHENSON: So then should the sentence say the SSC agrees to update the projections -- Something along those lines, that you're not just using the last three years, but you're using everything, but you're updating the data from the previous projections, which that terminal year was 2016.

ADYAN RIOS: Yes, I think it could be more specific, to point out that the SSC agrees to use the three-year average of the most recent landings to project potential OFLs for spiny lobster for each island platform. Technically, these years are called forecast years in the SS program, and we've got the data input years and the forecast years that start in 2017, after the terminal year, and I don't know if that's a terminology that would be helpful here.

RICHARD APPELDOORN: After "landings", could we say as to obtain forecast years estimated landings?

ADYAN RIOS: We could say that and say that through the most current year available.

RICHARD APPELDOORN: So, Graciela, it's "through the most current year available", after "landings".

GRACIELA GARCIA-MOLINER: Richard, can you repeat that, please?

RICHARD APPELDOORN: Well, it was Adyan's words, and now I've forgotten them.

KEVIN MCCARTHY: Are we not saying we were using the three-year average to estimate 2020 landings? I think, if I understand Sarah correctly, the way it was written had it appear that we only used

three years of data to make the projections, and I think what was done was use those three years to estimate what 2020 landings might be.

RICHARD APPELDOORN: We could say, to make this simpler, to use the three-year average of the most recent landings to estimate landings for 2020 in Puerto Rico and 2019 and 2020 for the Virgin Islands. Before "PR", I would put a parentheses and after "2019-2020", and I would like to add, after "potential", "future OFLs", so we know that we're talking about forecasting into the future.

JOCELYN D'AMBROSIO: I think this paragraph is where you want to include updating the 2019 information that was put in the last paragraph, because the last paragraph was talking about the data changing from the pandemic, and obviously that's a 2020 issue, and I think what Kevin was mentioning earlier about 2019 data is that there was some question about 2019 data in Puerto Rico for the expansion factors, and I think it's only through the September -- We're not using it in the USVI, and so, to the extent you had it at that point, you could update those three-year averages, and you could actually use 2019 data, for example, and then use three years, through 2020, in the USVI.

RICHARD APPELDOORN: Well, I understand what you were saying, but I'm not understanding where you were putting it. Would this comment not stay down at the bottom?

KEVIN MCCARTHY: Isn't this first section what was done and what we agreed was a reasonable approach?

RICHARD APPELDOORN: Yes.

KEVIN MCCARTHY: The last one is how we would like to see an update when the data are available. That's my understanding.

JOCELYN D'AMBROSIO: I think it should be a different sentence though. Based on the sentence, it's like 2020 is going to be different from the pandemic, and so you want to update 2020 as soon as possible and then explain whatever issue you had in 2019 and that that should be updated as well.

RICHARD APPELDOORN: We could have a separate sentence there that would also allow for the use of the final version of the PR 2019 data.

KEVIN MCCARTHY: I think that's also true of the Virgin Islands.

RICHARD APPELDOORN: Yes, but there's more coming in the sentence.

KEVIN MCCARTHY: Okay.

RICHARD APPELDOORN: The use of the final 2019 PR data, due to questions concerning the calculation of the correction factor for that year, or the availability of a correction factor, and I don't know what the exact -- Does that seem --

GRACIELA GARCIA-MOLINER: You need the year for the U.S. Virgin Islands for the final --

RICHARD APPELDOORN: Yes, but there's not a correction factor problem with the Virgin Islands. This is unique to Puerto Rico. How does that look now?

JORGE GARCIA-SAIS: It's okay with me, Richard.

RICHARD APPELDOORN: So, Adyan, you had typed something in the box here that doesn't, I think, go with what we've written, and so, for Puerto Rico, you used -- We did use 2017, 2018, and 2019, but, in St. Thomas, St. John, and St. Croix, landings are complete through 2018, and 2019 data include records through September. It's the same. Sorry. I was just reading it wrong, and so we're good.

I am assuming we're going to have that table before this meeting ends, and so that statement is good for today, but it would not be a valid statement at the end of the meeting, because we'll already have the table.

GRACIELA GARCIA-MOLINER: I will remember to change it when it comes.

RICHARD APPELDOORN: Okay. Given that, and I'm not hearing any more comments or opposition on this, and I would say that's the state of our recommendations, coupled with the decisions that were recorded for yesterday, and we'll await the final table from Adyan, but this is essentially going to conclude the SEDAR discussion.

It's now 4:36, and I am thinking that this might be a good place to break for the day, because I think we're going to have -- What we're going to do is get started on the next box before we're going to be shutting down and have to kind of restart again, the next sub-model, and so my recommendation is to end for the day and --

GRACIELA GARCIA-MOLINER: You have Adyan asking for a turn to speak.

RICHARD APPELDOORN: Go ahead, Adyan.

SHANNON CALAY: I think Adyan was concerned about the term "recent landings", or "most recent landings", and she thought it was vague in the first sentence, and I think what she was going to say is that we provide you with a more detailed explanation for the report, and you can simply refer to that with a footnote, or she can speak for herself, now that she has found her voice.

ADYAN RIOS: Thank you. I found it. Yes, because "most recent landings", for Puerto Rico, it just refers to the near complete approved landings -- If the landings are indeed final, or semi-final, but the data providers, and we had that discussion earlier, as part of the -- I can't recall exactly what part, but "the most recent landings" are vague, in saying that we also have recent landings, and perhaps it needs to say "complete years of recent landings", and that's what I mean to say, but I think that I can provide an explanation that could be used as a footnote.

RICHARD APPELDOORN: All right. I am suggesting that, since we actually list those at the end of this statement, why don't we just move that into the parentheses, where you say to include Adyan's footnote.

GRACIELA GARCIA-MOLINER: She is going to send you something.

RICHARD APPELDOORN: Yes, I understand, but the actual values, the PR 2017, 2018, and 2019, put those right when we say the most recent landings, and so that's what we're talking about. Then you can put an asterisk at the end of that parenthetical thing, and that will refer to the footnote that Adyan will provide wording for, and so an asterisk and then parentheses.

ADYAN RIOS: In short, my footnote is the start of my statement here, where this points out the Puerto Rico is 99 percent complete, but that's okay. I will work on it and share it.

RICHARD APPELDOORN: Okay, and so, Graciela, you might, at the bottom someplace, put the asterisk and put "wording to be provided by Adyan". Okay. Any other pending things? We have already lost two committee members.

GRACIELA GARCIA-MOLINER: A couple of things. You are meeting tomorrow at 10:00. Do you want to change that time? Probably not.

RICHARD APPELDOORN: I don't, no.

GRACIELA GARCIA-MOLINER: Okay, and so tomorrow at 10:00, and you will begin with the second of the sub-models, and then everything else on the agenda down to the next day, and so we'll do that tomorrow morning.

RICHARD APPELDOORN: We've already modified the agenda that we are going to continue through Wednesday afternoon.

GRACIELA GARCIA-MOLINER: Perfect. I don't have any more housekeeping items. Thank you very much for everything. To the Science Center, thanks.

RICHARD APPELDOORN: Thank you, all, and we'll see you all, or hear you all, at 10:00 tomorrow.

(Whereupon, the meeting recessed on May 19, 2020.)

\- - -

May 20, 2020

WEDNESDAY MORNING SESSION

\- - -

The Scientific and Statistical Committee of the Caribbean Fishery Management Council reconvened via webinar on Wednesday morning, May 20, 2020, and was called to order by Chairman Richard Appeldoorn.

RICHARD APPELDOORN: Good morning, everybody. This is Wednesday, May 20, and this is the Caribbean SSC meeting. again, we'll start with a voice roll call with the SSC. Joe Kimmel.

JOE KIMMEL: This is Joe Kimmel, SSC member.

RICHARD APPELDOORN: Churchill Grimes.

CHURCHILL GRIMES: Churchill Grimes, SSC, present.

RICHARD APPELDOORN: Doug Gregory.

DOUGLAS GREGORY: Doug Gregory, SSC.

RICHARD APPELDOORN: Reni.

JORGE GARCIA-SAIS: Reni Garcia, SSC. Good morning.

RICHARD APPELDOORN: Walter.

WALTER KEITHLY: Good morning. Walter Keithly, SSC.

RICHARD APPELDOORN: Kevin.

KEVIN MCCARTHY: Good morning. Kevin McCarthy, SSC.

RICHARD APPELDOORN: Tarsila.

TARSILA SEARA: Hi, everyone. Tarsila Seara, SSC.

RICHARD APPELDOORN: J.J.

JUAN CRUZ-MOTTA: Good morning. J.J. Cruz, SSC.

RICHARD APPELDOORN: Jason Cope.

JASON COPE: Jason Cope, SSC. Good morning.

RICHARD APPELDOORN: Okay. I believe that's everybody on the SSC. For others, Liajay.

LIAJAY RIVERA: Buenos dias. Liajay Rivera, council staff.

RICHARD APPELDOORN: Graciela.

GRACIELA GARCIA-MOLINER: Good morning. Graciela, council staff.

RICHARD APPELDOORN: Bill Cordero.

BILL CORDERO: Bill Cordero, trusty language interpreter. Good morning, everyone.

RICHARD APPELDOORN: Carlos Farchette.

CARLOS FARCHETTE: Carlos Farchette, council member. Good morning to all.

RICHARD APPELDOORN: Bill Arnold.

BILL ARNOLD: Bill Arnold, EBFM TAP Chair. Good morning, everybody. I hope you're doing well.

RICHARD APPELDOORN: Alida Ortiz.

ALIDA ORTIZ: Buenos dias. Alida Ortiz, Outreach and Education Advisory Panel.

RICHARD APPELDOORN: Michelle Scharer.

MICHELLE SCHARER: Michelle Scharer, independent contractor.

RICHARD APPELDOORN: Nelson Crespo.

NELSON CRESPO: Good morning. Nelson Crespo, DAP Chair, Puerto Rico.

RICHARD APPELDOORN: Orian Tzadik.

ORIAN TZADIK: Good morning, everyone. Orian Tzadik, Pew Charitable Trusts.

RICHARD APPELDOORN: Ricardo Lopez.

RICARDO LOPEZ: Good morning, colleagues. Ricardo Lopez from the Puerto Rico Department of Natural and Environmental Resources, Fishery Research Lab.

RICHARD APPELDOORN: Christina Olan.

CHRISTINA OLAN: Buenos dias. Christina Olan, council staff.

RICHARD APPELDOORN: Maria Lopez.

MARIA LOPEZ: Good morning. Maria Lopez, NOAA Fisheries.

BRACKEN HOLKMAN: Bracken Holkman, interpreter.

RICHARD APPELDOORN: Alexis Sabine.

ALEXIS SABINE: Good morning. Alexis Sabine, USVI Department of Planning and Natural Resources, Division of Fish and Wildlife.

RICHARD APPELDOORN: Okay. Mandy Karnauskas.

MANDY KARNAUSKAS: Hi. Mandy Karnauskas, Southeast Fisheries Science Center.

RICHARD APPELDOORN: Miguel Rolon.

MIGUEL ROLON: Good morning. Miguel Rolon, council staff.

RICHARD APPELDOORN: Michelle Duval.

MICHELLE DUVAL: Good morning. Michelle Duval, independent

contractor for the council's strategic plan.

RICHARD APPELDOORN: Adyan Rios.

ADYAN RIOS: Adyan Rios, Southeast Fisheries Science Center.

RICHARD APPELDOORN: Sarah Stephenson.

SARAH STEPHENSON: Good morning. Sarah Stephenson, NOAA Fisheries.

RICHARD APPELDOORN: Jocelyn D'Ambrosio.

JOCELYN D'AMBROSIO: Jocelyn D'Ambrosio, NOAA Office of General Counsel.

RICHARD APPELDOORN: Marcos Hanke.

MARCOS HANKE: Marcos Hanke, Caribbean Fishery Management Council Chair. Good morning, everyone.

RICHARD APPELDOORN: Good morning. Skyler Sagarese.

SKYLER SAGARESE: Skyler Sagarese, Southeast Fisheries Science Center.

RICHARD APPELDOORN: Then we have Caller Number 1.

JULIAN MAGRAS: Julian Magras, St. Thomas/St. John DAP Chair.

RICHARD APPELDOORN: All right. Thank you, Julian. Caller Number 3.

MIGUEL ROLON: I believe that's Kevin.

RICHARD APPELDOORN: Okay. Kevin, are you on the phone?

KEVIN MCCARTHY: I am on the phone. Yes, that's probably me.

RICHARD APPELDOORN: That is you. Okay. Then Caller Number 2.

TONY BLANCHARD: I guess I would be Caller Number 2. Tony Blanchard.

RICHARD APPELDOORN: Good morning, Tony. Thank you, everybody. The first thing is to look at the agenda for today, and if you could scroll up, as far up as you can. It's basically continuing through the -- Working through the sub-models of the ecosystem component model, and that would continue working down the list

that Liajay is highlighting there above. Graciela, you were saying that habitat is going to be moved down?

GRACIELA GARCIA-MOLINER: No, and I was saying is to edit the agenda like that, and so continue discussion, but just amending the agenda, so that we can keep track of the days that things happen. That was my only comment, but you can change the order too, if you so think that you should do.

RICHARD APPELDOORN: So far, I think we're okay. I know you were having discussion about some difficulties in presentations, but I doubt we're going to get to that today, since that's second-to-last, but we'll see how it goes, and I think you kind of solved some of the problems there.

GRACIELA GARCIA-MOLINER: The only thing is that Vance emailed you that -- I don't know if he's present, and I don't think he's present right now, and so he's water quality, and so he will come back after lunch.

RICHARD APPELDOORN: Yes, or maybe late morning, but most likely lunch, and so we'll probably have to move water quality down, but let's just -- Can we just leave it where it is and deal with that at the time?

GRACIELA GARCIA-MOLINER: Yes.

RICHARD APPELDOORN: Okay.

GRACIELA GARCIA-MOLINER: But you're just letting everyone know, everyone who is listening, that that might happen, and so that's good.

RICHARD APPELDOORN: Okay. I will start off by saying there were some emails going around, mostly prompted by Michelle Scharer, about the definition of highly migratory species in the marine ecosystem component, and so, at some point, I would like to get back to that, but, right now, I would like to leave things where they are, so we can kind of move forward on this, and all of this is going to be revisited again when we start looking at the connections between the sub-models, and we can look at that, but the question revolved around what is the Magnuson definition of highly migratory species.

What Jocelyn had posted in the chat yesterday had the language that it included, quote, oceanic sharks, unquote, and so is that really including things like nurse sharks and whatever, which is the question that Michelle had brought to the group, and so that's

kind of something that we'll come back to, but keep it in mind. The next sub-model is habitat, and I think, Doug, you were dealing with that one.

DOUGLAS GREGORY: Yes.

WALTER KEITHLY: Mr. Chairman, before we start that, could we go back to the discussion yesterday regarding spiny lobster just for a moment? I want to bring up one point, which I don't want to have any relitigation of the 2019 landings, but just something that National Marine Fisheries Service may want to do before the council meeting.

RICHARD APPELDOORN: Go ahead, Walter, and let's get that out of the way before we --

WALTER KEITHLY: Specifically, if everybody -- Some of you may recall that we deleted the 2005 data throughout Puerto Rico for all the species, because all of them appeared to be very high for that year. Now, the discussion yesterday about the 2019 provisional data for spiny lobster is that it may be the expansion factor.

While I don't want to, again, relitigate the issue at this meeting, I think it may behoove the Science Center to look at the other species and their landings in 2019 and see if they're also systematically high for the year. If they are in fact high, it then may indicate that there is a problem with using the 2018 expansion factor for 2019. Thank you, Mr. Chairman.

RICHARD APPELDOORN: Thank you, Walter, for that comment. That is, I think, very sound advice. I don't know if -- Kevin, I guess you would be the first person that would fall by, and so do you have a comment to that, or please keep your eyes open for that.

KEVIN MCCARTHY: 2018 correction factors were only used as a temporary placeholder, because the 2019 correction factors are not yet available, and so, as soon as those 2019 factors are available, we'll switch to those, but, yes, it was for -- That was the information we had at the time, and so we'll update those, once they're available, and I know that Daniel Matos and other staff in Puerto Rico are working on those now, entering those data and calculating the factors.

RICHARD APPELDOORN: Okay, but I think Walter's point was that it would be interesting to plot out a couple of other species and see if they're also spiking, to show was this a correction factor issue, or was it lobster in particular that was having a really

good year, shall we say.

WALTER KEITHLY: Yes, Mr. Chairman. That was what I was getting at. It was my understanding, from the discussion yesterday, and, Kevin, correct me if I'm wrong, that you would not have the expansion, the 2019 expansion factor, ready by the council meeting.

Now, if you have it ready by the council meeting, then this becomes a moot issue, but, if the 2019 expansion factors are not ready by the council meeting, I think it would be due diligence on your part to look at the other fisheries, all the other species, to see if there were systematically very high landings for 2019 too. It puts the council in a bind on what to do at that stage, but I think it would be due diligence on the part of the Science Center. Thank you.

KEVIN MCCARTHY: Right. That's good advice, I think.

RICHARD APPELDOORN: Of course, we're already on record as recommending to the council that the actual ABC, et cetera, recommendations ought to be recalculated once the 2020 data are available, and so even what they were going to be looking at at the next council meeting is going to be somewhat approximate, based on having those better data available at the time when these things are going to be closer to implementation.

JORGE GARCIA-SAIS: Richard, I believe that not only should they look at other species, but look at the effort, because, if there was a -- Again, these socioeconomic aspects come up every single time, and it's that, if there has been an increase in demand, it might be related to an increase in effort, and then most of the species would increase. It's not a matter of, if one thing increases, everything increases. If the socioeconomic demand for fish increases, fishing effort tends to increase, and, thereby, you would expect all species to increase, and so that has to be looked at, too.

RICHARD APPELDOORN: Okay. Good point. With those comments then, I think we can move forward now to get back to the ecosystem conceptual model, and I will turn it over to -- Hopefully Doug can lead us through some conversation on the habitat sub-model.

PRESENTATIONS ON EACH COMPONENT FOLLOWED BY DISCUSSION
HABITAT (16:35)

DOUGLAS GREGORY: Going back to the ecosystem, I thought, in my mind, that I was waiting until the end to ask about sharks, because I didn't see sharks and where they would be located, but we can go

back to that later.

These are the boxes that we discussed in October, at a previous meeting, and the numbers are the numbers that were in the spreadsheet. Habitat was one of the first items to be discussed at the last meeting, and so we talked about the various components very extensively.

What I'm suggesting as a change here is including sargassum as a pelagic habitat, since it seemed like our discussion identified it both as a habitat and then later as an algal bloom, and it could be handled in both places, to avoid confusion, and I suggest removing the label of "benthic essential fish habitats", because all but one of the habitats is benthic, and, the way it was pictured, it implied that other habitats were not benthic, and I think we could re-label this slide as "essential fish habitat", because, in my mind, they're all essential.

Now, the way I've labeled this was different than what J.J. did. At the base of each arrow is the strength of the arrow, and so, where you have a one, you also have a dashed line, and so I'm trying to detect the strength of the interconnection in two different ways, one with the number and the other with the line type, and so a regular line is number two, and a what you might call bolded line, or a heavier line, is a number-three connection.

Down in other habitats, you will see a one, comma, one, and I thought it was just easier to start two arrows in the same place that had the same number and let them go in that regard. Are there any questions about how this reads?

RICHARD APPELDOORN: Only to note that at, the one, comma, one, the line that goes up doesn't have an arrowhead, and so which way is it going, from mangroves to pelagic?

DOUGLAS GREGORY: The arrowhead got hidden behind the pelagic box, and so, if we move the pelagic box, or we could move the line back towards mangroves, and the arrow will appear. In order to get these arrows in a way that was not confusing, I enlarged all the boxes, as you can see. That way, I had some separation between the arrows.

Now, as this was extensively discussed at the previous meeting, I would suggest that then, if we want to reevaluate these connections, that would be a good way to go. My thought was, or suggestion, is that, the arrow between mangroves and seagrass, we have a two, and that implies a positive interaction.

My thoughts with this, and we did talk about it a little bit in October, was that seagrasses trap sediment and build up the bottom, so that mangrove seedlings can take root, and, once mangroves start growing, they displace seagrass, and so I don't know if that should be a positive-two or a weaker-one, or even a negative-one, going from mangroves to seagrass, and we might want a stronger number going from seagrass to mangroves.

RICHARD APPELDOORN: Before we even get there, I am trying to think back to our last discussion on this, and I don't think that we were talking about the direction in the sense of positive or negative relationships, and so the sign was never considered when we were putting in the values, and I don't know if that's how we're going to discuss this. Was that your impression?

DOUGLAS GREGORY: My impression is that we discussed having negative values, but, when we discussed habitat, I don't know if we considered negative values. There was some confusion at the previous meeting.

RICHARD APPELDOORN: I thought we had started -- We didn't start thinking about positive or negative until we were into some of the other models, and so I don't remember whether all the connections here are in fact positive or we just weren't considering the sign before.

GRACIELA GARCIA-MOLINER: Richard, you have J.J. who wants to speak.

RICHARD APPELDOORN: Go ahead, J.J.

JUAN CRUZ-MOTTA: From my recollection, we said that there is an interdependence among most of these boxes, and there is a relationship that says it's two, but then it will be hard to say positive or negative, and, by definition, if they are dependent on each other, I would say we just put a strength and that's it, but that's where I might be wrong.

DOUGLAS GREGORY: Anything else?

RICHARD APPELDOORN: No. Go ahead and proceed, Doug.

DOUGLAS GREGORY: Well, this is basically my presentation, and this is a very simple sub-model, and I don't envy those of you all who have more complicated sub-models. The question is do we want to change any of the linkages or magnitudes?

RICHARD APPELDOORN: The only one that you were looking at that

you were questioning was the mangrove to seagrass strength?

DOUGLAS GREGORY: Correct.

ALIDA ORTIZ: Can I ask a question?

RICHARD APPELDOORN: Go ahead, Alida.

ALIDA ORTIZ: When you have, in the lower box, corals, should that be coral reefs, because corals is not the only organism, species, in that habitat. We are used to using mangrove for mangrove forest and seagrass beds and the pelagics, but, when we say "corals", you might be talking about one type of coral, the hard corals or the soft corals, but then it's such a huge community that I think it should be coral reef. Thanks.

RICHARD APPELDOORN: I think, and the rest of the committee can correct me, having not gone back to the dialogue that we had on this previous discussion, but we were largely thinking corals here, the hard corals that are reef building, and then you could think of say sponge bottoms and things like that as one of many other habitats, rocky shorelines and things like that, and we were just trying to keep this to the major components, and I think corals is, in a sense, the dominant reef-building structure providing organisms, but your point is well taken that there are other things on a coral reef, and sponges probably being structurally, as far as fish are concerned, very important as well. I am getting lots of comments here.

DOUGLAS GREGORY: In my mind, that was implied, but I would have no problem labeling that as coral reefs and maybe labeling mangroves as mangrove forests and seagrass as seagrass beds. That kind of identifies the communities, rather than just the species.

JUAN CRUZ-MOTTA: I would agree with that suggestion.

RICHARD APPELDOORN: Graciela posted in the chat that, essentially, that is in fact what we were talking about, coral as a structural habitat and organisms associated with that.

GRACIELA GARCIA-MOLINER: Do you want to go ahead and make the changes in the boxes, and so seagrass beds, mangrove forests, coral reefs?

DOUGLAS GREGORY: Yes, if there's no objections, and there was a chat asking about why would ocean pelagic non-sargassum habitat be in other habitats, and would it be in other habitats? What I should have done is put "sargassum" in parentheses, as far as

discussion, but I think pelagic habitat is for all habitats.

Our discussion of other habitats involved consolidated sediment, beaches, sand, hardbottom that was not coral, and so the other habitats was discussed in our previous meeting as a benthic habitat, and I think we did discuss sub-units of pelagic habitats, but I think most of those fell out into the water quality category. If anybody wants to identify specific pelagic habitats, like we've done with the benthic habitats, that would be okay with me.

RICHARD APPELDOORN: I would like to keep it simple. Orian posted a reminder from our discussion at the last meeting that the mangrove to seagrass connection was given a two because of the role of mangroves and their nursery function for reef fishes then feeding into seagrass beds, where a lot of the feeding goes on for those fish that are residing in the mangroves.

A lot of this connectivity has to do with not, per se, the habitats themselves, but the things that are using those habitats and how they are connecting, although that is in the form of the movement of fishes, for example, but we also have important flows in terms of say dissolved organic matter coming out of seagrass and going to coral habitats, for example, which is one of the things that contributes to that value of three connecting those two boxes.

Ricardo Lopez is asking about sargassum and what happens when it hits the shoreline and bottom, and I think we had substantial discussion on that at the last meeting, and I am not sure it actually came to any conclusion. Sargassum is its kind of own habitat in a pelagic realm, and then, when it hits the coast, all kinds of other stuff happens, and I'm not sure if we want to look at that, but, obviously, you would get some negative interactions, certainly, there, in terms of smothering effects, hydrogen sulfide production, et cetera.

JORGE GARCIA-SAIS: It will have a direct interaction with water quality.

DOUGLAS GREGORY: We discussed this at length at the previous meeting, and I thought we had decided that that would be handled under algal blooms, as a negative impact.

RICHARD APPELDOORN: Right, so that then will link into the water quality sub-model, to handle that issue.

DOUGLAS GREGORY: We have a question about deepwater habitats, where there are little corals, very little coral, and I guess that is subsumed under other habitats, which we may need to specify a

bit better.

JORGE GARCIA-SAIS: Very little corals is going to depend on how deep. How deep is deep?

DOUGLAS GREGORY: Well, the question here was the deepwater snapper and grouper habitats.

RICHARD APPELDOORN: So that's very deep.

JORGE GARCIA-SAIS: That is deep, and so there is corals down there. There is a lot of coral, and so I don't know if you want to expand the -- That's a question that I was about to ask, if this was a neritic perspective or we are going down the slope for all of these things, and so it's an important consideration. It hit me also when I was doing the land-based, because most of these sewage outfalls are actually on the slope, upper slope.

RICHARD APPELDOORN: I think we're talking say mesophotic areas, where we have still a fair amount of zooxanthellate corals, this is covered in the thinking here, and so that's just an extension of the shallow coral environment, albeit with different species, as you go deeper. When you get down to the serious deep snapper grouper areas, then you are largely talking fairly steep slopes, unless you're getting way out on the platforms, and, there, you're going to be dealing with the non-zooxanthellate corals, and that's a whole different thing, and we could just put that in other habitats.

This would get very complicated if we start breaking out other habitats, and, given the explosion of boxes perhaps we had in some of our later sub-models, do we really want to have to deal with that degree of complexity, or should we be trying to kind of hold the line, so we can get through all of this?

GRACIELA GARCIA-MOLINER: Richard, do you want to include -- I just sent you in the chat what you had included in the other habitats, and so algal flats, coral rubble, beaches. I mean, you can go down the line and include regolith reef and mesophotic, and so include depth in the definition of other habitats, or, as you said in the beginning, under coral reef, then the definition of changes by depth of the communities would be included under your coral reef identification of communities.

The change you suggested was to include coral reef instead of corals in that box at the bottom on the left-hand side, and it would be defined as the identification of the communities associated with that coral reef, and that would change depending

on depth. It would be part of that box.

RICHARD APPELDOORN: That is certainly my thinking on that, that coral reef is a coral reef, and depth is just another factor telling you what species are there, but it's still coral reef, and so the fishes are responding very similar to those deeper reefs as they do to the shallower reefs.

JORGE GARCIA-SAIS: Certainly, from my perspective, what's going to happen is that, for example, the interactions with seagrass and corals will vary with depth. There is going to be a stronger seagrass-coral reef interaction within the neritic zone than the interaction that you would expect between seagrass and slope communities down the slope, and so the interaction between seagrass and the coral reef impact is strengthened by the fact that seagrass areas, seagrass habitats, are recruitment and nursery habitats, and so coral reef fishes and invertebrates and so on, and, as the species assemblages change with depth, with increasing depth, that interaction is going to weaken as you go deeper, to the point that it will disappear at some point. I mean, there is always some kind of trace inputs, but they will vary significantly across depth.

RICHARD APPELDOORN: Well, to some degree, but there's a substantial proportion of say mesophotic fishes that are still dependent on shallow-water habitats for their nursery stages, and a lot of them are migrating out, and so there's going to be potential link between say shallow reefs, the species on shallow reefs, and the species in deeper areas, due to a lot of predation activity.

There is a lot of internal feedbacks, circles, coming into and back out of coral reefs that would accommodate that, and I don't think it requires any changes into the nature of the boxes here.

JUAN CRUZ-MOTTA: I totally get that, what Richard is saying, that we don't want to start overcomplicating the models, the sub-models. However, taking into consideration a few of the comments, some of the comments, that have been made so far, I am wondering whether that other habitat should be split at least in terms of like benthic versus pelagic or soft bottom and hard bottom and pelagic.

This is just something that I would like to submit for your consideration, and I don't know what is the opinion of the rest of the group on this. Doug, have you thought about this, about splitting this box a little bit further, when you were doing the exercise, or did you think it would be okay just to leave it like it is? Thank you.

DOUGLAS GREGORY: When I was doing the exercise, that consideration didn't come to me. It wasn't until Michelle asked a question about the deeper habitats. Now, we could -- We did, in our discussion in the minutes of our meeting, and Graciela pointed it out, identify some other habitats.

I see no problem with, in the discussion or supporting documentation, identifying deepwater habitats as part of the other habitats, but I think we were trying, at the time, to identify the major components, the seagrass, the mangrove, the corals, and the sargassum, and then everything else was just kind of lumped together, and I think that's a good way to go now. We have a lot in front of us to do this week, and we can always come back and revisit these items.

JUAN CRUZ-MOTTA: Thank you.

TARSILA SEARA: I just wanted to make a comment, or perhaps a suggestion. Maybe, when we begin to connect this sub-model to some of the other sub-models, these boxes may become a little bit more -- We might be able to split these boxes into other types of habitats, depending on those connections, and that's just a thought.

RICHARD APPELDOORN: I was going to say -- I lost my audio connection for a little bit, but, generally, speaking to J.J.'s idea, the thought about splitting up a box ought to come with I think we need to split this habitat from the other habitat, and so I don't think -- If you're not sure whether something -- If you don't have a concrete proposal about how to split the other habitats and why that's important, then it's not really a question to raise.

I do think Graciela's point is worth considering, that we should perhaps make a more expansive list about what's included in other habitats, and while still indicating that that might not be totally inclusive, and so what was in there before was algal flats, coral rubble, beaches, and you can look at rocky shorelines, and I'm not really sure all the ones we want to bring into, but --

GRACIELA GARCIA-MOLINER: In this one, we can add all the habitats as they have been described in our essential fish habitat, for example. I mean, there are twenty-six categories, or something like that, and so we can be all-inclusive, and, whatever is not in the other four boxes, we can put under habitats.

They will become important, depending on the group of species that

you are looking at, and then you can start bringing those out when you start making the interconnections. We can put, under other habitats, everything that we have, the muddy bottoms and the sandy bottoms and all the other categories that we have in EFH, if that's agreeable with you.

RICHARD APPELDOORN: Well, we can look at that list, but I think some of those things are actually going to fall into some of the boxes, and maybe not algal flats. It's already in other habitats, and that is, obviously, an unconsolidated sediment, but it's just a colonized one, but things like colonized pavement I would consider coral reef, and so we would have to take a look at that list and then see which ones would fall under other. Is that a list that you happen to have handy?

GRACIELA GARCIA-MOLINER: I am going to go look for it. Do you want to continue discussion while I look for it? I might have to access the server.

RICHARD APPELDOORN: Okay. That would basically, I think at this point, take us out of this sub-model and into whatever the one after water quality is, since I don't think Vance is back online yet. Maybe the way to go is to go to the next sub-model, which I think is fishing, and, Jason, I think you were working on that, and we will address the total list of essential habitats and how those partition out to our boxes when Graciela gets that list, and how does that sound?

JASON COPE: That's fine with me. This is one of the sub-models where we don't have any of the -- We have connections, and we have boxes, but we don't have any of the magnitudes, and so, if I'm the one doing that, should I be filling that out, or is it easier if someone else is kind of in control of that? I just wanted to sort that out before we get into this.

RICHARD APPELDOORN: That's up to you. My personal take is I like somebody else doing the work, but other people like to be able to be more hands-on, and so --

JASON COPE: I was going to say that, whoever is going to run the -- Well, they have a PowerPoint, and so I guess I should do it. Maybe I should just do it. That might be easiest.

RICHARD APPELDOORN: Then somebody needs to make you the presenter.

JASON COPE: I am in full admittance as well that it's seven-something in the morning, and I'm still making breakfast for my kids, and so I will be finishing off these muffins for them while

we talk about this, but I think I can do it.

RICHARD APPELDOORN: We are willing to give you a little extra time and go to someone else first, if that's going to be a problem for you.

JASON COPE: Well, if someone else is ready, go for it. That would bide me the half-hour I need to make sure the eggs aren't burned and so forth, but I'm also happy to do this, and so, if anyone else is ready to step up, and we can ask that question. If not, we can get into this.

RICHARD APPELDOORN: Well, I would point out that this is a lot simpler than the next one.

JASON COPE: What are the remaining ones?

RICHARD APPELDOORN: The next one would be land-based sources, which would be Reni.

LAND-BASED USES (52:25)

JORGE GARCIA-SAIS: Okay. I sent Graciela the original version of what was for land-based and some revised or proposed -- A little bit more-detailed model, and so maybe Graciela wants to put it up. Starting from the first one, from the basic one, and, for that, I have the numbers in the Excel chart, the directions and the magnitudes, or, if you want to consider the one that I have been looking at more recently and want to work on that, and so it's up for comments.

GRACIELA GARCIA-MOLINER: Liajay, do you have Reni's presentation, or do you want me to put it up?

LIAJAY RIVERA: I have it. I can share it now.

GRACIELA GARCIA-MOLINER: You want the second one that you sent, right?

JORGE GARCIA-SAIS: Let's start with the first one, so that everyone can see where we were at in the beginning, and I believe that we paid very little attention to this sub-model whatsoever.

GRACIELA GARCIA-MOLINER: Liajay, you have the first one too, right?

LIAJAY RIVERA: Yes, and let me look it up for a moment.

JASON COPE: Are we going to switch over to that one, and then I can go next?

GRACIELA GARCIA-MOLINER: Yes.

JORGE GARCIA-SAIS: This is the model as we had it originally, and, essentially, it's separating point source activities from non-point activities, and then we have the list of point sources, essentially sewage outfalls and powerplant effluents and industrial waste. Then the non-point sources are including agriculture runoff, urban runoff, septic seepage, landfill leakage, and other NPS discharges, with agriculture and urban runoff contributing to watershed erosion.

We can work out from this one, and it's a very generic model, and I have -- The main problem that I have with this model is that it doesn't include rivers, and, because it doesn't include rivers, we lose a very important source of information regarding all of these inputs. Just for consideration, can you pass to third slide?

That's how I see it, from my standpoint, over here, and it's essentially the same, but it's a little bit more -- The boxes have been detailed a little bit more, but you have the point sources here, with the sewage outfalls contributing to nutrients directly and powerplant effluents contributing to a thermal discharge, and also the factor of entrainment, which all these plants have, because they work from seawater for cooling purposes, and so they have a lot of mortality, zooplankton mortality, associated with entrainment.

Then these non-point sources, all of them continue in different magnitudes to rivers, wetlands, and watershed laminar flow, which is essentially what will get to the marine environment. The good thing, what I like about this alternative model, is that, with this, you can assign most of the loading, all the material loadings from these sources, and actually get to rivers, which are the main input into the marine environment, and this can be -- It can be quantified.

I mean, every single watershed in Puerto Rico has either a river or a wetland discharge into it, and most of the rivers, for most of the rivers at different parts of the river, there are USGS data acquisition points that can identify each of these relative contributions to the total loading at that point of the river.

At every single major river, in its discharge point, there is a U.S. Geological Survey data collection point that will allow you to estimate the loading of each of these major rivers into the

marine environment.

Knowing the stream flow, stream flow in cubic meters per second, multiplied by the concentration of the nutrients, can give you loading -- Prospectively talking, you know, if you want to quantify the quantities of the relative inputs to both the sediment and the water quality down the line, it will be very important to include rivers in this model, because, otherwise, you will not be able to get data from these non-point sources that are probably some of the -- Well, they are, by far, the largest contributions of these material loadings to the water quality and to the sediment quality that I know are other sub-components, sub-model components.

This is going to take some time, but you tell me if you want to go for it or we just work from the very simplistic model that we had that we never even started putting values into or anything, and I did. I went through them and put values in, and so that could go pretty fast. Otherwise, we would be putting values into each of these relative contributions to the sub-components.

RICHARD APPELDOORN: This is really an amazing piece of work, Reni, and thank you for that. I'm not really sure how to answer your question, and so I'm going to put it actually over to somebody like Bill Arnold or J.J., who is going to be dealing with these things, and we're looking at conceptual models, and this is actually fairly different in the way you have linked it through the sources, and is the ecosystem group looking for something that could actually be tied that finely, if you will?

I mean, even the way this model is set up, it's not -- It's obviously not targeting individual rivers, but it just acknowledges that that's in fact how the system works, but, if you were talking about -- Well, if you increase something, that just goes into rivers, which is going to go trickle down the line, without specifying which river, and the only difference between rivers and wetlands, for instance, is the nutrients box, because the wetlands are going to soak up nutrients, but rivers are going to dump those out into the environment.

What kind of detail are our conceptual models really trying to kind of capture, and is there a point where we go too far or not? If this is okay, then we really need to think about, okay, how do we do that, relative to the work that Reni has done here, but I would like to hear some comments from either Bill or J.J.

BILL ARNOLD: The question of whether you have gone too far or not far enough, that's a tough question to answer, and it really is. In some ways, you're going too far on all these sub-models, but

the information is valuable. It may not be used immediately, and it may be used down the line, just to provide the framework, and keep in mind that what we're trying to do in the EBFM group is have multiple groups create their view of what a conceptual model is, and that's really the overarching conceptual models.

All these conceptual models have a vast number of potential sub-models, a vast number. You can dig and dig and dig as far down as you want to go, but our guidance from Mandy and Adyan is what they are doing on the Gulf coast of Florida, and we're certainly very attentive to their guidance, because they are staying ahead of us on this thing, is they will take these multiple kind of overarching conceptual models, which are, in your case, and not in the case of the DAPs, and I don't know how the other groups will construct their conceptual models, but, in your case, they're kind of being built up from the bottom upward, which is fine, but, if we stack these things to look for those common elements, to create a single overarching whatever you want to call it, U.S. Caribbean coral reef conceptual model --

Again, I'm happy for Mandy or Adyan to comment on this, but a lot of these details are going to drop out, is what I would anticipate, and you're going to be left with one core overarching model, and I think that, ultimately, the only two models that are really going to matter are the overarching model, which is sort of how we address other agencies and other groups interacting with the council, or the council communicating with these other groups in a manner that they can understand and have some buy-in on.

That's kind of what the overarching model is for, but the sub-model that is key to the council is the fisheries sub-model, because they do fishery management. They don't do river management, and they don't do a lot of management -- Of course, I understand that all of these details could influence how things are managed, and so this is probably not helping much.

It's not an easy answer to give, but, at this point in the process, you would probably be better off, from an efficiency point of view, and I think you guys know my feelings on that, of looking at the higher level, knowing that, down the road, if you identify another sub-model that needs more emphasis, or needs more development, then you can do it at that time, but, like I said, I'm not the only one who has a perspective on this, and my perspective is not the predominant perspective, and it's just another perspective, and so that would be my input, and I am also curious as to J.J. and the other TAP members that are on the call -- I would be interested in their input as well, if you guys are. It's certainly not up to me to make that decision.

JORGE GARCIA-SAIS: Richard, the reason that I took some time to draw this is that, here, there is a lot of arrows and things, and everything can be much simpler, but, for example, the most important thing here is that, if you consider the first one to the left, the sewage outfalls, there is data for sewage outfalls, for the regional sewage outfalls, and it is a source of information, quantifiable, concentrations of 274 parameters.

If you take the sewage outfalls and the rivers, for which there is quantitative information for all the major rivers of Puerto Rico at the discharge point, stream flow data, cubic meters per second and concentrations of a myriad of parameters -- Of course, nutrients and sedimented sediment and TOC and all -- Just a huge amount of information.

Then, multiplied by the stream flow, those concentrations give you loading, and so, just considering sewage outfalls and rivers, you have probably over 90 percent of the material loadings into the marine environment. If you have these, then you can quantify the material loadings into the marine environment, and then you can -- If you want to go back to modify these material loadings, you can start looking at the arrows contributing, at least for the non-point sources and for the sewage outfalls, and the quantification is there, too.

This model can be mathematically driven is what I mean, if you include rivers. If you don't, then you are lost. You are lost, because these things are very difficult to quantify unless you go river-by-river and NPDS-permit-by-NPDS-permit, and still that information is inaccurate and incomplete, but, from the rivers, you have the consolidated, the integrated, inputs of all these things, and you have a much better opportunity to pinpoint each one, depending on what point in the river you are looking at, because the USGS has monitoring stations in several points around each of the watersheds of Puerto Rico.

BILL ARNOLD: A couple of things I would not -- I think Reni's work on this is excellent, and it's a very nice sub-model, and I would not want it construed that I was criticizing it, because I'm not. I'm just trying to be practical in application, and, in fact, I have used sewage outfalls, especially those offshore outfalls, in many instances as an excellent example of how these models can be used at a higher level than the council.

If you find, for example, that a sewage outfall off of southwest Puerto Rico is resulting in damage to 20 percent of the coral reef habitat out there, and that is reducing resource abundance and

potential harvest, then the council would have a very strong interest in that and in communicating with the EPA the need to go to tertiary treatment on the sewage coming out of here, and so these are good things, but what you have to ask yourselves is, at this point in the process -- I would not want you to throw this model away, but you need to ask yourselves where are we going, relative to where can we go, again, in a practical sense, as we get this ecosystem-based approach to management cranked up.

It's an infant process, and we've got a long way to go, and the council is still not even real sure of it, and the Southeast Regional Office is not real sure exactly how ecosystem-based outcomes from this effort are going to be blended into management, and I'm not saying they're not, and I think there are tremendous opportunities, but I don't think anybody, any individual, has a clear idea of exactly how that's going to happen, and so, obviously, the SSC can take this as deeply as they want, and you just need to ask yourselves how deep is practical at this point in the progression.

RICHARD APPELDOORN: We have comments from J.J. and also Mandy.

JUAN CRUZ-MOTTA: I would suggest Mandy speaking first, so she can be a view of their approach, which is targeted for management. Thank you.

MANDY KARNAUSKAS: I can't comment too much on the Caribbean conceptual models, and I haven't been involved throughout the whole process, and I just chatted in the chat box there to say, if there's questions on what we did in the Gulf, and we recently did other conceptual models for the South Atlantic Council, I can talk more about that, but, essentially, we build conceptual models with different groups of stakeholders and looked at sort of just the properties of the network models themselves, and we didn't go into scoring or trying to simulate or quantify linkages, as you're doing here, and so it was a little bit of a different process.

RICHARD APPELDOORN: All right. I have a comment, but, Graciela, did you want to comment?

GRACIELA GARCIA-MOLINER: One of the things that you have to bear in mind is that you are following the same process as the DAPs, and these are aspects of the environment that really have a direct implication on the fishery outcomes, and that is why people are concentrating on the most important aspects of what is impacting fisheries in the end.

It's true that the council -- The only thing that it can regulate

through NOAA Fisheries is fishing, per se, but it can also make aware of all the problems that are related to the changes in habitat and to the changes in the species composition and in the nearshore and offshore reefs, et cetera, by creating these models.

The approach that the SSC has taken is based on what are all these other issues that are related, directly related, to fisheries, and fisheries including changes to essential fish habitat and habitat, and so, in a sense, you might not want to spend an incredible amount of time in looking at the very specific little boxes in your model, but you also want to have it in the record of all the implications that these activities, other than fishing, have on the fisheries, and so just to keep that perspective.

Because that is one of the issues that the council has been discussing, and the DAPs have been discussing, in other things that are impacting fisheries other than the exploitation of the fishery by fishing activities.

JORGE GARCIA-SAIS: Graciela, let me give you a very quick example of where these things can be used, and it's exactly what you are talking about. The case of the Guanica watershed, I mean, there has been an initiative to divert the inputs of the Guanica wetlands into Guanica Bay, and, from the justification, among many other considerations, of improving the water quality and improving the development and the health status of coral reefs in the area.

Well, okay, if you do that, you probably are going to improve the -- If you see down here the turbidity, the water turbidity, because water turbidity is mostly influenced or regulated or influenced by chlorophyll or by phytoplankton productivity.

What happens when you do that is that you might have less turbidity, and perhaps considering that coral reefs can grow faster in water that is less turbid, or that will develop better in water that is less turbid, which is a matter of debate, and I will take it, but the point is that, if you reduce nutrient loading into that Guanica Bay, you will reduce phytoplankton productivity, and thereby zooplankton productivity, and zooplankton productivity in that bay is very important for the king mackerel fisheries, because there is a lot of zooplanktivorous fish, like clupeids and anchovies, that depend on that zooplankton productivity, a secondary production, to maintain their populations.

Those populations of zooplanktivorous fishes are essential for the king mackerel fisheries at the mouth of the bay, and so you have two diverting trends here that you can manage. Do you want better water transparency for coral reefs, or do you want less water

transparency, but higher plankton productivity for the mackerel fisheries? That is the dilemma, but, anyway, for that kind of management decision, it's good to have this kind of information, and that's all I'm saying.

RICHARD APPELDOORN: Here's my comment and observation. Your top row is the original boxes minus industrial sewage, and I think there's a third point source, and you have no interconnections between any of them, which I think is kind of where we were when we left this thing, is that all these, as you have elegantly drawn, connect to other sub-models, and they become very important in how they do that.

As I said, you have really done an elegant job here of pointing that out, and we may just kind of, at this point, do a little punting, if the committee agrees, and say, okay, for the sub-model, there really aren't interconnections, and all the connections are going to be with other sub-models, and we move on to the next one, and we're going to come back to how to treat those connections and whether we need to have say river nodes or wetland nodes, et cetera, to be able to channel those in the kind of elegant detail that Reni has provided for us, and so what is the committee's thought on that?

JOE KIMMEL: I am looking at Reni's construction of his sub-model here, with all the arrows on it, and I would hate to lose all that detail. It looks like it's very well thought out and well presented.

RICHARD APPELDOORN: I am not suggesting that we lose the detail, but I'm suggesting that detail gets put in at the next stage.

TARSILA SEARA: I just want to say that I agree with that. I think this will be a great way to inform how the inter-sub-model relationships are going to work out for this one, and so I think that that's a great way to go about this.

ALIDA ORTIZ: Can I make a comment?

RICHARD APPELDOORN: Go ahead, while the others are thinking.

ALIDA ORTIZ: I do agree with Tarsila, and also with Reni. This is very, very, very detailed, but, when we are going to go to what is a fishery ecosystem plan, and these conceptual models have to be simple and understandable, and that doesn't mean that, when you take one of those boxes, that you cannot go into detail, but that is not part, I think, of the big conceptual model, and so this is very valuable information, and I am glad that Reni can do all of

this, but we have to find a way to say how can I, as outreach and education, get this information to all the stakeholders and not just the fishers, but the consumers and the government people and the recreational and the marinas and everywhere. That's what, to me, it's -- I have to use this information and put it in a simple model, and that's it.

GRACIELA GARCIA-MOLINER: Richard, can we look at the slide before this one, with the actual Excel format, because I think there were some --

RICHARD APPELDOORN: I was going to ask you to read Mandy's comment, because you probably have a bigger screen than I, and so I actually had struggled reading the comments.

GRACIELA GARCIA-MOLINER: Okay, and so I will keep interrupting you when I get comments, or Mandy can actually give her input, but it says an important question to ask might be how much analysis of the conceptual model do you need to get the information you need out of the model? No amount of analysis of the conceptual model will tell you -- For example, the percent reduction in nutrient inputs that you need to obtain to achieve certain fishery management outcomes. The level of detail in the analysis of the conceptual model should match the level of detail you are trying to take out of the model.

MANDY KARNAUSKAS: I'm here, and I can talk, and I just didn't want to interrupt, and so I was just throwing out some food for thought. It's just about the analysis of these conceptual models should match the objectives of what information are we trying to get out of the models, and I apologize that I missed the first half of yesterday, and so I might not be aware of what the long-term end goal is with the conceptual model.

RICHARD APPELDOORN: Well, one point is that, right now, we're trying to come up with what we would be calling the generic model that then would be fitted to the three island platforms, and so we're trying to -- The generic model would, I think, have more detail than the individual platform models, because some things are going to be more important some places, versus others, but functional pathways should be fairly similar, and I think that's what Reni has come up with.

I would point out that, particularly in the Virgin Islands, coming out of the DAPs, is that generated, and I think it was kind of these concerns, and some others, for which they decided they really needed to have a conversation not just with the fisheries people, but with a number of the other agencies in the Virgin Islands

government that have jurisdictions over the kinds of inputs that we're looking at here, and the ability to explain to those agencies that you have jurisdiction over here, and look how this flows through the system and can potentially affect our livelihoods, and I think that's really important.

I like the detail that Reni has brought to this, and I would like to conserve that, to the degree possible, but I am still asking whether that's the next step after we have all the internal sub-connections for the sub-models done.

This would actually inform us a little bit, because things like rivers and wetlands, for example, that Reni has drawn here in the connections, are not represented in any other sub-model yet, and so this may make us think about how we want to handle that going forward, as we get to the interconnections between the sub-models.

JORGE GARCIA-SAIS: Richard, with the detail comes the data, because, if you go from watershed-to-watershed in Puerto Rico, the number of these lines might change. That's the way it is. It is good, and, at the same time, it can be specified. I mean, you can look at it conceptually, and it will work, but, if you -- If you want to make it quantifiable, a model that runs with numbers, it will run differently from watershed to watershed, depending on the degree of agricultural runoff and on the urban runoff and so forth, particularly with non-point sources, because non-point sources are a difficult thing to get a handle into.

There is little information, and what you get is the partitioning on the loading at different points of the river, because there are U.S. Geological Survey monitoring stations throughout many of the rivers of Puerto Rico, in the gradient from the mountains up to the discharge point. It will work differently from watershed-to-watershed, but, conceptually, this is how it works.

RICHARD APPELDOORN: So I have only heard from two others on the committee about whether we can just kind of shelve this for now, because we don't really have connections within the sub-model, and we can go to the next sub-model, and we can just go back to the fishing one, and then we're going to look at Reni's work here again in detail when we start looking at the connections to the other -- - Between sub-models, and the question is, is that okay with the committee?

JOE KIMMEL: It's fine with me, Mr. Chairman.

KEVIN MCCARTHY: I am okay with that approach.

CHURCHILL GRIMES: Likewise, and I think that's a good way to go.

JASON COPE: I think so as well. I'm good with that.

DOUGLAS GREGORY: It's okay.

RICHARD APPELDOORN: All right. That's at least a plurality.

JORGE GARCIA-SAIS: Richard, for the original sub-model that we arrived at, it was one of the last ones, and we didn't have much time to deal with it, and I prepared the Excel worksheet of the directions and the magnitudes of what I saw originally that we could work with, and so there is some departure point there for the original generic model, and so if you want to go through all of them.

I can also -- You know, if you want to leave this for the end, I can work on like an average watershed and assign numbers to all of these, and so -- I have included here some of the point source activities that shouldn't be there, but, anyway, however you want to deal with it, we will go with it, and we can work on this later on in the process or whatever.

RICHARD APPELDOORN: Because, here, you have interactions between the components of the sub-model, which were not in your diagram that you had just showed us, the arrow diagram, and so do you want to explain what you have here?

JORGE GARCIA-SAIS: For industrial waste, I put a one into the sewage outfall, because I see that, in one way or another, some level of industrial waste flows into the regional sewage outfalls. It is a point source activity, at least for some of this industrial waste, and it will, at some point in the watershed, be discharged and end up as a non-point discharge within the watershed, and it eventually could get to a landfill, and thereby affect the landfill leakage, and I don't think it is of great importance, or I can be wrong for some watersheds, but, in general, I believe it's kind of like a one magnitude problem.

Septic sewage is something else, and I don't think that's any -- For urban runoff, which is kind of like a generic, integrated runoff from a given area, the industrial waste in some watersheds may be a quantifiable thing, and so I would place a one here. Agricultural runoff, I don't see a direct connection, and I do see that it contributes to the non-point source activity, to the total of the non-point source activities.

RICHARD APPELDOORN: My comment is, and this will make things a

little bit easier, is point source activity and non-point source activity are in fact not components, and they were just organizing headings above the other sources, and I would recommend deleting those from the spreadsheet, and that will simplify things. Otherwise, I agree with everything Reni said, which is maybe the first time I've ever said that.

JORGE GARCIA-SAIS: If you want, I can go to the next one, the powerplant effluents.

RICHARD APPELDOORN: Wait a minute. This is just a picture in the PowerPoint and not the actual spreadsheet.

GRACIELA GARCIA-MOLINER: We actually have the Excel, if you want to change it now.

RICHARD APPELDOORN: With these values already in them?

GRACIELA GARCIA-MOLINER: Liajay, did you put these values in the new Excel sheet? Probably not, but we can pull it up and fill it in right away. There it is. So she does have it.

JORGE GARCIA-SAIS: You can delete the two headings, the point source and the non-point source activity, E and K.

GRACIELA GARCIA-MOLINER: E and F, those are the columns that you want to delete?

JORGE GARCIA-SAIS: E and K. Do we want to work directly from the Excel sheet, so we can make changes, if needed? That would be good.

RICHARD APPELDOORN: Yes, I think that's the way to go.

JORGE GARCIA-SAIS: Okay. Moving into powerplant effluents, I see powerplant effluents influencing -- Powerplant effluents, what they are is thermal discharges, essentially, and that's what it is. You know, it's a thermal discharge with a bunch of dead zooplankton and little phytoplankton, and so I didn't see --

In my model, my connection was directly to the phytoplankton and to the plankton and benthic pelagic community structure and productivity, and that's where the powerplant effluent, from my perspective -- Because the actual output is hot water. The input is coastal water, and it has implications in terms of zooplankton entrainment, but that's connections with another sub-model and not within the sub-components of this one, as I see it.

RICHARD APPELDOORN: I think the silence means we agree.

JORGE GARCIA-SAIS: Power plants usually suck up about half-a-million gallons per day of seawater, and then that pretty much that same amount is discharged, a hundred-degree-temperature water, essentially, and it goes a little bit up and down, but that's what it is, and so that's what I have. It has some implications, but not within this model sub-component, and so we can go to the next one, sewage outfalls.

From my perspective, there might be some other sewage outfalls, but I am considering these sewage outfalls as the regional sewage outfalls, and so there are -- Last time I checked, there was about eight or nine of them, and seven of which are primary treatment, what they call disinfected primary treatment outfalls, and there are three that are secondary/tertiary treatment outfalls, including the Mayaguez, and there's another in Humacao, and I am not sure which one is the other one, but, anyway, these sewage outfalls interact very little with any of these.

Essentially, what they affect is the direct coastal community, and, essentially, they create an estuary within the coastal environment, because the sewage outfall comes essentially with freshwater, and it's mixed with fresh water, and so they create an estuary in the zone where it is discharged, and then, based on the currents, you have to create -- In order to be able to discharge, you need a waiver, and the waiver needs a mixing zone, and so, based on the currents on the area and the concentration and the flow, they are discharged into the marine environment, but I don't see any connection with any other sub-component of this sub-model.

RICHARD APPELDOORN: I think that means we agree.

JORGE GARCIA-SAIS: Okay. If we move to other NPS discharges, that is -- It's mostly a watershed issue, and, basically, we call it other non-point source discharges, and I believe it should be the discharges that are not included in the NPDS permits that these kind of discharges require within the watersheds, and so it's whatever is not accounted for, but, again, this is a watershed issue that will have little impacts to other of these sub-model sub-components, other than be received by a waterbody, which, in most cases, is either a stream or a river or some of that kind of thing.

RICHARD APPELDOORN: The context here is it's anything else that's not on the list, basically.

JORGE GARCIA-SAIS: Right. Well, the way I look at it is because

I know that many of these NPDS discharges do have -- I mean, things like a restaurant, for example, that up in the mountains never had a sewage tank, or could not be connected to any aqueduct, and it was discharged right there into the mountain, but that was an identified location, and they needed an NPDS permit to do that, but some actually were even without the NPDS permit, and so they discharged there, and nobody really cares, but the input is there.

RICHARD APPELDOORN: I'm shocked.

JORGE GARCIA-SAIS: If any of you guys see any direct connection with any of the other NPDS discharges to other sub-model components, let me know, and we can insert it right here. That is what I was preferring when I started doing this, and I noticed that these are just a list of things of non-point sources, I mean sources of non-point sources. I mean, there is little interaction between them, because they actually affect directly the marine environment, through the river pathway.

RICHARD APPELDOORN: That's correct. I think that's exactly what we were thinking, and so, in the rest of your -- Going down that list, the rest of the ones on the left-hand side, except for a few of them, the only interaction is other non-point source discharges, and I'm asking whether that's really an interaction or -- Because our definition of non-point is something that is just not these, whereas I think, when you talked about the industrial waste, you said there are in fact pathways where that does get into the sewage component, if you will, but I think the rest of these are somewhat different, and so I am questioning all the ones in the lower part of the other non-point source discharge for this.

JORGE GARCIA-SAIS: I have included septic sewage as part of the urban runoff, because that's how it works in the mountains. I mean, you have all these little bathrooms, and they are without any aqueduct or anything, and that would be part of the urban runoff.

RICHARD APPELDOORN: I am not questioning that. I am just questioning the other non-point discharge column. I think, when you talked about the urban runoff, and you have the one and the two there under landfills and septic sewage, I am not questioning those.

JORGE GARCIA-SAIS: Okay. You are referring to other NPDS discharges and the effect of landfill leakage?

RICHARD APPELDOORN: These are different sources of inputs, and so, to me, unless you are saying that septic and urban runoff is

somehow -- Although they started off as one thing, and they just blend into something else, then that would be valid, but, if they're staying their unique sources, then I would remove the ones, and so are you saying that, in some cases, they are blending in, and therefore --

JORGE GARCIA-SAIS: This was a hard call, and I didn't really know what to do, but I said, well, essentially, they become part of other NPDS discharges, because they are not accounted for, and they are not quantified anywhere else, and I was doing this with -- I was trying to, at some point, provide some mechanisms for quantification of these things.

RICHARD APPELDOORN: Excellent. Thank you. Now that I understand your reasoning, I actually have no questions on that.

JORGE GARCIA-SAIS: This sub-model, as it is in this very generic way, its main interaction is with other sub-components. Unfortunately, in this sub-component, we don't have a box that will connect directly with other sub-components, and that is why I thought that rivers was an essential thing to have, because, I mean, it's very difficult to connect -- Unless you connect the entire model, and, if you connect just the land use, you connect land use to habitat. You connect land use to water quality, and, still, there would be a lot of discussion and a lot of controversy regarding whether that interaction is negative or positive.

RICHARD APPELDOORN: Yes, and so that's going to give us a lot of thought into how we deal with all those connections when we get to that stage.

GRACIELA GARCIA-MOLINER: You have a comment from Michelle that sewage and storm drains sometimes have liquids, quote, unquote, mixed, due to the lack of maintenance, but not on purpose, when it floods, but, other than that, I don't have anyone else asking for a turn.

Richard, we need to -- For clarification, what we have fixed in the Excel file is what we're going to use for this sub-model, correct? Have you come to that consensus yet?

RICHARD APPELDOORN: Yes, I think we have, because the real detail that Reni provided is coming out of that sub-model.

GRACIELA GARCIA-MOLINER: Okay. Let me know what you want to do next.

RICHARD APPELDOORN: I would like you to read the comment from

Ricardo Lopez, which is much more generic than the discussion to this, and then maybe I can respond to that.

GRACIELA GARCIA-MOLINER: Do you want him to speak to the comment? Just as a reminder, for the final document, the connections, or arrows, between concepts in the concept maps must have defined the meaning of that connection, either in each connection or in a legend, and usually it is a verb or a short phrase, so that it can be read as a complete idea. This is a common mistake, which affects understanding, especially of the least experts. Duly noted.

RICHARD APPELDOORN: Yes, and so my comment is it's not just the least experts that -- As evident from our conversations here, not all of us are remembering our previous conversations on a lot of these points, and so it's a good point, and, perhaps unfortunately, the nature of that labeling is captured in the discussions, and so are not embedded in the model, per se, at this point, and so thank you for the comment, Ricardo.

GRACIELA GARCIA-MOLINER: You have another comment from Ricardo that the detection of pollutants in moving water is very difficult, specifically from rivers, and what we can have of better quality is the measurements of pollutants in calm waters, which is sometimes somewhat difficult, also.

JORGE GARCIA-SAIS: We have measurements of pollutants at the discharge of the sewage treatment plants, and we have measurements of pollutants at the discharge point of the rivers, for the river mouths.

Obviously, those are integrated measurements of the pollutant inputs within the watershed and within the regional sewage treatment plant networks, but the important thing is that we have artisanal flux of loading into the marine environment, if we consider these kind of mathematical models instead of the -- I mean, if we move from -- When we move from the conceptual to the mathematical models, if we ever do that, we can, for these two components, or these two models.

RICHARD APPELDOORN: Okay. Ricardo says, thank you, Reni. At this point, is the committee willing to accept the spreadsheet as it has now been put forth by Reni? I think you've done a fantastic job.

JOE KIMMEL: It looks good to me.

JASON COPE: It looks good.

CHURCHILL GRIMES: I agree.

JUAN CRUZ-MOTTA: I agree.

TARSILA SEARA: I agree.

WALTER KEITHLY: It's fine with me.

KEVIN MCCARTHY: I agree.

RICHARD APPELDOORN: Okay. At this point, it's ten of twelve, and we actually have a request for a starting time at 1:30 for today, for after lunch, and so the question is do we want to start the fishing -- Get back to Jason on that for a little bit, and hopefully finishing no later than 12:30, or are people dying to get out of their chairs?

JASON COPE: I am ready, if you guys want to.

RICHARD APPELDOORN: My sense is that we move on to Jason and see how that works, for the time that we have.

GRACIELA GARCIA-MOLINER: Okay.

FISHING

JASON COPE: Let's start in, and this is the fishing sub-model, and it's, on some level, less complicated than others, but we can have a discussion on it. This is what it currently looks like, and so we got to the point of identifying many of the components put in that sub-model and the connections there, and we do not have any of the magnitudes of these connections, and so we'll talk about those here in a second.

In the presentation, for those who have it and are looking at it, I just provided the glossary there, in the event that we wanted to make sure we understood what was being said here, and we might want to have some discussion on what we call these, but those are there for you.

Our charge here is to kind of go through this and make sure, given that we got to the point of putting the sub-model together, did we miss any components, and did we miss any connections, and possibly we could just simplify it even more, and then, once we have that settled, we'll move on to the magnitudes, as far as how much weight each arrow has, and then we can -- I am not sure how far we're going to get into that third point, but the other thing on the

table would be how it connects elsewhere.

Again, this is currently how it looks. To facilitate our discussion, I personally found it more useful to rearrange this a little bit, in order to kind of see the flow, and this worked for me a little bit better, and so I presented this version of it, and the reason I did this was -- What you kind of see is all of these kind of up top are moving towards -- Essentially, what this model does is everything is moving toward fishing mortality, either through another component or directly to fishing mortality, and so everything is kind of pushing towards this direction.

Many of them are going through recreational fishing and commercial fishing, with discards and bycatch having a complicated relationship in some instances, but everything is kind of moving towards this one final component, which is fishing mortality, and so one question to the group would be if that sounds right, if these components still seem like everything is there, are there any missing connections, and are what we're calling these things descriptive enough to capture what we mean?

One of the things that I will bring up, just as an example, are discards and bycatch, and I wanted to clarify this with everyone. When we say discards, are we referring specifically to dead discards, and, if so, we might want to make sure that that is there. If not, we just need to keep that in mind when we're setting, in the next stage, setting the magnitudes of the arrows, that there is both a release discard and a dead discard aspect to this. Anyone have a thought on that clarification? Are we talking purely dead discards in this box?

RICHARD APPELDOORN: We were talking about discards that were either dead when they were discarded or they are consumed -- They are eaten on the way back down or something like that.

JASON COPE: Right, and so they get removed from the population because they were discarded, whether they died onboard and were killed in the gear or whatever and thrown over, or they get thrown over and they get picked apart by birds or other fish, couldn't handle the reintroduction, et cetera. Okay, and so that's what I am calling dead discards, because that has a different -- Discards is a broader thing, and so I don't know if that would lead to confusion and if we need to make sure that we're talking about dead discards.

Then, the bycatch component of this, this is also -- I don't know, and they are obviously connected, but they also have different aspects to them. Bycatch means that something isn't targeted, but

it's still -- It could still be sold or still be utilized, or it could be completely thrown back, and I just wanted clarification with everyone here, and are we fine with those nuances in the words not being fully expressed in this component box? Are we fine with the way it is?

That ultimately leads to will it cause any confusion when we start to put numbers to these arrows, because we haven't really fully considered those nuances?

RICHARD APPELDOORN: Well, my feeling was that everything in that box is dying, either being thrown back and is dying or it's being retained and dying, but I see your question, in terms of -- You know, if it's bycatch and it's being retained, isn't that falling under actual commercial fishing landings, or are -- I can't remember whether we were separating out this is the stuff that's not in the landings, per se, but it's still being retained and sold or given away, as is done a lot in the artisanal fisheries, to friends and family and whatnot.

I am guessing, from our previous conversation, that this is why bycatch is in there, that it's catch, and they are going to die, but it wouldn't necessarily show up in either the commercial or recreational landings.

JASON COPE: Right. Okay.

TARSILA SEARA: I just wanted to make a comment about the discards. I am just wondering if it wouldn't be important to consider, under discards, the selectivity, and so, if these are being discarded because they are not necessarily dead, but a lobster is being discarded because it's too small or too large, because of demand, and that's something that can vary, shouldn't we be capturing that under discards, live discards?

JASON COPE: It's a really good question, and it's one that I was thinking about too when it comes to this idea of fishing gear, because fishing gear is going to be -- Basically, it's getting at the selectivity of that gear, which is what you're talking about, which is going to lead to certain decisions, and fishing gear, just in general, different gear have very different impacts on things, and it may lead to the decisions of high-grading or whatever, if you don't have really good selective gear for what you're trying to get to.

I think I was running into this issue of, when we start to put down the magnitude of this arrow, fishing gear towards discards, or fishing gear towards anything, it seems like there's a really

wide spectrum of what those magnitudes could be, given the very particular type of gear, and so I think -- I appreciate that comment, because I think it gets to a larger issue with the selectivity and the fishing gear on how we even quantify its effects when it has so many sub-components to it that are going to vary greatly in their contribution to that kind of overall composite magnitude.

RICHARD APPELDOORN: We have a couple of comments that I'm just going to go through. IUU is illegal, unreported, and something else.

JASON COPE: Unregulated, and so it's illegal, unregulated, and unreported.

RICHARD APPELDOORN: I think a number of other comments are taking care of the fact that we're defining the discards and bycatch as things that die, that component that dies.

JORGE GARCIA-SAIS: Jason, did you consider in this model mostly commercial fisheries, or you have here recreational fisheries landings, and I was -- I had the question of if the released fishes, because of their size or because of their species or whatever it is, would be included in these discards and bycatch. Like, for example, blue marlin, and people release blue marlin all the time, and there are some other fishes that are released because of seasonal or whatever closures, and I was wondering if you were considering that in that box.

JASON COPE: That's exactly kind of what -- That's along what my question was, and I think I prefer to have this say something like dead discards, because there are lots of ways to release a discard animal in these various fisheries that allow them to survive, but there is also tons that don't, and so, really, I think what we're really focused in on here are the ones that are dying.

Everything else that's released kind of -- They went through one of these boxes, but then it was like a do-over for them, and they got sent back, and presumably they are functioning just as well post-commercial and recreational interaction as prior to it, whereas this box is really getting at the fact that these things are -- There are things that are not being recorded in the landings that are removing things from the population, which is contributing to that ultimate box of fishing mortality.

JORGE GARCIA-SAIS: Okay. Thanks.

JASON COPE: Did we get at the other question, or did anyone else

have comments regarding the type of gear and the effects on discards? Again, this fishing gear question is definitely one that I would like to get more input on, how we're going to deal with that, but there is an arrow here, and so we have that explicit relationship that we have set up, and so maybe what we do, before we get into those details, is let's just ask ourselves if we're missing any additional components that anyone can see, and are there any connections here that you think are lacking, either to or from?

We have a lot of to here, and we have got a lot of one-way flows that end up here, and there's a couple that kind of -- There is only one that kind of comes back here, and there is not a lot of two-way arrows in this model, but, yes, let me know if you see any missing connections here.

WALTER KEITHLY: Should we include, at this point, fishing regulations and its impact, or their impact, on commercial fishing landings and recreational landings? It seems to me that could have fishing grounds as a component and fishing seasonality as a component, and you may want to include fishing regulations as a component, because certainly they will drive your landings and then your fishing mortality. Thank you.

JASON COPE: I really, really like that suggestion, and I was thinking the same thing, and I did not know if that was a different sub-model in some way that was going to feed into this one, because you're absolutely right.

The way that a lot of these things run, the fishing gear that's used, where people fish, the fishing ground, when they fish, the seasonality, the fishery infrastructure, all of that stuff, and then down to maybe possible high-grading and discarding and all these sorts of things, and they're all often human behavior reactions to management measures that are in place, or lack thereof, and so having -- Somehow having the management system affecting either this sub-model as a whole or as one of the components I think is an essential feature, and I didn't know if that went into a different sub-model.

TARSILA SEARA: We have regulatory process in the human dimension in the socioeconomic sub-model.

JASON COPE: Excellent, and so we'll be able to take advantage of all of that when we get to the sub-model connections then, it sounds like, but thank you for bringing that up for us, just to keep in mind. Any other suggestions for connections or other missing components?

KEVIN MCCARTHY: I have a question, and it's not a suggestion at this point, but I am trying to understand the arrows that are going from commercial fishing landings to dead discards, recreational landings to dead discards, and fishing mortality to dead discards.

I can understand the dead discards going to fishing mortality. If it's landings, it's not a discard, and so I guess I can understand the arrows going -- I am just looking for a clarification on why those arrows are heading to dead discards.

RICHARD APPELDOORN: I would get rid of the arrow between -- Running from fishing mortality to the dead discards, and then, Kevin, it is kind of a question of how do we want to treat this, because we have labeled them commercial fishing landings, as a source going into mortality, and the connection to dead discards would be really commercial fishing activities, and so it may be a labeling issue, or we run to arrows from the various components, as we have to recreational and commercial landings straight to dead discards.

KEVIN MCCARTHY: Right, and that's what I'm thinking. Well, I don't know which way is better, to relabel some things or to add some arrows, and I am open to either approach.

WALTER KEITHLY: I think I like the arrows as they are, and I may just suggest changing commercial fishing landings and recreational fishing landings to commercial fishing catch and recreational fishing catch. That, I think, will solve the issues that are being discussed. Thank you.

KEVIN MCCARTHY: That is equivalent to the dead discard box, because catch is kept and discarded, right, or is that just adding boxes we don't need?

JASON COPE: I do like that suggestion, because, at least how it works in my brain, is that it's saying you're catching things, and that's going to be affecting fishing mortality, but we've also broken out this other sub-box that is recognizing that part of that catch is in this kind of dead discard section, and the important part of breaking that out is that, ultimately, knowing the magnitude of this, and then having the ability to kind of do a sensitivity on changing the degree of what this box is doing to ultimate fishing mortality could be informative, ultimately, to management decisions and so forth, and that's the way I read that suggestion, and so, for me, it works that way, but I'm not sure -- Does it work for others that way?

RICHARD APPELDOORN: I think the way we have it now is fine. I think Kevin's question is do we want to make it explicit, on the way from commercial fishing catch to fishing mortality, it runs through a box that says commercial fishing landings, and, equally, recreational fishing catch, and, that arrow that runs to fishing mortality, would it run through another box that says recreational fishing landings, just so we have boxes representing actual data.

KEVIN MCCARTHY: The thing about this sub-model is we can put some numbers here, and, in some of the other sub-models, we're going to have a bigger problem doing that, and so I'm not suggesting that we parse it out so much that we can stick a number on absolutely everything, just because we've got a number for it, but we may want to consider that we have data for some of these things, and how best do we want to approach this sub-model, given that we have some information.

WALTER KEITHLY: I would hate to complicate the model anymore, and, again, I've been arguing, for a couple of meetings now, to try to keep these models as simple as possible, and we can expand these models infinitely, but I think this captures the essence of what we're trying to solve in this case.

RICHARD APPELDOORN: I hate to say it, but I totally agree with Walter.

JASON COPE: One thing I was trying to think through is, if you did add that say commercial fishing landings box, what does the arrow between catch and landings become? I think it becomes this weird -- Because all of the magnitude from the landings is going to inform the mortality, and from the discards is going to inform the mortality, and so these little arrows that go from catch to bycatch and landings -- I don't know, and they might kind of be an odd thing to try to give a value to, and, if that's the case, you probably don't necessarily need them, as long as it's understood that the magnitude for this arrow is going to be representative of truly landings, whereas the additional fishing mortality due to discards and bycatch and so forth are going to be coming through this channel.

RICHARD APPELDOORN: I don't think we need boxes, and the reason is because the boxes aren't actually necessarily a component. All it would be doing would be labeling that arrow.

JASON COPE: That's exactly right.

RICHARD APPELDOORN: As a consequence, I don't think we need them, and, actually, I'm honored to agree with Walter.

JASON COPE: Okay. Great suggestions. All right, and so, so far, we've changed the labeling here to clarify some stuff, and I've added dead discards here, and then we've got rid of this kind of back arrow that we didn't really know what that was about. Okay. Any other changes so far, before we move to trying to put some numbers on these arrows?

GRACIELA GARCIA-MOLINER: Richard, do you want me to read the comments from Ricardo and Mandy?

JASON COPE: Are they chat comments?

GRACIELA GARCIA-MOLINER: Yes, and they're comments in the chat.

JASON COPE: Let me see if I can find that. There they are. Okay. I see Mandy's. Let me just read kind of some of these. Maybe just walking backwards, with Mandy's question of fishing effort, I don't -- I mean, I kind of feel like the fishing effort is going to be -- Is that going to be quantified in the magnitude of each of these arrows?

RICHARD APPELDOORN: Effort is going to come from the socioeconomic drivers, and they will then -- There is going to be a lot of connections between that sub-model into this one, because all the drivers are there.

JASON COPE: Okay, and so, to answer Mandy's question then, the effort is going to be handled in a different sub-model that is then going to feed into this. Mandy, let us know if that -- If you have any comments to that solution.

To Ricardo's question, this kind of harkens back to the question that I had yesterday of thinking about like positive and negative. I think the issue here is that all of these are basically contributing -- These arrows are going to be positively quantified to increase the fishing mortality, and they're all kind of building up, right, and they're all building towards whichever suite that you're going through that is ultimately leading to this fishing mortality model.

His question then becomes -- Let's see. So we're not including, and this might also be answered by -- The question is it appears that all connections negatively affect the fishery, positively affect fishing mortality, which in turn negatively affects the fishery. Those that positively affect it, regulations, aquaculture, education, et cetera, are not included, and those are included those in these other sub-models, would be my guess.

RICHARD APPELDOORN: That is correct. All these things, as they are the extent of -- It's a direct relationship, and so, if you increase the season available for fishing, that should lead to an increase in fishing, and so an increase in commercial and recreational catch. If you decrease the season, by putting in a seasonal closure, that should decrease, and so it's a direct relationship.

The same thing with fishery infrastructure. If you build up the infrastructure, that should allow for more fishing going on. If you increase the fishing grounds available, that should increase the fishing. If you close areas, that will decrease the fishing, and so the impacts are still direct. There is no positive relationships there.

JASON COPE: I am going to move over to this slide, because I think we're getting -- We can still have the discussion on links and components while also maybe considering magnitude.

TARSILA SEARA: I was wondering if it would make sense to have a connection between IUU fishing and derelict fishing gear.

JASON COPE: I think the separation there is that the derelict fishing gear is unintentionally out there killing things and removing individuals from the population, whereas IUU is strict human poaching of it, and that was my interpretation of that.

JULIAN MAGRAS: Can I ask a question?

RICHARD APPELDOORN: Go ahead.

JULIAN MAGRAS: My question, when you said the derelict -- The traps, or the lost ones out there is killing fish, that's an incorrect statement. The fishers did a study that proved that the gear that is lost, because of the rules that are in place, or not on the rules that are in place for the escape panels, but fish come and go every day.

The St. Thomas/St. John Fishermen's Association did a study on this with Dr. David Olsen and with members of the University of the Virgin Islands that proved that that information is incorrect, and so I have concerns when we say that the gear is just out there killing fish, and so I just wanted to put that on the record.

RICHARD APPELDOORN: That would be handled by the magnitude of the scoring for that, and you're saying, in the situation of the Virgin Islands, that score would be very low, or zero.

JULIAN MAGRAS: Yes, correct.

JASON COPE: We're kind of revisiting how we have defined that particular box, and it is lost gear that contributes unintentional mortality, and so what I am hearing is there is also lost gear that basically become artificial habitat, is what I am hearing, and it's not detrimental to the population, and so, with that insight --

JULIAN MAGRAS: Just one more quick comment, if I may. Not only the lost gear becomes a habitat, but, when the traps are no longer fishable, because of their age, and they are full of holes and stuff that we can't retain a catch, we cut those traps away, and we leave them in a pile, because they are already a living reef. They already have all kinds of habitat and corals and everything growing on them, and so, instead of bringing them and killing something that could help protect juvenile fish in their early stages, we leave them out there.

JASON COPE: All right, and so maybe a couple of suggestions, with that insight. One, it sounds like -- I don't know if that should be added to habitat, that there is this accumulation of habitat, and, again, the magnitude will be dealt with in the scoring, but that sounds like a habitat contribution, whereas, specifically for this one, we're trying to figure out are there any gear types, and maybe traps don't rate well, but maybe there are other gear out there that do have a derelict form that do cause unintentional mortality, and maybe that number ultimately is going to be low.

If it is not a factor, then we would just remove the component, but it sounds like we should at least acknowledge that there is a significant contribution of derelict gear, or gear that's left, that turns into habitat, and so I don't know if we want to add that to that sub-model and then focus here on kind of detrimental effects and then handle it through either the scoring being lower, or, if it's really not a big deal, it would just get taken out. I don't know, but those would be my proposals on how to handle those two kind of possible contributions of fishing gear that is left behind.

RICHARD APPELDOORN: I think that's a reasonable way to handle these things. If we're at the point now where we're going to try scoring, I am going to say that we break for lunch, because that would be a convenient way to do that, and we can reconvene at 1:30.

JASON COPE: Sounds great.

RICHARD APPELDOORN: Is that all right with everybody? Okay. Graciela, we're going to break, and we will reconvene at 1:30.

GRACIELA GARCIA-MOLINER: Perfect. Thank you.

(Whereupon, the meeting recessed for lunch on May 20, 2020.)

- - -

May 20, 2020

WEDNESDAY AFTERNOON SESSION **(142:17)**

- - -

The Scientific and Statistical Committee of the Caribbean Fishery Management Council reconvened via webinar on Wednesday afternoon, May 20, 2020, and was called to order by Chairman Richard Appeldoorn.

GRACIELA GARCIA-MOLINER: We want to go back to Jason's screen, and he was the presenter, and so I think we're back to him.

RICHARD APPELDOORN: That's assuming that Jason is here.

JASON COPE: Yes, and can you see my screen?

GRACIELA GARCIA-MOLINER: Perfect. Yes.

JASON COPE: All right. I think we're at the point where we're going to start filling in these question-marks, and it will make us look much more informed than we are here, and so, unless someone is feeling very passionately about throwing down some values for anything in particular, maybe we can just start over at this kind of top ones that inform some of these other bigger ones that finally feed into fishing mortality.

Maybe we can start with fishing grounds, and I think some of these other ones might be a little harder, and so maybe we start with fishing grounds, and fishing grounds has two contributions, both going to different sectors of the fishing fleet, recreational and commercial. I am assuming also -- It seems like our range is from negative-three to three, and is that what we're doing?

GRACIELA GARCIA-MOLINER: Yes.

JASON COPE: Okay. I think someone also pointed out the fact that most of these are going to be probably in the positive realm,

because they're all kind of leading towards an increase in fishing mortality, but we can see. So fishing grounds, and this is where I need -- I am going to kind of lead us through this, but I am in no way the expert for the local fisheries and the areas and so forth, and so I'm really going to lean on everyone else here. What do you think is going to be a good value here for fishing grounds feeding into these fishing fleets? I'm assuming fairly high, right? They don't just randomly go out and fish.

RICHARD APPELDOORN: I think the consideration here is we have say a fixed amount of area where fishing can occur, and there seems to be two things that limit that. One is a designation of someplace as a no-fishing zone, and the other would be, particularly in the Virgin Islands, an area known to be ciguatoxic, which would be the fishermen from intentionally poisoning their clients, and so those lead to reductions in grounds, and that potentially limits catch, and so I don't think we really have any areas that would be described as say new fishing areas that no one is fishing yet, although I could be wrong, but it's a function of basically -- It's going to come down to either what is being regulated by law or regulated by nature, if you will.

In that sense, if you think that a -- If you closed half of your areas of marine reserves, that would lead to a reduction of your catch equally as drastic, and then we're talking a three, and I think that's kind of the level we're dealing with.

JASON COPE: That was going to be my presumption as well. The way that I see this is, if you do convert this into a management measure, we're talking spatial management here, when we talk fishing grounds, and people go fish in certain places because of all of the reasons above that you just mentioned, and so where you fish is very important and is reflected in what is landed, or caught, or interacted with, and so, yes, my presumption would have been that these would both be, for both of these fishing fleets, a three. Any arguments against that?

JUAN CRUZ-MOTTA: More than a comment, a question, but wouldn't you give a heavier weight to the commercial fishing than the recreational fishing? I am saying this because, in my very limited experience, among recreational fishers, there is an important component of that fleet that is randomly fishing, that they just go out and fish, and whereas, the commercial fishing, they all go to places where they know they will catch something. Thank you.

JASON COPE: A question on my end for this. When it comes to recreational fishing, how much recreational fishing is allocated from local recreational fishing versus tourism?

JUAN CRUZ-MOTTA: Here I would say, and Richard would know better than me, but I would say that it's more local than tourism.

JASON COPE: Okay, because that definitely matters. Obviously, with tourism, you want people to catch stuff, and so you are going to go to fishing grounds. If it is leaning a little bit more on just folks going out and fishing, and then it's a little less tied, and so, yes. I mean, I don't think you would probably lower this beyond a two, and do others thing that, because of that reason, it should drop to a two?

RICHARD APPELDOORN: No, I think it should stay a three. Yes, there are some people who are just going down and don't really kind of know where they're going, but there are others that -- I think the bulk of the people at least know the kind of habitat they want to be in and are familiar with what they're doing. Even the people who are shoreline fishing have spots they like to fish off the shoreline, because of their past experiences, and so I don't think it's quite as random, although there are some certainly novice people out there that could be viewed that way.

JASON COPE: Right.

JULIAN MAGRAS: Can I make a comment?

RICHARD APPELDOORN: Go ahead.

JULIAN MAGRAS: My comment on the recreational side of it that I see here in the St. Thomas/St. John district -- For the recreational side of it, most of it is based on the pelagics, where they would rent boats and go out, and they're fishing for tuna and wahoo and stuff like that. As far as it's concerned to the fishing on habitat, as far as fishing on habitat, that's not taking place. It's very, very little, even to the weekend warriors, and they more target the wahoo and the dolphin, and so I just wanted to put that on the record.

Then, also, one other comment, and I don't know if this is the right format, but we talk about discards, and I was listening to that, and I didn't comment, but discards and bycatch -- Bycatch needs to be looked at in two different aspects, because seasonal closures -- We release that part of the catch, which is considered bycatch, because it's closed for that period of time, and we also have the spiny lobsters, the undersized spiny lobsters and the eggers that we release, and then you also have like the no-catch, like the Nassau groupers and stuff like that, and so all of those are released, but they're not released at a mortality rate. They

are released where there has to be a high percentage of survival, and so I just want to put out, when we're weighing some of these points, that we need to take into consideration some of those aspects. Thank you.

JASON COPE: Thank you.

WALTER KEITHLY: I was going to go back to the fishing grounds. Could I see the definition of fishing grounds again, please?

JASON COPE: Absolutely. Yes, let me jump up to that. Down here at the bottom, and, again, it really highlights -- This is the spatial component of the fishing activity, just where things are happening.

WALTER KEITHLY: Okay. I see it now, and, again, as I said at the last meeting, I am not giving any quantitative numbers to any of this, because I don't think I know enough about the systems to get a hold on this and any further presentations, but, having said that, again, it comes down to a short-run effect versus a long-run effect, it seems to me, that, in an unfished area, fishermen will go out to the preferred area, and that eventually may be fished down, to the point where the CPUE declines, and then they move to another area, which was less preferred originally, and so I just -- Again, a lot of these factors, components, we're looking at, it's very difficult to look at them in isolation and at a given period in time. That's all I'm going to say. Thank you.

JASON COPE: Your point to localized depletion is certainly something on my mind and why I think this -- It's one of the reasons why I leaned towards a higher number for the fishing grounds to have an influence, because of that exact thing. People go where they know they're going to catch animals, and, when they don't catch any more, they more somewhere else that may not be their first choice, but it's going to be a choice based on something.

It's not just completely and utterly random, and that sort of localized depletion effect is quite devastating to some populations, and that's the spatial component of fisheries, which I think is captured in this component of fishing grounds, and that's why I think it should be a three.

WALTER KEITHLY: Okay. Again, I'm not going to give any quantitative numbers on anything, but it's just difficult, conceptually, for me to assign numbers to a lot of this, these factors, components, because I think there's a difference between short-run and long-run effects. Okay. Thank you.

RICHARD APPELDOORN: Walter, we could consider a line running back from commercial fishing to fishing grounds, and that would take into account that idea that potential excess fishing in one area would lead to a shift in the grounds.

WALTER KEITHLY: I think that's what happens, but, again, I don't want to make the model any more complex than it is, but it's just a concern that I have and I think a problem with assigning a number to it. Again, I don't mind saying whether it's positive or negative, but, when it comes to quantifying it, I just have some concerns with doing that. Thank you.

JASON COPE: That underlines the big challenge here. I think most of us could probably put the right signal on here, positive or negative, but, as far as magnitude, actual magnitude, I think that's where we're going to struggle the most, and, yes, what is really the difference between a one, two, and three?

It's kind of hard, for me as well, to conceptualize how big of a jump and how that plays in the system, et cetera, and so I think, at this point, we just try to do our best, and maybe the suggestion is we don't get too hung up on that exact magnitude of is it a two or a three.

I think what we're expressing here is that fishing grounds have an impact where they raise fishing mortality and that they're important, and I think that's what we're trying to reflect in that qualitative statement, which we believe. We're trying to turn it into a quantitative one, which we don't really have a good measure for that.

WALTER KEITHLY: I don't know if I understood Mandy correctly this morning, but, in either the Gulf or the South Atlantic, they did not attempt to quantify any of these components, but just a qualitative positive or negative relationship. That's not to say that we should not quantify it, but I just feel ill at ease trying to do so.

JASON COPE: I mean, I think, by at least throwing some numbers in here, we also capture that positive/negative relationship, and so, at the worst, you could reduce this down into a positive or negative, if that's ultimately what would want to be done, but just throwing somewhat of an attempt at a magnitude -- As long as we don't get bogged down, and I don't think we should argue too much on a two or three, and I think we put something in there and understand kind of the discussion we're having and then move on and get this set up, because we're going to be revisiting this

often, I would assume, and so this is just our first scratch at this.

WALTER KEITHLY: Okay. Let's proceed.

JASON COPE: Does that sound all right?

RICHARD APPELDOORN: There are two comments, one from Carlos Farchette that fishers also go to fishing grounds to target a group of species that may not be in other grounds, and so not all fishes are found everywhere.

Nelson Crespo says, in the west coast of Puerto Rico, we have a high increment of recreational fishers, especially in the live-bait fishing for deepwater snappers.

GRACIELA GARCIA-MOLINER: I just have one question, so that we can move on. The fishing grounds, the seasonality of the fishing grounds, which is what -- It also applies to what Carlos was saying, and, I mean, we don't have too much work on that, but we know that there is that seasonality of changes in fishing grounds, not only because of the species, but because of the same species moving along different habitats, and so I will just keep that in the --

JASON COPE: Do you think we should add an arrow here?

GRACIELA GARCIA-MOLINER: Yes.

JASON COPE: That's very true. Good point. Do I make you also give us magnitude for such a good suggestion?

RICHARD APPELDOORN: That's your reward.

JASON COPE: That's a reward.

GRACIELA GARCIA-MOLINER: I would go middle ground.

JASON COPE: So a two. All right. Forgive me if I just start putting -- If I just put a number in, it's more to elicit response than me saying I know exactly what I'm talking about, and so, if I do that, please use it as an opportunity to say yes or no.

Michelle has posted this, and she posted this I think right before the break as well, but would you included a released live box, and that brings us back to this discard thing. What I want to do is I think we're going to have more of a deeper discussion when we get to that box, and so I want us to not forget that comment when

we get there, and we can talk about how we want to reconcile some of those differences, which we kind of brought up a couple of items regarding bycatch and discards already, and so let's keep that, and let's move through this and get to that box, and then we can really dig into that.

ALIDA ORTIZ: I have a simple question. If you have that fishing seasonality connected to fishing grounds, are there different fishing gear to different fishing grounds? Is that a connection, too?

JASON COPE: I will let others say whether different fishing grounds have different fishing gears.

RICHARD APPELDOORN: Well, yes. I think that's true, in the larger sense. There are limitations to where you can put traps, in terms of slope, for example. If you're out doing some of the pelagics, you're not going to be using certain types of gears, again, and so, yes, there is a connection between the grounds and the type of gear you would be using.

ALIDA ORTIZ: I don't dare put a number on that connection, but there is a connection there, and I feel that is correct.

JASON COPE: A suggestion would be -- Let me just physically do this. If we do this, which is what I'm hearing, and so now what that implies is that --

RICHARD APPELDOORN: No, it's the other way around. The ground determines the gear.

JASON COPE: Got you. Okay. Great. This is going to increase, and so, just so we see this, we have fishing grounds connected to commercial fishing, but now we also have it connected to commercial fishing a second time through this interaction, and so we would rather -- Basically, what you're doing is you are elevating fishing grounds above a three and its interaction with commercial fishing, because it has two channels to affect it, and I just want to make sure that what we're talking about isn't just in this kind of maxed-out three value anyway, and does that make sense?

RICHARD APPELDOORN: Let me go back and give a different viewpoint of fishing grounds from Alida's, and not taking away from what she said, or was suggesting, but fishing grounds -- You're largely talking here, I think, about the amount of fishing grounds, and, therefore, subsumed into that is how you're going to fish those grounds, in which case we would not draw the connection, and there would just be a an acknowledgement that there is a gear that's

used, but we were talking fishing grounds basically in the context of is this going to get greater or smaller, and that's how it's going to affect these things.

In that context, I don't think it affects the fishing gear. The location of the ground does, but I don't think that's necessarily what we're talking about. Obviously, this could come into play if we were driving fishermen say off the platform, because say, hey, we closed the platform, and now you have to go fish for dorado and wahoo and whatever, and then fishermen who were fishing the platform with traps or something are going to have to change their gears, but I don't really think that's the context of which we're viewing these things, and so I would take the arrow out.

JASON COPE: In particular because we've already maxed this out. I think, if there were components to this, which we wanted to put together, but to have it be even more influential to that. Rich, to your point, I think I agree with that. Not that that consideration isn't unimportant here. It absolutely is, but I think we're capturing the essence of it through here, even if it's not explicit in an arrow. Is everyone comfortable so far with those additions and changes?

Then we're going to move to fishing seasonality. Obviously, we can come back to any of these as we talk, and you might have more opinions, but let's move to fishing seasonality. This is another one that I assume has a decent level of influence. My guess would be a two or a three.

RICHARD APPELDOORN: I would say a two, unless you're actually closing an area, and that makes it a fishing ground issue.

JUAN CRUZ-MOTTA: Yes, I agree. I agree, and I was going to say two.

JASON COPE: For both of those sectors? All right.

GRACIELA GARCIA-MOLINER: The fishing seasonality impacts more the commercial fishers, because there is more compliance, usually, and they are more aware of the regulations, et cetera, or the seasonality of whatever species they are targeting. For the commercial, it would be higher. I am not an SSC member, but that's the --

JUAN CRUZ-MOTTA: I agree, Graciela.

KEVIN MCCARTHY: I have a question about what we're talking about with seasonality here. Are we talking about different times of

the year are better for catching a particular species, or are we talking about a regulatory thing, which I thought was coming in from another sub-model?

RICHARD APPELDOORN: We're talking about a regulatory thing that is coming in from a separate sub-model, and that's how it will link in. If you change a regulation -- That box will just say "fisheries regulations", and so the ones that affect seasonal limits will go to the seasonal one. The ones that create MPAs will go to the fishing ground one, for example.

KEVIN MCCARTHY: Okay. I just wanted to be clear on that.

RICHARD APPELDOORN: I have a -- I hate to bring this up, but both fishing grounds and seasonality usually are management measures that are initially put into place as a mechanism to preserve something, and usually, especially in seasonality, it's spawning stock, and so, while you close an area, that's going to reduce the amount of fishing that is going on, but it will have a positive -- It's supposed to have a positive impact on the population, and in fact might reduce fishing mortality, and so we don't have that kind of connection built into either seasonality or fishing grounds.

JASON COPE: Yes, that's true, because that's the whole -- Well, so I guess the perspective here is it's really access to fishing grounds, is really what this is, right, if it's going to be like this positive-three, and it's access, and, as you reduce that, it's going to reduce the fishing mortality, which is where this is getting at.

RICHARD APPELDOORN: So, yes, it is incorporated, exactly the way it's set up.

JASON COPE: Yes.

RICHARD APPELDOORN: Then we're good.

JASON COPE: Yes, we're good. Then fishery infrastructure, and let me go back and remind us what we're -- We don't have a definition for that, and so we might want to have a little discussion on what we're talking about here. I can imagine a few things, but does anyone have a feel on that component, as far as let's start with the commercial fishery.

RICHARD APPELDOORN: This could be anything, but, if you have well-established fishery co-ops, where they have facilities to get ice and keep their stuff on ice when they get back, there is an outlet

there for sales that people can come to. Boat ramps makes it easier to get in, and that's also maybe more so recreational fishing, and so those kind of facilities that facilitate fishing, one way or the other, and that's going to be influenced by market demand. If you have the infrastructure, it helps you meet that market demand, by being able to bring in and maintain fresh products.

JASON COPE: Yes, and that's a good definition, and so, in regard to that, how would you rate this? Obviously, the more structure, the more ability to go out and do what you want to do, and so, yes, it's increasing fishing mortality. Relative to these other things that we're already setting at twos and threes, what do you think the fishery infrastructure would place in the system as?

RICHARD APPELDOORN: Either a one or a two. Maybe somebody has some more experience with that, or some of the fishermen can comment about how important some of this stuff is to their ability to get out and fish.

JASON COPE: I'm going to put in a one, just as a starting point. Anyone --

TARSILA SEARA: I would be okay with a two. I think there are going to be some important interactions when we start to talk about coastal development and some of the aspects of the fishing community resilience that are going to be interacting with infrastructure and the presence of infrastructure, and I would be more comfortable with a two, but that's just my opinion.

JASON COPE: Great.

RICHARD APPELDOORN: I am comfortable if she is.

JASON COPE: Yes, that's fine with me. On the recreational side, we're talking --

RICHARD APPELDOORN: I think it's just as important. It's basically the marinas and boat ramps.

JASON COPE: Yes. Bait shops and all that whole huge infrastructure. Okay. Great. Let's come back this way now. Let's talk about fishing gear. Fishing gear has five different places that it plays into, those two that we've been talking about, recreational and commercial fishery removals, or catch, and it also feeds into fishing mortality directly, which we can talk about what that means, and derelict fishing gear, and, again, derelict gear fishing gear is specifically the detrimental side of left

gear, and then down to the discards.

Now we might start entering into -- Actually, let's move to the IUU first, because that isn't getting into the discard issue, and let's take care of this one first, and so it has three entry points, through the recreational and commercial, and then its own thing. I am curious about this, and so the IUU -- This is basically the poaching, underreported and unregulated stuff, and so these would be folks illegally recreationally fishing. I am assuming this line are those who are illegally getting things to sell, and then I'm not exactly sure what this line would be. Do we need this third input direct to fishing mortality?

RICHARD APPELDOORN: Well, that's a good question. I think the thinking there was that these are things that are just not showing up that occur, and so you don't know whether they are commercial, and you don't know whether they are recreational, but I think your point is well taken that it's going to be one of the two, regardless of whether you know what it is or not, and I think it was there because, before, we were talking landings.

This comes back to, okay, what is the -- For example, the line going from commercial to fishing catch, to fishing mortality, we kind of said, well, that line is the definition of landings, but it's not if you have unreported stuff.

WALTER KEITHLY: Mr. Chairman, it seems to me that IUU fishing directly influences fishing mortality, but it would also indirectly influence your commercial and recreational catch by subtracting from the stock, and so, again, you have a very direct relationship. The higher the IUU fishing, the higher the fishing mortality, but, the other way, increased IUU fishing, that's going to lead to a reduction in recreational fishing and commercial fishing.

JASON COPE: That's an interesting point, and so the bulk of the poaching is coming from this, whereas this right here is actually maybe in a negative direction, towards these two. That's what I am hearing from there, and that's an interesting way to interpret this. I think that's absolutely the way we can do this, because the other suggestion would be to say just take these two lines away and just have IUU directly contributing to fishing mortality, because it's disassociated with these two fleets, and it's basically a third fleet, a poaching fleet.

TARSILA SEARA: I just wanted to make a comment that I agree with that, with what Walter said. The one thing that I am thinking here is that there is some direct connection between the IUU

fishing, and, at least for the commercial sector, with poaching directly from traps, and I don't know if that would be better captured by a direct connection there, because it's not necessarily just subtracting from the stock and then affecting the catch, but it's actually directly affecting, because there are fishermen who are poaching directly from traps.

JASON COPE: They are stealing from them. Okay. So a suggestion here would be -- Again, the magnitude I don't know. I don't know what the magnitude is, but the suggestion could be, here, that these are negative values.

TARSILA SEARA: I don't know if that happens in the recreational sector that way, but that would be maybe a question for --

JORGE GARCIA-SAIS: They don't like it. The fishermen don't like those illegal fishing activities. They don't.

JASON COPE: So this negative would be reflective of the fact that, when poaching goes on, it just reduces the overall opportunities, because the population is affected. This negative-two is doing that, plus the idea that they're getting directly stolen from, and then this three is saying that there is a significant amount of poaching going on.

Now, I don't know if that's true, and maybe the magnitude of this is a one or a two, but I understand -- The way that this is set up right now would be this is through effects on the population, and this is through effects on the population and direct stealing from the commercial traps.

Does this -- I like this setup, and I like this suggestion of going negative here and showing that effect on these, but still having this direct one go right to fishing mortality. We want these to be in the negative, and does negative-one or negative-two -- Unless you think that this is just rampant stealing from the commercial, two is probably as high as you would want to go.

JORGE GARCIA-SAIS: I would go with one.

JASON COPE: With one on commercial?

JORGE GARCIA-SAIS: On commercial, minus-one, and I don't think it's that -- At least in Puerto Rico, it's not that bad, but it is presently occurring.

JASON COPE: Okay, and so it happens, but it's not a huge effect on the commercial fishery, people being robbed.

JUAN CRUZ-MOTTA: I very often hear the fishers on the west coast complaining about the catch being stolen. I mean, I would put a different number in those two lines, because I think it's a bigger issue for the commercial fishers than for the recreational fishers.

JASON COPE: Yes, and that was the kind of hope, was to create contrast.

RICHARD APPELDOORN: A note that Nelson wrote, a comment, is that stealing from fishers is very common in the trap fishery.

KEVIN MCCARTHY: Just so I'm clear on where we're headed, and I hope that I am, and I'm totally fine with this idea, but, effectively, what we're saying then, given the way we're keeping all these lines, is that the box that is commercial fishing catch, that's the catch that we know, and that's the catch that is reported, and then the IUU, of course, is estimated.

As the name says, it's illegal, and it's unreported, and it's unregulated, and so, just so we're clear, currently, except for some voluntary reporting that is just getting started in the Virgin Islands, all of the recreational fishing catch is unreported, because we don't have a program to collect it, and so just so we're clear on that.

RICHARD APPELDOORN: Right. So, when we adapt this model to the situations in the Virgin Islands, the scores might change here.

KEVIN MCCARTHY: Right, and I don't know what we would want to do, but we're not to recreational fishing catch yet, and so we can chat about that again later, but I just wanted to make sure that everybody is not forgetting what the reality is on the ground.

RICHARD APPELDOORN: I was going to make a comment about our minus-two. How that goes depends on what happens to those things that are stolen, and so, if commercial divers, or recreational divers, are stealing from the traps, for example, but they report it as their commercial catch, or their recreational catch, it's still going through those channels, and it would not have that kind of impact.

That's just that the person who legitimately caught them is losing, and so, in that case, I would make it a minus-one. It just depends on is it going in -- The stuff that's stolen, is it staying within those pathways, or is it going straight to that IUU to fishing mortality box?

JUAN CRUZ-MOTTA: Since we don't know who is stealing, because what you're saying is that everybody that steals is basically a commercial fisher, right, and since --

RICHARD APPELDOORN: No, it could go either way. It could go that recreational guys could steal it, just as -- They would probably do more.

JUAN CRUZ-MOTTA: If that's the case, it's not counted towards the commercial fishing catch, and it's being used by individuals at their parties or whatever they are doing with that.

DOUGLAS GREGORY: At least here in the Keys, people that tend to rob from others will also take undersized fish and exceed the bag limit and probably not report it.

CHURCHILL GRIMES: What do some of the fishermen have to say about this? I mean, what actually occurs in Puerto Rico or in the Virgin Islands? What's the nature of it?

RICHARD APPELDOORN: Well, I said that Nelson was saying that theft from trap fishermen is a significant problem, but the question here is basically who is stealing it and what pathway does it take after that.

TARSILA SEARA: I think the fact that we don't know I think just strengthens the need for that relationship there to be somewhat moderate, I think.

DOUGLAS GREGORY: What do we care? It's under IUU, and what do we care if it's a commercial person or a recreational person or neither?

RICHARD APPELDOORN: Well, it would be whether that person was reporting it as their catch, and so, if it's a commercial fisherman stealing from another commercial fisherman, but he reports it, it actually has no impact toward the commercial fishing catch, but it's just someone else is reporting it instead of the initial person. If it's a recreational person stealing from a commercial, it does detract from the commercial catch, but it's going to actually add to the recreational catch.

If it's somebody who is not reporting at all, then it goes into that third line, but I think Walter made the point of, since we don't know, maybe we should not be making these things too important, but acknowledge that they're there, and we can tweak them as we come into the different systems, and so a minus-one for a minus-one.

Vanessa is online, and she had a comment. It says, from her experience working daily in the fisheries, for every commercial license, we have two without.

JASON COPE: That speaks to this third line.

RICHARD APPELDOORN: Correct.

JASON COPE: So maybe this is a three. It sounds like this is a significant issue. Remember that, these other two lines there, the other thing that they were trying to measure was the population feedback if you are basically doing a large amount of removals that is undocumented, and so illegal, et cetera, and that's going to feed back into these other fleets and their opportunities, which was the initial suggestion of why we want something negative.

Then, in addition to that, it was brought up the fact that the commercial might have a bigger effect, versus the recreational, because it doesn't just have that population feedback issue, but it has actual stealing going on from them, and so it's limiting this, and that was why there was a desire to break this up.

Now, these are really coarse levels, a negative-one, negative-two, negative-three, and that's all you have, and so the real question is, in the population feedback, is the stealing significant enough to make these different, or should we just make them negatives right now, with the knowledge and understanding that part of this is also things being stolen?

DOUGLAS GREGORY: I mean, you can't steal from a recreational catch, but you can steal from a commercial catch, and so they shouldn't be the same.

JASON COPE: Right, and that's kind of our dilemma here, is we know that these are both starting from the same place, having the same population feedback issue, and so that gives them a negative value, but there is something additional going on that sounds like it's common, and so that was the idea of having a two here, to at least differentiate these two things.

JUAN CRUZ-MOTTA: I would agree with Tarsila and what we were saying that there should be differences here, and I would be happy with the way it is now.

JASON COPE: Okay. Let's go with what we have here right now. Again, this isn't the final, final version of anything, and I think we've got a good space here, if we want to revisit it at some

point, but I think that was a really good discussion to have, and there is more to be had here. All right. Thank you for that.

RICHARD APPELDOORN: We had a number of comments, again from Vanessa, and also Nelson, that a lot of recreational people are in fact selling their catch, which doesn't affect the conversation here. It's obviously a regulatory problem for the fisheries, because it screws up what is supposed to be commercial and who is legal and who is not and whatnot, but, in terms of the way we're drawing flows in the boxes here, it doesn't affect it.

TARSILA SEARA: I just wanted to make a comment about that. When we get to the socioeconomic and cultural drivers sub-model, we will be able to address some of these concerns about the market price and whatnot through these illegal activities.

JASON COPE: Good point. All right. Well, just so we can keep moving on here, and we're almost done, and I think these might actually get a little easier, to some extent.

KEVIN MCCARTHY: Jason, before you move on, I just want to ask a quick question. Is there any need for a line going from IUU fishing to dead discards, or are there no discards that we're -- Is that not an issue? I just don't know, and, of course, we would have no way of knowing what that magnitude is.

JASON COPE: It's almost like -- You could almost also bring that the opposite way. Some of these dead discards, that is unreported, and so that's actually feeding back into the IUU and going into there, and so which way is the -- Because these would be commercially caught, or recreationally caught, but then just thrown back without any reporting, and so I would almost argue that you would have a feedback path to the IUU that way, but I think that's the intention of this box in and of itself, is to identify that phenomena of not reporting and throwing it back and having things be dead.

I think these two things are related, and I think this got broken out to identify a particular part of one of the U's, which is the unreported, and that's my interpretation, and so I think, if we link these, I think we're doubling up, whereas we've broken this out of one of the U's. That's my interpretation of this.

KEVIN MCCARTHY: I'm not suggesting that we do it, but, before we move on, I just wanted to bring up the issue and see what people's thoughts were on it.

JASON COPE: Yes.

KEVIN MCCARTHY: I don't have strong feelings one way or the other, but we did use the term, or perhaps you used the term, that this IUU box is almost like a third fleet, if we think of recreational catch and commercial catches as fleets, in the sense of sort of modeling this thing, and so, if that were true, then a lot of -- We might need to consider some other arrows, and I'm not suggesting that we put them in there necessarily, but, before we move on, let's take a look and see if we're missing any connections. I can be content with your explanation of the unreported stuff and the discards and no particular need for an arrow going in either direction.

JASON COPE: I guess the other argument of, even though this is a third fleet, it's a rogue third fleet that is not connected to any of these other sort of things that are going to be affected through management measures. It's its own thing, and so I think that's why it also kind of lacks some of the connectivity to some of these other higher-level things that these other two fleets do.

KEVIN MCCARTHY: Right. I would agree.

JASON COPE: I think that's a really good point, and I think, as we have it set up here, it can be reflective of that detail in the IUU and the relationship to bycatch, as long as we treat it that way in our scoring.

I am just trying to fill in some blanks here, to do some easy stuff, and I'm assuming that commercial fishing is probably a three, and so I'm assuming that's not controversial. Recreational fishing, also a three?

RICHARD APPELDOORN: Also a three.

JASON COPE: Great. Let's just talk about the commercial and recreational inputs into the discards. Pretty high for both? Would these also be threes?

TARSILA SEARA: I would agree with that.

JASON COPE: Any alternative opinions here?

WALTER KEITHLY: This is one area, one of the few areas, that I think we have some documentation on, and I can't think of the name of the firm out of Tampa that has actually looked at how much discarding there is by the commercial fleet, at least in Puerto Rico. MRAG is the firm that I am thinking of.

It seems like this would be one situation where we ought to be using available information to make a determination on quantification, and, as I recall, there is very little discards, but somebody else may remember more than I do.

RICHARD APPELDOORN: Walter, your points are correct, but that would show up in the box from discards to fishing mortality, and so, as I see that, the greatest source of discards, whatever magnitude they are, come from the commercial and recreational fishing. Then we might say, but, they're not so much. Therefore, the connection from dead discards to fishing mortality might be a one.

WALTER KEITHLY: My recollection is that there was very little discards by the commercial fishing industry. If in fact that is the case, there would be no discards, and so it would be a very minor impact.

RICHARD APPELDOORN: Well, then a one.

JASON COPE: So is that a suggestion that this is a one?

RICHARD APPELDOORN: No, not from me. In other words, who is impacting the number of discards? The discards could be low, but who is impacting that directly? The commercial and recreational fishing. The three on those lines doesn't say anything about how much discarding there is. It just says where it's coming from, and so the dead discards, whatever level they are, are directly and strongly impacted by commercial and recreational fishing.

JASON COPE: Correct. So where this comes from, no matter how much, is this, and then we get to this next one, which we were going to get to, is what is the magnitude of bycatch? Now, it sounds like we're saying, overall, compared to other removals, which are these three fleets, removals from the system by dead discards, due to this bycatch, is smaller, and is that what I'm hearing? It's obviously in the positive. It's contributing to mortality, but it's on the lower end.

RICHARD APPELDOORN: That's how I would look at it, and I have looked at the past studies on discards, and there aren't that many in Puerto Rico, but the fishermen -- Not so much discards as bycatch, but they do keep part of their catch, and they don't sell it, and they keep it for themselves, or, as I said, their friends and families -- There is some social connectivity going on there, and so it's not zero, but it's not very large.

JASON COPE: Yes. I am just doing a quick check-in on the chats

here. These are a little lagged, and at least we might look at these, and some of them are about ten minutes ago.

RICHARD APPELDOORN: Michelle's is the only new one.

JASON COPE: Just, for folks that posted the others one, I hope that our discussion has -- If it has not resolved what you were thinking about, please bring it up again. Michelle says that recreational releases would reduce to two towards discards, and so there's a suggestion that maybe discards would be two. Okay. Then Nelson said they only discard what the -- I think they were thinking that this was a three, and should this be a two? Any suggestion there?

WALTER KEITHLY: Again, I'm just looking at it differently. Again, I am not going to put quantifications on anything, but I would argue that it's a strong relationship between the commercial fishing -- I mean a weak relationship between the commercial fishing catch and discards, but then a very strong relationship between the discards and mortality, and I'm just looking at it the other way. I guess you can look at it either way, but, to me, if there is very little discards out of the commercial fleet, then it has little impact on dead discards, but we know that's fatal, the discarding, and so you would have to account for fishing mortality.

JASON COPE: I think the way -- Just to put it a different way, I think we're looking at this -- Say if there was fifty metric tons of discards that we just somehow knew, how much of that is coming from this and this is going to determine -- Say, if they're equal, then they're getting high values here, whereas one might get lower, and one might get higher, but, overall, fifty metric tons to the population or something might be very low, and therefore this is going to be low.

Now, the weird thing here is, if you do think about it, and I think Kevin was the one that brought up the fact, and Rich and others have mentioned this I think, but you can actually quantify some of these things, unlike a lot of these other things, which are a little harder to do. You can actually go get numbers to measure this sort of thing, but then they become relative to each other.

We know they're positive, but a three is not necessarily a three here, and that's where this becomes weird, because they all become relatively scaled to each other within each -- Anything feeding into those boxes relative to themselves, but then they're also at the same magnitude of these other things, and so it becomes a weird conceptualization of how these numbers play through, and I think our best bet here is just to think -- Regardless of how much this

is affecting fishing mortality, of whatever is discarded, is it mostly coming from this, because we know these are two positive things, and is it mostly coming from this, or do they have kind of an equal contribution?

Walter, to your point, I see what you're saying, in the sense that they may have an equal contribution, but what if this is only ten metric tons? This is going to be small, but, in reality, this is also going to be small, because, if you give it a three, you're saying it's at the same level as this, which it may not be, because it's just smaller.

Even if all of it was coming from the commercial, would that justify this being a three? It may justify it being a one, relative to everything else, and so I do see what you're saying. Regardless of how much it overall affects this, these do play through the system relative to these other numbers, and I think that makes it a little strange, because we can't truly isolate these.

RICHARD APPELDOORN: I think the numbers is supposed to reflect the strength of the connection and not the flow rates between them, and that's how I have understood all the numbers that we're talking about here, and so we can say what impact does commercial fishing have on dead discards, regardless of the amount of dead discards, and what impact does commercial and recreational fishing have to dead discards, and those are the only two sources going to dead discards.

Now, you could say, hey, one of those doesn't do any bycatch or discards at all, and the other one does it all the time, in which case those numbers would not be the same, but dead discards is totally dependent on those two things.

JASON COPE: Exactly, yes.

JULIAN MAGRAS: Can I make a comment?

RICHARD APPELDOORN: Go ahead.

JULIAN MAGRAS: We might need to be looking at it in a lot of different ways, because, with discards, you're looking at mortality, which, for a fisherman -- I've been a fisherman for thirty years, and I look at discard mortality as being very low, because -- There are several reasons.

A lot of the fish that we release, we release them alive, like the big olewife, the queen triggerfish, the fish that are poisoned, but then, at the same point, some of these fish that are being

released are feeding the predators, the sharks, the frigate birds, and it all ties in.

For all my forty-plus years of being out on the water, from when I was a kid to present, this is all part of the circle of life, and, if these species don't get what they are supposed to get to eat, then it's a problem. I think it all balances out, and I think the mortality rate on the releases, or the discards, is very low, and there are some papers out there also that we did with -- We did a couple of bycatch studies, and they can show the type of fish and what was released, and some type of mortality was calculated at that time, and so I see that it's very low and not on the high side.

RICHARD APPELDOORN: I think that's been captured by some of the comments that others have said, but I would also point out the fact that you just said that some of that release is going to sharks and whatever, and it's counted as dead discards. From the point of view of that fish, it didn't make it back into the population.

Now, once it's back in the population -- If it does make it back into the population and then there is predation, then that's just part of the natural cycle.

TONY BLANCHARD: Richard, can I make a comment?

RICHARD APPELDOORN: Let Jason go first and then Tony.

JASON COPE: Just quickly, I was going to say, likewise, when someone catches something, and instead of selling it commercially, he keeps it for the family, that is unreported, and so that's either in an IUU or it's in a dead discard category. It's in one of the two, right, and so dead discards isn't just everything that just gets tossed over the boat.

RICHARD APPELDOORN: Tony, go ahead.

TONY BLANCHARD: I guess I'm back to the comment that Mr. Magras made. The way I see it is just like he stated. I see it as going back into the circle, and the fishery, to me, is not just the fish. It's the birds and whatever else comes into play in that circle.

It would be like a -- I'm going to talk about discards. When you say that, if you toss the fish overboard and the sharks eat it, it didn't make it back alive, what about the guy, the poor fisher, that has a fish on the end of the line and the shark eats it? How are you going to classify that? It went back to feed the same

predator fish that would have normally fed on it, and it's no different than throwing the fish overboard, after you catch it alive, and the same predator fish eats it. It all depends on how you want to look at it, and I don't think we're looking at this in, in my opinion, in the right way in which it should be looked at.

This is all a big circle, and, if the predators can't eat -- The predators is at the top of the food chain. They keep things in balance. They feed off of the weak, regardless of if the fish is sick or it's injured, but they play a very big part of keeping the balance in the ocean, and so, like I said, once again, you throw it overboard, and the shark eats it, or the barracuda, and it still goes into that big circle of them having to play a part of.

RICHARD APPELDOORN: But I think, in this case, the way we're looking at it is that the recreational -- The fishing activity is what made that predation possible, and that's why it gets counted as part of the mortality associated with the fishing activities. Yes, it feeds back into the populations, and so it's not a total loss, in terms of its effect to the greater ecosystem, but it is something that would not have happened had that fishing activity not occurred, and we know, for example, that dolphins, in particular, and seagulls, will track boats, because they know they're going to get a meal out of it.

They change their behavior according to that. Is it a great way to maintain your dolphin population? I don't know. It's not a natural way, but maybe there are so many other stresses that it's actually a good byproduct of that, but I think that's outside the context of how we're viewing this model.

JASON COPE: In particular, to follow-up on that, this model, again, is leading everything to this term "fishing mortality" and fishing mortality is whatever is done, no matter who ultimately eats that animal, whether it's a human or another animal, but fishing activity removed its life from the system.

Now, the interesting thing though that was said is that maybe there's an interesting feedback from bycatch out of this sub-model into the ecosystem model, or something like that, and so, where there is a contribution, where the fishing mortality is calculated, having taken it out of the population, but it actually gets returned to the system, through these discards, that might be something to consider, but I think, in our measuring of fishing mortality, it fits firmly in that activity of removing individuals from the population, but we haven't --

JULIAN MAGRAS: Can I make one more small comment?

RICHARD APPELDOORN: Go ahead.

JULIAN MAGRAS: Also, take into consideration -- Remember that we installed the trap vents, and we moved from inch-and-a-half mesh to two-inch mesh, which released a lot of the compressed fish, and so a lot of that bycatch that we used to have, years and years ago, are being released automatically down on the bottom. This is for the trap fishers, and so I'm also throwing that out there. That, again, also brings down your mortality numbers.

KEVIN MCCARTHY: Can I add something here? Let's recall this big red connection magnitude, and we're not saying anything about the effects. We're saying what is the strength of the connection, and we're not saying there is a bazillion discards that all die, but we're saying, when there is -- Dead discards come from fishing activity, and we're not saying how much there are, but we're just saying that's the connection, and it's a strong one.

It may be very low in numbers, and it may be very low in number of dead fish, but there is a direct connection that is a strong one. The filling in and quantifying this is all the stuff that J.J. and Tarsila and others are going to be doing after this.

We're just talking about the strength of connections here, and so we're not saying there's a ton of dead discards. We don't know that number. We're just saying we think there is a strong connection, although the magnitude, or the value, or counts of those dead discards, may in fact be small, depending upon the species. That's where we're at right now, and I understand it.

JASON COPE: With what Kevin said, does this one reflect dead discards, and the strength is kind of a weaker -- It's basically the weakest positive effect on fishing mortality, and is that a fair thing to say?

RICHARD APPELDOORN: I think so.

JASON COPE: Okay. Well, I think what we have left is mostly fairly easy, because fishing gear, I'm assuming, is a three. Fishing gear is incredibly important, and it defines our selectivity, which ultimately determines fishing mortality, and the comment that was just made is that you can highly influence the amount of discards and so forth by selective gear, and so I would think that these would all be threes. I was curious, again, about this direct line from gear to mortality that doesn't go through some sort of --

RICHARD APPELDOORN: I was going to say remove that. I was questioning that one as well. Either it has to go through the fleet, or it has to go through the derelict --

JASON COPE: Exactly. Okay. Good. That just leaves us here on the fishing gear effect on the derelict, and, again, this is the negative effects of derelict fishing gear that causes mortality and not the positive effect. Is this also -- I mean, I would think that the fishing gear is going to predetermine whether it's -- The derelict fishing gear is highly determined by the fishing gear itself, which would then leave us with this arrow of this magnitude from fishing gear to fishing mortality. It sounds like it's lower, from the discussion.

RICHARD APPELDOORN: I have a comment on that. If we're talking about the magnitude of mortality, it's been greatly reduced by changes in gear and fishing practices over the years, and some of that has come about through regulations, like increasing mesh size and putting in escape panels and things like that, which were done by lines coming from fishing regulations, and so, when we're looking at the current state of what's going on now, that is already encompassing the effect of those fishing things, and so, if those regulations weren't there, these numbers could be quite different, and so I'm not sure which numbers we're supposed to be looking at, the potential or the actual.

JASON COPE: You're talking about for all of the fishing gear?

RICHARD APPELDOORN: No, I'm talking about directly this derelict.

JASON COPE: Okay. Thank you.

RICHARD APPELDOORN: Because what we want to be able to say is, okay, if we make changes at the regulatory level, they will feed into this sub-model and help control fishing mortality to levels that are optimal for the fishery. Now, to a large extent, as Julian was explaining, that has been done, particularly in the trap fisheries, already, and so, I mean, do we leave this as a one, but all these things could then change?

I mean, because, if you asked me forty years ago, what about derelict gear, I would have said maybe it's bigger, and I don't know. I am actually comfortable with a one now, and so maybe I'm just raising these things and we're not really going to change anything, but there is a situation where we're looking at the situation now and not what it potentially could be in the presence or absence of regulations.

JASON COPE: Right, that latent effect, where things could escalate quickly without certain safeguards.

KEVIN MCCARTHY: Nelson has got, in the chat, back at 2:05, and Nelson has got a comment about unattended or abandoned fishing gear, like trammel nets, is very dangerous, and I guess something about poachers and the data are not reported, and so I guess that's also -- I have no idea whether derelict fishing gear or fishing mortality should be any more than a one, but I guess it's also that not all gears are as benign as a lot of the measures that have gone into traps to try and prevent them from being problematic if they are lost or abandoned, but I'm okay with a one being there.

RICHARD APPELDOORN: I think the comment is a good one, but I'm not sure it's here. I have heard, from fishers, some actual horror stories about people who are fishing gillnets and trammel nets and they just leave them in there, I guess for lobster, and they're just throwing away gobs of fish, and so that's dead discards, and just keeping the lobster, and it's usually unlicensed fishers, but the gear isn't derelict.

They are coming back to it, at some point, and getting all this stuff, and so there are components of the fisheries, and maybe that's an IUU thing more than something that is passing through the commercial fishery, but those are catches that don't show up that do cause mortality, but, from the IUU point of view, we said there aren't really discards, but they are just taking everything, for the most part, causing it directly into mortality.

JASON COPE: Okay, and so I feel like this sub-model is pretty well established now, and we've taken out some connections, and we have revised a couple of things, and we have the magnitudes in there. This is the full version now, but the thing here was just the next step would be to do the sub-model connections, which I believe we're doing later and not now, correct?

RICHARD APPELDOORN: That is correct.

WALTER KEITHLY: A question, and it's more of a general question, and I don't know who to address it to, other than the fact that we've discussed a lot of issues with being -- Now, these arrows all go one way, all impacting fishing mortality.

Obviously, fishing mortality, either simultaneously or recursively, will then feed back into affecting the commercial fishing catch, the recreational fishing catch, and the IUU fishing. How is this going to be handled through these different models?

JASON COPE: This is the sub-model connections, I believe, because this would have -- Fishing mortality would then go out, and then coming in would be from the sub-model that contains the management measure sort of stuff that is going to come in and affect where you can fish, when you can fish, maybe infrastructure, how you fish, and it's going to come in that way, and that was my understanding.

RICHARD APPELDOORN: Well, even -- I mean, I agree with that. I think Walter is saying would there not also be lines running, negative lines running, from fishing mortality back to commercial and recreational and IUU.

TARSILA SEARA: Wouldn't that come from the ecosystem sub-model, where fishing mortality is going to impact the resource and the resource is what is impacting the amount of catch?

WALTER KEITHLY: I don't know, but it's just a question that's been bothering me since we started this, is that, obviously, what we want to look at are the long-run effects, and this sub-model only captures the short-run effects, and it may, after we put all the models together -- Maybe there is this feedback mechanism, but I certainly do not see this feedback mechanism model at this stage of the analysis. With that, I will stop.

GRACIELA GARCIA-MOLINER: Can I say something? If we go to the Excel file, and we have it the way we had it set up, you can actually do the loops around, and so what you're saying, Walter, is that fishing mortality will have an impact on -- You see here that we have everything on the top and everything on the side, and then we can transfer the numbers that we had, and so they all go in one direction, but then you can actually look at this and how that would influence each of the other boxes in the opposite direction, if there is a connection. Did everyone follow what I just said?

WALTER KEITHLY: I kind of follow what you just said, but are we going to do that, and when?

GRACIELA GARCIA-MOLINER: The when, you could do it now, because, basically, you filled this in one direction, and so now you would have to do the other side, and you just mentioned three of all the things that we have in there that would be impacted by fishing mortality in the other direction, and so that would be one way of doing it.

JASON COPE: It may take some iteration here to figure out how the

other sub-models do connect and provide that feedback system and linkage, and if that is insufficient to capture any remaining links that we think are important, we would have that chance, I believe, to fill them in here, to make sure that it's totally covered, right, and so I guess the question becomes do you do the sub-model connections first and then do a second passthrough, to make sure that all the connections that you think are important are there.

Walter, this is like a general -- Like you said, this is a general -- It's very prominent in this fishing sub-model, but it's also a general comment on how all these things are going to go together, because there may be some other internal feedback things that could be taken into consideration, through linking sub-models, or you have to do it within the sub-model.

WALTER KEITHLY: Sure, and I have played around, many times over the years, with models, and it makes me feel like we haven't seen the larger picture yet, but, at this stage, I don't see how we're going to have this feedback yet, and so I don't know whether to do it now or wait until the end and see whether we have the feedback, but I think, right now, what we have is a very -- I won't say it's a short-sighted model, but it's a short-term analysis of what happens when you increase your commercial fishing catch or something.

RICHARD APPELDOORN: Well, as I said, but -- Well, first of all, Walter's comment is spot-on. We do need to capture that feedback, and so it is a question of whether we handle it internally or externally, and I would suggest we note the question, with a big asterisk, and move on, but, if we were going to handle it inside this model, it's going to be fishing mortality.

As fishing mortality goes up, commercial fishing catch and recreational fishing catch and IUU catch is going to go down, and so you would have a negative relationship feeding back into those. That's one way to handle it.

I think Tarsila's comment is also valid, and so I would like to see, when we start looking at the bigger picture, whether we have the place for this kind of feedback already there and we just haven't connected it yet or we can just handle it inside, and so, at this point, I would kind of like to wait and see.

JASON COPE: I think it's even more complicated, because, depending on what side, and, getting to the technical side of things, what side of the yield curve you're on. If you have a very undepleted stock, the more fishing mortality is going to actually lead to more catches as you fish the stock down to something that's around

MSY, and, once you get below that, then you start to enter this negative relationship.

Depending on what side of that yield curve you're on, it may actually be positive, or it could be negative, and so it becomes a fairly complex interaction, depending on the state of the population, which is what our management system should be dealing with.

WALTER KEITHLY: That's an excellent point, and I agree entirely.

RICHARD APPELDOORN: The standard kind of relationship is your catch per unit of effort is going down, regardless of what side of that yield curve you're on, as you increase fishing mortality, right? It doesn't say anything about whether you're at a level where you could increase the catch or decrease the catch you're talking about, but it's kind of just what's there.

JASON COPE: I mean, I guess it's that sort of developing fishery theory. If you're catching something at a really small amount, and all of a sudden there's a target switch, and people switch over, more fishing mortality is going to get you more -- It's going to get you more catches, but, at some point, it's going to degrade the population to the point where the fishing mortality is -- Now, what you're saying is catch per unit effort would be tied to abundance, and absolutely. If it's reflective of the population, it's going to go down, the CPUE is, but the underlying fishing mortality that's there may be steady or increasing, and so I think it becomes just a little bit more of a complicated scenario.

RICHARD APPELDOORN: Yes, and the model is not based for non-linearities.

JASON COPE: Exactly.

RICHARD APPELDOORN: It's one line to one box, and we may be able to affect that through multiple pathways, but we'll have to see.

JASON COPE: I think Walter's point is a very good one, and I think, like you said, it has to be kind of floating to the side of the sub-model, just to make sure that we are -- The feedback system is very important in this sub-model, and we've just got to ensure that it's happening properly as all the puzzle pieces come together.

RICHARD APPELDOORN: Thank you very much, Walter, for bringing that up, and we have to make sure that we have that noted as a very important component that we have to make sure is built into

our final product, and probably not just here. There's probably other places where these kind of feedbacks are going to have to be dealt with.

JASON COPE: Agreed. One just logistics question. It seems like this version right here, this slide, is the most current version of our fishing sub-model, with the arrow magnitudes and so forth, and is this something that you want me to translate into the spreadsheet, or is someone else doing that? I just wanted to make sure that there's not a double-duty on efforts here and that it's done right.

GRACIELA GARCIA-MOLINER: We can do that. They have already -- Sarah and Liajay are behind-the-scenes working on the Excel sheets, and so that's taken care of.

JASON COPE: Awesome. Would you like me to send you this one slide, and then you can distribute it as necessary?

GRACIELA GARCIA-MOLINER: Yes, please.

JASON COPE: I will send it to you, isolating this one slide, and then you will have it.

GRACIELA GARCIA-MOLINER: Perfect. Thanks.

JASON COPE: Given that we're wrapping this thing up, and I think we were originally scheduled, last week, to go until 9:00, I have another meeting right now, and I'm not sure how much longer we're going today, but I have another meeting scheduled that I've got to jump off for, and so I apologize for missing, if we go further today, and I apologize for missing anything more, but I will be back tomorrow.

RICHARD APPELDOORN: Thank you, Jason. I think we are going to try to continue to 4:00, another hour.

JASON COPE: Okay.

RICHARD APPELDOORN: My question is did Vance survive his medical crisis, and is he prepared to look at water quality?

VANCE VICENTE: I checked in when I walked in.

RICHARD APPELDOORN: So you're here. He survived.

VANCE VICENTE: Yes. I'm okay, and I'm here. I checked in when I got back.

GRACIELA GARCIA-MOLINER: Vance, do you want to be the presenter, or do you want us to present what you sent, and which of the versions do you want presented?

VANCE VICENTE: I sent you the information, and that's all I can contribute for now, and then you can mess around with the arrows, and we can discuss the different values. I have a big range, from one to three, because everything is going to be dependent on various things for each island.

For example, where Puerto Rico has fifty-eight rivers and permanent streams, and none of the Virgin Islands have any permanent streams, and so all this turbidity and light intensity is going to be so dependent, not only among islands, but also within islands, and also as a function from shore into deeper water, and so there is so many variables that I don't feel comfortable in assigning any value, and let's discuss it together.

GRACIELA GARCIA-MOLINER: Okay, and so you want Liajay to present what we have in the Excel file?

VANCE VICENTE: By all means, please do.

GRACIELA GARCIA-MOLINER: And the Word document that you sent us earlier?

VANCE VICENTE: Yes.

GRACIELA GARCIA-MOLINER: Do you want to start by seeing the one that the SSC had made before this one, or do you want to start with this one?

WATER QUALITY (233:10)

VANCE VICENTE: Let me start with this general model, and are there any questions on it? What I like about this model is the connectiveness between everything that we have been talking about in the last three meetings, which is upland sources, coastal sources, and the mechanisms by which they affect the autotropic systems. If there are any questions, you are welcome to ask.

If there are no questions, we can move to the next slide, and that's the way that I interconnected the water quality components, and I did want to modify them a little bit, just to try to explain my point of how important live transmission is in the water column and the importance of the photosynthetically active radiation, which is the source of the productivity of all the ecosystem that

we've been talking about.

RICHARD APPELDOORN: Can we go back to the first slide, please? I was looking at the original model, so then I could look and see what you had up there, to understand how they differ, and so, without the first page up there, I can't tell that.

VANCE VICENTE: What I am trying to do is --

RICHARD APPELDOORN: Can we blow it up, so we can read it?

GRACIELA GARCIA-MOLINER: Richard, you just want to see the first page, right?

RICHARD APPELDOORN: Right.

VANCE VICENTE: Essentially, what I wanted to present on this slide is really the connectiveness that there is between the upland sources, upland impacts, as well as coastal impacts, and how you can segregate those into how they affect light transmission, which eventually has an effect on the autotrophic systems that we've been talking about and emphasizing the benthic autotrophic system, specifically benthic essential fish habitats.

These are the different sources that come from upland or coastal resources and how you can really trace them back, but that's not the purpose of this meeting, and it's just to establish the diagrams and show the connectivity and relative impact of each of them, but essentially, that's what I want to show here, is that there are different sources that affect turbidity, and turbidity is interpreted in a very holistic sense, which is everything that attenuates penetration of photosynthetic active radiation, specifically, between the 400 nanometer and 700 nanometer, which is the visibility spectrum that we have, and it's also the photosynthetic spectrum, and how these systems, specifically coral reefs and seagrass beds and other benthic autotrophic systems depend on and how turbidity affects them in different intensities.

I mean, if the increase in turbidity is low, well, corals can adapt, and the same thing with seagrasses and algae. They can modify the relative proportion of their photosynthetic pigments, and they can -- The primary production is going to be reduced, but they can still remain as an integral individual in the colony.

If you go from low to medium, well, what happens is that, eventually, there is not enough primary light energy that is reaching the benthos, the autotrophic benthos, and what happens is that the seagrass cover decreases, the same thing as algal cover

decreases and the coral cover decreases.

If the turbidity increases along that gradient to a greater level, then what you have is a shift in the vertical distributions of these ecosystems, and so seagrasses become very shallow, and everything else -- I mean, they become extinct from deeper waters, and the same thing happens. I mean, in very turbid waters, the depth limit of corals, of live corals, also diminishes.

Then, eventually, depending on the gradient of how much decrease there is in the surface photosynthetic active radiation, the whole system transforms from autotrophic to an heterotrophic system, and so there is a gradient here that is -- Maybe it's not part of this discussion that we're doing, but it's something that we really have to pay attention to, because we're talking about light, photosynthetic active radiation, between 400 nanometers and 700 nanometers, which is really what maintains the primary productivity, or secondary or third productivity, and so I am just stressing on the importance of light in this model, and I don't know whether it has been given the proper attention to it.

In the second diagram, I'm trying to conform to your request of showing arrows and connectivity and relative intensity of connectivity between these parameters, and so you can move down to the second slide.

Here, I tried to do my best to conform with your request of how we're going to integrate this water quality issue into the model, and what I essentially did is we have to discuss how important our allochthonous sediments and autochthonous sediments that come from the upland resources, whether it's dredging or land clearing or whatever, which both scatter light, and it diminishes the light penetration to the systems, and those factors that also attenuate photosynthetic active radiation by absorption.

Nutrients through phytoplankton and by chlorophyll, and they absorb -- They attenuate the photosynthetic active radiation reaching those bottoms, and then you have the gelbstoff, the colored dissolved organic matters, which also have a significant effect.

Now, I put a one to three, because it really depends on where are we talking about. I mean, one can be more important than the other. For example, in Puerto Rico, where you have fifty-eight rivers constantly dumping into the ocean, versus Vieques and Culebra Island and the Virgin Islands, which you don't have any permanent streams, and you have intermittent streams, and so, here in Puerto Rico, it's going to be more important, and, in other

areas, it's not going to be as important, and, also, even within an island, it's going to vary.

Even between embayments it's going to vary, and so that's the kind of thing that I would like to discuss and to agree with, but I don't know -- I really don't know, and I don't want to feel responsible to put any numbers right now unless we discuss this openly, but, anyhow, all those factors, whether it's light scattering or light absorption, anything that impacts light attenuation, that affects the light extinction coefficient of light through the water column, is reflected in turbidity.

I am using turbidity here to include anything that interferes with light transmittance across the water column, and it will have an effect of one to three, again, depending on location and depending on distance from shore, on depth, which eventually has a direct effect on light penetration, which eventually has an effect on benthic autotrophic systems. That's how I tried to link the different compartments that we have been discussing about during the last three meetings, and that's the kind of connection, and that's my contribution.

I mean, I don't know how to express it any better, and so it's open to your discussion and to your additional inputs, and we discussed about this in the previous meetings, but I believe that the previous meeting had been very ephemeral qualitative discussions, and so I'm afraid of putting any numbers here unless I discuss it with the team, and that's it. That's my presentation.

RICHARD APPELDOORN: Well, thank you, Vance. Again, that's -- I guess you didn't see Reni's presentation this morning, but, in much the way that he did, you have given us a lot to think about, in terms of how things are functioning and how they're going to -- Some of those top boxes in this particular figure are going to come from other sub-models that are driving say land use practices and things like that, or use of fertilizers and potential runoffs that will start kind of working into these effects on turbidity.

Having said that, I'm not sure we're changing the basic model, where we've got to put the connectors in, but, Vance, you've made a really strong case that this is probably an area where we really are going to have significant differences between islands, and, as you said, it's even by embayments, but I think what is really important here is we're going to try and talk about strength of connections, and then the flow rates depend on what the loadings are into these things, and that is what is really changing between the systems, but, if you were to put a permanent river in Culebra, you would have more or less the same kind of impacts you would

have with a permanent river in Puerto Rico, and so the way you would want to treat a river source of materials would be similar in both, but it's just that the different areas are different spectrums of where those impacts could be.

Maybe, from the point of view of how they are constructed, they might look fairly similar, except when you actually don't have something, and then it's going to be a zero. For example, if we had a box about nuclear waste, and we had a nuclear waste facility on one island and not on the other two, then you've got a real difference there in the components of the sub-model.

VANCE VICENTE: Where is the nuclear waste coming in from? I really need that to be explained, because I know what the nuclear sources have been.

RICHARD APPELDOORN: It was a hypothetical model that actually didn't apply.

VANCE VICENTE: Okay. Sorry.

RICHARD APPELDOORN: I guess we need to then go to either the spreadsheet or the arrow version and start talking about things, and, right from the start, we need to be cognizant of -- There may be here serious differences between platforms, and, if that's the case, and we start seeing these, we may want to start simultaneously running three boxes and address all of them at the same time, in saying, okay, for these points, they are very similar, but, for these other ones, this is the situation in St. Thomas, and that's St. Croix, and this is Puerto Rico, and, if we can actually do that, we will have just made double progress, or triple progress.

GRACIELA GARCIA-MOLINER: Okay, and so Sarah can do St. Thomas, for example, and I can handle the Excel file for St. Croix, and you have the generic/Puerto Rico on the screen, and how is that?

RICHARD APPELDOORN: Can we move that over to the left, because my chat box is -- Thank you.

VANCE VICENTE: Okay, but one thing that I want to ask is are we going to keep the suspended sediments versus allochthonous sediments, because they are totally two different things. Suspended sediments, if they have not been exposed, and it's a geological site that has not been exposed to riverine or to any source of upland sources, it's going to be very, very different. I mean, all you're doing is resuspending -- That is going to be very different from an area that is receiving upland sources.

If you want to keep it just as suspended sediments, whether it be allochthonous or autochthonous, for the purpose of simplifying things, I am okay, but they are totally two different things.

RICHARD APPELDOORN: As you mentioned, as you get away from shore, the ratio of that changes.

VANCE VICENTE: Resuspension of sediments, irrespective of whether they are -- If they have been produced by articulated coral and green algae, versus clay material that comes in from the outside, okay, fine, if you want to keep it simplified, but I wanted to stress the point that they are totally two different types with totally two different coefficient, light coefficient, light extinction coefficient, values, but that's okay. Maybe it's not the time to get involved into specific details. Go ahead. Let me know. I don't know, but tell me.

RICHARD APPELDOORN: Well, I respect your judgment on this, and so, if we wanted to split the -- The case for splitting them would be, one, they would have different values going across this matrix, and, two, the factors affecting those, coming in from other sub-models, would be different, and, therefore, you could parse that out.

VANCE VICENTE: Maybe you can just call them "sediments". That way, we can maybe keep things simplified, and I don't know. That's a suggestion. I mean, whether they are being suspended or are they being allochthonous, or are they coming in from upland sources, creeks and gullies, in the case of St. Croix and St. Thomas, rivers and creeks, and maybe that will simplify things, and, if things get complex, then we can explain those further.

RICHARD APPELDOORN: Okay. I could go with that, yes.

VANCE VICENTE: Okay.

RICHARD APPELDOORN: The values that are in here were ones that were done in previous meetings, right?

VANCE VICENTE: Yes. One thing that I would really like to change, and Reni has a point, and, I mean, we don't have a general problem in the U.S. Caribbean islands regarding algal blooms, and they do occur here and there in lagoons, in very enclosed inshore types of habitats, and so maybe, instead of algal blooms, just call it increasing chlorophyll or phytoplankton, effects on phytoplankton, because chlorophyll does have a significant impact in absorbing photosynthetic active radiation, and so, that way, we can eliminate

that, because I agree with Reni, and so, maybe instead of nutrients affecting algal blooms, it's nutrients impacting on phytoplankton and chlorophyll, instead of calling it a bloom, because that would put it in a different category, maybe. That's the way that I put it in both models, in the general model and in the specific model.

JORGE GARCIA-SAIS: Vance, if I don't remember incorrectly, we included algal blooms from the perspective of sargassum nuisances or whatever.

VANCE VICENTE: Yes, I agree, Reni, but we also talked about phytoplankton blooms and things like that, and the way I would like to rephrase it, if you agree with me, is how nutrients impact the production of phytoplankton, which gets expressed as a chlorophyll concentration, which does attenuate photosynthetic active radiation significantly.

I mean, rather than call it a bloom, and I am trying to put a line between increased nutrients in autotrophic systems, which does increase the phytoplankton production, which eventually gets expressed with respect to light transmittance in the water column as the absorption of chlorophyll, by chlorophyll, molecules.

RICHARD APPELDOORN: I think, in this case, we are talking about phytoplankton and not the kind of say red tides that occur in the continental areas.

VANCE VICENTE: Correct, yes.

RICHARD APPELDOORN: So, Graciela, just change that box to phytoplankton.

VANCE VICENTE: That is much better.

DOUGLAS GREGORY: How do we address the impact of the sargassum blooms that we talked about now that that's been changed?

VANCE VICENTE: I want to exclude sargassum. I mean, that's a pelagic system, which has its own functions for the larvae of pelagic fish and sea turtles, and I don't want to include that in this section.

DOUGLAS GREGORY: But, in our previous meeting, we discussed extensively how the excessive sargassum coming in the shallow water has affected turbidity and --

VANCE VICENTE: Yes, but very localized and very temporal, and I don't want to include them in this part of the model. I think

that can go into the nuisances, into the blooms, into a different spectrum, because I think it's important, okay, but, as part of this model, or this sub-section, I feel it should be kept in a different block.

DOUGLAS GREGORY: That makes sense, but do we have someplace for excessive algal blooms or the sargassum impacts on the shallow water, or do we just want to drop it?

RICHARD APPELDOORN: We're going to have links between here and the other.

VANCE VICENTE: Not in this part of the discussion, because we talk about sargassum a lot, and then I think that we decided that sargassum does form pelagic important ecosystems in which it's not limited by light when it's up in the pelagic environment. There are locations in which the currents and the wave action and maybe eutrophication and the dust from the Sahara Desert and whatever have caused some blooms, occasionally, but I don't see it as part of this model, and I don't know. If you want to include it, it's going to mess up things, but that's my opinion.

RICHARD APPELDOORN: It's going to be included, if at all, by linkages with other sub-models, and it's not something that is here, and so if we say that, when we have these massive imports of sargassum, does it affect water quality, well, the remote sensing data says yes, unequivocally, but that's something that comes in from that pelagic habitat box, somehow, and then links into here, and it's not incorporated in this sub-model, and that's how I see it anyway.

VANCE VICENTE: Exactly. I have not seen any sargassum problems at all along the whole north coast of Puerto Rico in the last twenty years. It does occur on the south coast, southwest coast, and then the same thing with the Halophila stipulacea, but I am trying to look it at more holistically and trying not to contaminate the model as much and to stress the very important points that I believe are crucial in this model, but, I mean, I am open to whatever opinion, but --

RICHARD APPELDOORN: Okay. We need to start working on going across here. What we had said originally was that sediments were affecting turbidity, and then any other effect on light penetration is mediated through turbidity, and so that's how this was a three. Sediments could also contain nutrients, and therefore lead to eutrophication. Eutrophication would then affect phytoplankton, and then there could be toxic contaminants in the sediments.

VANCE VICENTE: The thing is that the sediment composition is very complex, and I am trying to stick to sediments from allochthonous sediments and looking at -- Versus resuspended aragonitic crystals associated -- Not associated, but which form under very pristine conditions. Together with effluents, you do have a portion of nutrients, as well as gelbstoff. Maybe I should include nutrients together with sediments in some way, and I don't know, but I was trying to separate compartments, in order to analyze things better, but I don't know, and I'm open to discussion.

RICHARD APPELDOORN: Well, eutrophication, I think, is nutrients, and, if you want to change the name to nutrients, that's fine.

VANCE VICENTE: Nutrients, as long as it's connected in some way, with some arrow, to chlorophyll, to phytoplankton, but they are two different --

RICHARD APPELDOORN: That will be there, and, as part of the sediment, I think we really are considering the stuff coming in from land, because the rest of the stuff is basically the natural system, and our activities and regulations are there, generally, to protect the natural system and the productivity that it supports, and so we're talking about what's the problem sediment, if you will, and so stuff that's there and being resuspended has been that way for millions of years, and that's really not the issue here. It's the loading.

VANCE VICENTE: No, it's not the issue, but it's different among islands, and even within islands, and that's why I'm saying that I didn't like to put a value number to the arrow, because it's very dependent among islands and the distance from shore to offshore, and so that variable -- I don't know if there is some kind of number which will incorporate that variability, that variation, and maybe a one would be a nice value, and I don't know, but it's going to be so variable, and that's why I did not feel comfortable in putting in any numbers for each of those arrow components, because I don't feel comfortable.

RICHARD APPELDOORN: Okay. Vance, let's just take an example here. The first two things, sediments and phytoplankton, and we have it saying both of those can affect turbidity. Now, would that strongly affect turbidity? Would that statement be different in Puerto Rico versus the Virgin Islands? Not that the magnitudes of the sediments are the same, but the relationship between the amount of sediment you have and the amount of turbidity you would have.

VANCE VICENTE: The problem is, Richard, is that there is so little allochthonous sediments in Culebra and Vieques Island and St.

Thomas and St. John, and even St. Croix, which is not part of the Puerto Rican shelf, and they don't have any permanent streams, I mean zero.

They don't have any, and they only have intermittent waters, which affects their literal and sub-literal zones during very specific periods and very seasonally, and that's very different from what is happening in Puerto Rico, where you have fifty-eight rivers constantly bringing in allochthonous sediments and allochthonous nutrients and contaminants and whatever you want to call it, and it is so totally different scenarios that I feel uncomfortable with that simplification. I don't know. Help me out.

RICHARD APPELDOORN: No, I think you did a great job explaining that, and so I think, based on the way you were explaining it, the connection between sediments and turbidity is going to be different among island platforms.

VANCE VICENTE: The sources of turbidity are going to be different. The effect on the turbidity overall, on how much of the photosynthetic active radiation is being attenuated may be the same, but the sources are going to be different.

I mean, the reason that I prepared these models was for management purposes, like trying to find out, hey, do we want to protect coral reefs, do we want to protect seagrass beds, what are the sources that affect light penetration, because that is what limits the density and the extension of those systems that are essential fish habitats, which are critical for sea turtles and manatees and fish herbivores and sea urchins and everything else that connects to the upper trophic levels, you know. I hope you get my point, because maybe I'm overstressing it, but --

RICHARD APPELDOORN: The question is I think you hit the nail on the head, in the sense that how sediments might affect turbidity would be the same on the three platforms, but the total contribution of sediments to turbidity versus some other source is going to vary greatly among islands, and, therefore, how are we scoring this? That's the question.

VANCE VICENTE: That's my question. Also, regarding turbidity, and I made a point on the gelbstoff, and you may have the problem locally in the Virgin Islands, on a very limited scale, but the amount of debris that is being decomposed in the uplands in Puerto Rico are very comparable to the Virgin Islands, and so that is the point. I mean, it's not only the sediments, but also the dissolved organic substances, which are going to be different, significantly different, from Puerto Rico to even within the municipalities of

Puerto Rico, Vieques and Culebra Island, and the Virgin Islands. It's just we do not know to what proportion each of these components affect the transmission of light, which is what keeps the primary production of all of our nearshore ecosystems.

JORGE GARCIA-SAIS: Vance, when we were trying to establish -- What were the components of turbidity that was causing the gradient? It goes in Puerto Rico from -- If you look at the satellite data, and you search for variables affecting turbidity across that inshore and offshore gradient, we have forty-two stations within that gradient, and 95 percent of the turbidity was explained by chlorophyll variability.

VANCE VICENTE: Okay. Good.

JORGE GARCIA-SAIS: What I have been trying to say is because people think about turbidity and that's caused by inorganic sediments, and --

VANCE VICENTE: You can look at the satellite imagery, which is --

JORGE GARCIA-SAIS: It's phytoplankton biomass.

VANCE VICENTE: But that's one factor. That's only one factor, Reni. There are other things below the water column that is contributing to the attenuation of light. You cannot just base yourself on satellite imagery. They look at the surface stuff. I mean, sometimes they look deeper, but what I am saying is that there are other parameters that have to be given value to when you analyze differences among islands, and even within islands.

JORGE GARCIA-SAIS: I accept that, but what I am telling you is that, in terms of management, phytoplankton productivity is the driver of -- It regulates turbidity on a great scale.

VANCE VICENTE: It's one on a great scale, and then we're looking at a different scale. We're looking among islands and within islands and between embayments, and it's going to vary. It varies significantly. Phytoplankton is one component, but look at the model that I sent you, and look in the presentation that I sent you. Look at Slide 49.

That's a way of separating the different components that attenuate light, because what is limiting primary production in nearshore shallow waters, like coral reefs and seagrass beds and algal beds and coral communities is light. I mean, that's the source of primary production, and there are so many different factors

attenuating the light penetration in the water column.

Chlorophyll, yes, in some cases, it may be the most important thing, and, from a satellite imagery, you are looking at a whole large scale, and what I am trying to say is to make a difference in what the sources are of light attenuation in different areas, depending on the type of activity, upland activities, clearing, land clearing, associated with -- Look at the first slide. I mean, there are different sources, which affect the water column and primary productivity from different sources, depending on where you are and how far you are from shore.

I mean, from a large scale, if you look at the effluents, and you look at all the satellites from Florida State University, and you say, wow, look at all these nutrients coming in, and, yes, they are significant, maybe for the pelagic systems, but, in the nearshore benthic systems, there is many, many variables, and that's the only point that I wanted to make. How far you want to extend that concept, well, it depends on the group, but I think it's critical for shallow systems and nearshore systems, and it's going to vary, like I said from the beginning, as you go from nearshore to offshore and from shallow water to deep water.

I mean, light extinction is going to vary significantly, simply with depth, not taking into account any of these other components, and what I am trying to do is trying to see if we can determine which components are more important for management purposes, and so maybe it's outside the scope of this discussion, but I just wanted to bring them up.

JORGE GARCIA-SAIS: You are saying that the productivity of inshore waters in Puerto Rico is light limited?

VANCE VICENTE: Depending on where you are. In Guayanilla Bay, definitely. If you look at the depth limits of coral reefs and how deep down you find live corals and percent coral cover and standing crop of different species of algae, it's definitely regulated by light penetration. I mean, read my presentation, okay, and it's largely based on thirty years of measurements in Guayanilla Bay.

RICHARD APPELDOORN: I am trying to get this back on track. Vance, in your expert opinion, and let's just take Puerto Rico, on average, whatever your perception of average is, what are the major contributing factors to turbidity?

VANCE VICENTE: Like I said at the very beginning, there are fifty-eight rivers with permanent discharge on the island, out of 240.

Riverine systems are one of the major sources of nearshore.

RICHARD APPELDOORN: Right, and they're bringing in --

VANCE VICENTE: Sometimes that much nearshore, and I mean Desecheo Island, and I have seen vegetation, tropical vegetation, in the very offshore waters, but, generally, within its rivers, and it's something that we don't have in the Virgin Islands, and that's a major distinction that I want to make. There are no permanent streams in the U.S. Virgin Islands, in St. Croix, St. Thomas, St. John, and not even in Vieques nor Culebra.

There is no permanent streams, versus Puerto Rico, which has fifty-eight rivers constantly dumping their sediments and their nutrients and everything associated with their discharge, refrigerators and docks and dead cows, I mean something that you do not find in the other islands, and I am trying to make a difference here, in terms of what kind of value we want to give to these turbidity parameters, because it's going to be definitely very different among islands.

RICHARD APPELDOORN: For Puerto Rico, the mainland of Puerto Rico, again, on average, what are the rivers bringing in that is affecting the turbidity? Is it sediments, or is it nutrients?

VANCE VICENTE: Nobody has determined that. Nobody has determined that.

RICHARD APPELDOORN: Well, this is now going to your expert opinion, and we can all take guesses on that, but --

VANCE VICENTE: I don't know, because nobody has ever distinguished, or differentiated, between the dissolved organic substances versus a clay material versus resuspended material versus chlorophyll. There is data on water quality, some, but I have not come -- With any distinction.

I would say that, in Puerto Rico, that one of the main drivers of water quality -- I mean, if you want me to make an educated, general statement, the effluents are associated with permanent water streams. That is what I would say that is the principle component of turbidity in Puerto Rico. I cannot say that, and I will not say that, for the Virgin Islands, because it's not.

RICHARD APPELDOORN: But could we get away with saying, for Puerto Rico, since we don't know what the major components are, we just give them equal numbers? It would be sediments, and it would be nutrients, and we don't have dissolved organic matter.

VANCE VICENTE: We do. That's another --

RICHARD APPELDOORN: It's not in the box.

VANCE VICENTE: Remember the gelbstoff, the dissolved organic matter, is the product of the decomposition of branches and leaves and everything associated with upstream activities. They can decompose, and it does contribute, and, in some areas, it's more important than the others.

RICHARD APPELDOORN: Thank you. What I said is we don't have a box for it.

VANCE VICENTE: No.

RICHARD APPELDOORN: Should we?

VANCE VICENTE: Maybe yes. For Puerto Rico, yes, because it's been shown that they can absorb a very significant amount of the photosynthetic active range, between 400 nanometers and 700 nanometers, which is the photosynthetic active radiation. It can absorb a lot of significant amount of light entering the surface.

RICHARD APPELDOORN: Is this what the remote sensors called the dissolved color --

VANCE VICENTE: It's called yellow substance, gelbstoff, chromophoric dissolved organic compounds, and there are different types of names to it, but they all relate to chromophoric dissolved organic substances.

RICHARD APPELDOORN: So that's the "C" in front of the "DOM"?

VANCE VICENTE: Chromophoric dissolved organic matter, CDOM. I mean, that's what appears in the literature. It's been shown to be very significant in reducing the amount of light reaching coral reefs and seagrass beds and autotrophic benthic systems. The thing is that nobody measures them. I mean, it's not a standard -- There isn't a water quality standard for gelbstoff.

In fact, for sediment, for turbidity, there is only one index, which really doesn't differentiate between where the sediment or the particles, which are the refracting light during the measurements is, and I mean there is very little.

There is a measure of water transparency, and it was abolished, and now we have other instruments, and in the last twenty years,

like instruments which measure specifically the wave lengths of the photosynthetic active radiation, which is between 400 nanometers and 700 nanometers.

That is the photosynthetic range, and not only the photosynthetic range, but it's our visual range. There is no difference between the photosynthetic active range and our visual range. Now they use NTUs, which the water quality standard is ten. If it's less than ten, you're okay. If it's ten or more, you are in violation of the water quality standards set for Puerto Rico and for the U.S. Virgin Islands.

RICHARD APPELDOORN: Well, let's get back to our boxes. We have river inputs being the major sources, and they are carrying sediments, and they're carrying nutrients, and they are carrying this gelbstoff, and so, if we don't know the contributions of those individually, can we just, as a starting point, give them all equal values?

VANCE VICENTE: Yes, I would be happy with that, even though it's going to be very variable, but, yes, let's give them a constant value, and with the note that it's going to be extremely variable among islands, and even within islands. That way, I will feel comfortable with that. I would be happy with that. I think the important thing is not to ignore something that can and is very important, and that's my only problem with this model, with this part of the model.

RICHARD APPELDOORN: So I would say then, for Puerto Rico, the factors affecting turbidity from rivers are going to be sediments and --

VANCE VICENTE: Well, maybe you don't want to only include rivers, and it can be rivers and creeks and runoff from agricultural lands. I mean, you don't want to pinpoint one specifically. It's upland sources, and that would give you a wide spectrum of factors contributing into it.

RICHARD APPELDOORN: So we have sediments being a three and turbidity, and we have the colored dissolved organic matter being a three on turbidity, and we have nutrients, which are going to run, I assume, through phytoplankton, and so nutrients would affect phytoplankton as a three. Nutrients affect phytoplankton, and then phytoplankton then affects turbidity, also as a three.

VANCE VICENTE: Good.

RICHARD APPELDOORN: Remember that this is just Puerto Rico. Now,

we also have, leftover from previous discussion, that sediments could affect nutrients, because there could be nutrients associated with that runoff.

VANCE VICENTE: Yes, and I remember that we talked about that.

RICHARD APPELDOORN: Right now, this is a one, and I don't know if we're happy with that, but, if we accept that, there also might be a --

JORGE GARCIA-SAIS: Richard, phytoplankton will have -- It's based on nutrients, and also because they will remove the nutrients from the water, making it into organic material, and then be the source for making them available back again in the water column.

VANCE VICENTE: Right.

RICHARD APPELDOORN: We're just not on that connection yet. That's the next line down.

JORGE GARCIA-SAIS: Okay.

RICHARD APPELDOORN: If we leave that like it is now, then we do get to phytoplankton, and we can talk about the impact that phytoplankton has on turbidity and nutrient levels in the way that Reni was just talking about, and so the first thing that I would question is why do we have phytoplankton affecting sediments?

VANCE VICENTE: I don't know.

RICHARD APPELDOORN: So that should be a zero?

VANCE VICENTE: Phytoplankton has two effects on light attenuation. One, it is a particle. Phytoplankton is a particle. It's an organic particle, but the way I interpreted it is that it's the chlorophyll within those cells, those particulate cells, which absorb, which significantly attenuate light, because of the molecule of chlorophyll, but they do have a scattering effect.

I mean, there is two different effect, a scattering and absorption, which leads to -- I don't know if you want to look at the physics of it, but, principally, the effects that phytoplankton has is because of this chlorophyll content, which absorbs the photosynthetic active radiation entering the sub-surface of the water column.

JORGE GARCIA-SAIS: What happens when they die?

VANCE VICENTE: They decompose. Then the chlorophyll turns into pheophytin. I'm glad that you brought that point up, because we have to define the scale of time that we're talking about. You can go forever in the long run, what happens to everything. Like our economist said, in the long run, we all die.

JORGE GARCIA-SAIS: Phytoplankton goes to the bottom. It goes to the sediments.

VANCE VICENTE: It depends what kind of phytoplankton, but we're talking about an instant in time. I mean, if we cannot define the scale in time --

JORGE GARCIA-SAIS: I don't understand. For me, when phytoplankton dies, it goes to the sediments.

VANCE VICENTE: Yes, and so what's the problem? What I am talking about is -- If you take a water sample, and you determine the components --

JORGE GARCIA-SAIS: If you want to keep the zero, keep it. In my opinion, it's not zero, and that's all.

RICHARD APPELDOORN: Okay. The sediments box is suspended sediments, the stuff in the water, and so, if we're talking about these particles die and they settle to the bottom, that's not an issue here.

VANCE VICENTE: Right. I agree.

JORGE GARCIA-SAIS: Okay. Great. I understand.

VANCE VICENTE: We're not at this stage of discussion yet.

RICHARD APPELDOORN: So now phytoplankton -- Are they affecting turbidity, and turbidity affects light penetration, or are phytoplankton affecting light penetration apart from making the water turbid?

VANCE VICENTE: The way I explained it is the nutrients, maybe nitrates, maybe nitrites, maybe ammonium, and also phosphates, which are one of the critical -- Because phosphate is more limited in the water column in all tropical waters. Phytoplankton picks them up and turns them into biomass. It turns them into a cell, which has a chloroplast, and the chloroplast has chlorophyll, and they absorb the light, and that's with a time-one, a T1, timeframe that it happens. Eventually, the chlorophyll molecule dies and turns into -- Then everything stops there.

In a dynamic system -- I mean, if you look at time-one, what happens is that these nutrients get transformed into phytoplankton biomass, of which the chlorophyll component is the principle molecule absorbing the spectrum of light between 400 nanometers and 700 nanometers. There is some UV radiation that may extend beyond that, but that is the spectrum of light absorption, of light attenuation, by chlorophyll within phytoplankton.

RICHARD APPELDOORN: All right, and so we keep that relationship with turbidity as a three, and then, taking into account what Reni had pointed out, phytoplankton will have a negative effect on nutrients, because they will take in those nutrients, and so that would be like a minus-something.

VANCE VICENTE: That's good, yes. Phytoplankton will absorb the nutrients and transform them into biomass.

RICHARD APPELDOORN: So what's the strength of that? Minus-three? Minus-two? Minus-one?

VANCE VICENTE: I don't know. Let me see. I haven't thought about that.

RICHARD APPELDOORN: I would put a minus-two, in the absence of knowing whether it should be higher or lower, but, if somebody can think about that, that would be fine.

JORGE GARCIA-SAIS: Richard, considering that it is very hard to measure nutrients within the euphotic zone, at least in the northern Caribbean, a little bit away from land, I would say that it's at least a two.

RICHARD APPELDOORN: Yes, and that's a good point. Whatever happens, they take it up very quickly.

VANCE VICENTE: Yes.

RICHARD APPELDOORN: So it may even be a minus-three.

VANCE VICENTE: Yes, it could be.

RICHARD APPELDOORN: Now, the last one, water toxicity, we have a three, and I don't know if that was based on previous thinking about sargassum, which we don't particularly have here, and so I'm not sure that we should be --

VANCE VICENTE: The toxicity aspect, we never agreed on anything.

I mean, I reviewed the minutes of our last meeting, and there was a lot of discussions about toxicity, and I did point out that the levels that -- There are toxic compounds in the ocean, or anywhere, in any systems, that have been listed by the U.S. EPA, and there are standards of which emissions, specifically point source emissions, which require an NTDS permit, is very much regulated.

I kept on thinking about that, and, with regard to fisheries and to ecosystems, I have not found any evidence in which there has been a shutdown of fisheries in the U.S. islands, U.S. Virgin Islands and Puerto Rico, the U.S. Caribbean, because the toxic levels of mercury and zinc and any of the toxic chemicals have been shut down, and so I kept toxicity out of my mind, because I have not been able to link it with anything that I know.

The major toxicity studies that have been done were done by the Puerto Rico nuclear center, and they began back in the 1970s, and they analyzed -- I mean, you can't believe what kind of elements have been analyzed, and they have not -- The only thing that has been found regarding toxicity and fisheries was a master's thesis which found that, in the blue crabs off of Guayanilla, they were very close to the maximum level of mercury permitted by the U.S. EPA.

Lopez and I analyzed seagrass beds and everything, and we did not find any bioaccumulation, and I don't know of any situation in which toxicity in the water column, as much as bioaccumulation, has shut down any fisheries. There was some indications in a lagoon, and there was some indications that there were some toxic chemicals there, and I don't know, and so maybe there is a local situation there, but, regarding the commercial or recreational fisheries being shut down by any high levels of a toxic component, I don't know any. I mean, I'm open for discussion, and I don't know if Reni has heard anything, or anybody else.

RICHARD APPELDOORN: Okay. The particular box here is the effect of phytoplankton on water toxicity, and that might have actually been back when it was algal bloom and talking about ciguatera, and, actually, I don't recall, but are you arguing -- We don't have red tides here, which are a significant thing in the continental waters, and so are you arguing that we actually could take out the water toxicity box?

VANCE VICENTE: It depends on how you want to define toxicity, because you can have toxicity due to allochthonous chemicals and discharge from industry, allochthonous sources, or you can talk about toxicity from a biological origin, and so you have to make that distinction.

RICHARD APPELDOORN: Well, we do, in the sense that -- At least a water column source, because that's what we're talking about, water quality. If there were contributions that affected water toxicity, they would be incorporated here.

However, we are going to have water toxicity values coming out from industrial uses and things like that, which will affect this water toxicity box, and, if we say water toxicity affects something else in this box, or some other box in another sub-model, that's how those are connected in, and so this is looking at what's coming in from basically the upland flow, plus what might be generated internally, and the only internal generation that I can think is plankton, but, if we were thinking about something like ciguatera, that's not the phytoplankton contribution, and I don't know how that's related.

VANCE VICENTE: That's a totally different -- Remember we talked about that there is going to be a health issue block, remember?

RICHARD APPELDOORN: Right, but it affects where and when or what people can fish.

VANCE VICENTE: Yes, but we put that in a totally different sub-model, if I recall correctly.

RICHARD APPELDOORN: That's fine, and so, in this case, we would say the phytoplankton affecting the water toxicity maybe should be zero.

VANCE VICENTE: I mean, I don't know of any instances in which a definitely identified toxic substance has been analyzed in the water column to such a level that it has prohibited any type of fishing activities or swimming or diving activities, I mean recreational-type of activities. The only thing that I know within that regime is that the waters of Puerto Rico, as well as the Virgin Islands, are classified as Class A, Class B, and Class C.

It depends on whether you can have direct contact or indirect contact with the water, but it doesn't relate to specific toxic compounds. It refers to overall the general water quality conditions of the water, and it's not that there is a definite toxin that, if you dive in, you're going to wind up with a significant high level of mercury or zinc or copper or anything like that. It's just the way that they have been classified regarding -- Class A waters, for example, are going to be strictly areas which are very high in ecological value, such as the bioluminescent bay in La Parguera, national parts, some MPA areas

in the U.S. Virgin Islands.

Class C will be industrial waters, which you are not supposed to be in direct contact, which I have always been in the last forty years, diving in Guayanilla Bay, and then Class B waters is anything in between the very highly-valuable biologically and ecologically-valuable areas and the industrial.

Everything else is classified as a Class B, but I have never found any restrictions, and maybe for some internal waters, lagoons, in which the coliforms levels have been high, and you are just supposed to jet-ski on them and fish, but not any direct contact, like diving, but I just -- I have thought about it, but I have not found any -- I don't know how to put a value on toxicity in connecting it to boxes on fisheries, or even water quality. I just haven't been able, and so you can put a line among the different components of the model and a zero, but -- I mean, unless Reni or somebody else has a different opinion, but I cannot put a value on it.

RICHARD APPELDOORN: Well, again, I'm thinking of -- If we're looking at this from a phytoplankton point of view, that actually should be a blank, because -- Well, a zero means no line, and I don't know how you guys are interpreting this, because, in the past, a zero was a line, but we hadn't assigned values to it. You Mental Modeler guys, is zero no line, or is zero a line with no value?

VANCE VICENTE: Zero was a line, from the very beginning of this, but the direction or intensity were not going to be expressed, but there is simply a connection, and that's what I understood from the previous meetings, and I don't know. I may be wrong.

GRACIELA GARCIA-MOLINER: Do you want to keep a connection between these two boxes, or do you just want to have them and not be connected?

VANCE VICENTE: No, I would have a connection, but we don't know the connection, but I would not put any arrow. It would say, hey, there's something here that needs to be discussed further, unless somebody else --

JORGE GARCIA-SAIS: The thing about toxicity is that, in the regional sewage outfalls, we have the -- There is detection of heavy metals and organic chlorinated compounds and things like that. I mean, we have some loading of toxic chemicals in the marine environment.

VANCE VICENTE: Yes.

JORGE GARCIA-SAIS: That happens is we say that we have a water toxicity problem that has not been brought about, because within the mixing zone determinations, those concentrations for those heavy metals and organic carbonated compounds --

VANCE VICENTE: The factor is so high, and the only guys that dive out there is you and me. It's not a commercial and recreational diving spot. I mean, right there at the discharge of these treatment plants, I don't think very many people use those areas.

RICHARD APPELDOORN: All right. I have two points here. One is water toxicity is going to link to other sub-models, and so we don't worry about what the impacts will be, and those will be taken care of by those connections, which sounds like they're going to be quite low.

Orian pointed out, in a comment, that a zero was there to indicate a line without a value. Once the table is filled out, then all the zeroes mean there is no connection.

VANCE VICENTE: I mean, going by my memory, the only thing I have read regarding the toxic levels -- Within the toxic list of the U.S. EPA has been mercury, but not exceeding a per unit biomass in tuna and offshore pelagics, and the only recommendation is that females that have some degree of pregnancy can only eat X amount, X pounds, of tuna fish or marlin or whatever, but the levels -- Because the threshold level within the tissue of these pelagic animals do not exceed the levels of the U.S. EPA.

RICHARD APPELDOORN: That's going to be when we talk about water toxicity's effect on fishing overall, and it's going to be low, but that's going into another box. Graciela, the zero just means zero, and don't delete the connection.

Looking at light penetration, light penetration is obviously going to affect phytoplankton growth, and that should be a positive relationship. Should it be a one, or should it be --

VANCE VICENTE: Regarding the pelagic systems, regarding the phytoplankton, it's not a limiting factor, because plankton does migrate up and down. In fact, it's sometimes negative, because -- - At a pelagic level, I have not read any papers that light is a limiting factor on phytoplankton, per se.

I mean, you may have other information that I don't have, but it's not, because they live close to the surface, and, in fact, when it

becomes too intense, that's when they exhibit the nocturnal migrations, and so, with respect to pelagic systems, I don't believe it's a limiting factor, but it's probably important to consider, to include it.

JORGE GARCIA-SAIS: Inside bays, within river plumes and all that, light penetration is a limiting factor to phytoplankton growth, even in the presence of nutrients, and that's something that happens very frequently.

Every time there is a big rainfall event, you have a lot of nutrients coming into coastal waters, but the phytoplankton productivities remain slow for the first days of the rainfall period, because of light limiting equations, because of the inorganic sediments that are suspended in the water column, and so it's a very dynamic -- In the open ocean, light penetration is not limiting within the euphotic zone, but, in certain situations, it can be limiting.

VANCE VICENTE: But it's very localized, but phytoplankton reproduce about every twenty minutes, and, I mean, yes, it can be a limiting factor within a given local inshore range. Yes, it can be, yes.

RICHARD APPELDOORN: So we keep that as a one, or is it so small that we just want to forget about it?

VANCE VICENTE: Let Reni answer that.

JORGE GARCIA-SAIS: I would leave it as a one.

RICHARD APPELDOORN: Okay. Then we're talking about the next row.

JORGE GARCIA-SAIS: Richard, it all depends on how deep you want to go.

VANCE VICENTE: How far from shore you want to do. Exactly. That was my point.

RICHARD APPELDOORN: Well, I think we're drowning here, and so we need to get moving. Let's look at the turbidity row. Turbidity is going to affect light penetration, and so we have that relationship, but there's a one here with turbidity affecting phytoplankton, actually stimulating phytoplankton.

VANCE VICENTE: No way. I cannot see that one. I don't know where that came from.

RICHARD APPELDOORN: I don't understand it either.

VANCE VICENTE: No, and maybe Reni has an answer, but I don't know.

JORGE GARCIA-SAIS: Remember that phytoplankton was not there before.

RICHARD APPELDOORN: It was algal bloom.

VANCE VICENTE: Exactly. Yes.

RICHARD APPELDOORN: I don't think turbidity affects algal blooms positively.

VANCE VICENTE: I would give it a zero.

RICHARD APPELDOORN: Right, because the effect on phytoplankton is through light penetration. Nutrients are affecting phytoplankton, yes?

VANCE VICENTE: Yes, definitely, especially in the tropics.

RICHARD APPELDOORN: But they don't affect anything else?

VANCE VICENTE: It affects turbidity. The more phytoplankton, the less light penetration. I mean, the higher the turbidity and the lesser the penetration.

RICHARD APPELDOORN: But we already have phytoplankton contributing to turbidity, and so the line for that, the nutrients, would go to phytoplankton, which would go to turbidity.

VANCE VICENTE: Got it. Okay.

RICHARD APPELDOORN: Which brings us then to water toxicity, and we said that -- I don't know why we have a three, why water toxicity would affect turbidity.

VANCE VICENTE: I don't know either. I think there was a discussion, and I am checking the minutes of the last meeting, and we said that there was resuspension of sediments and some of the chemicals associated with the sediment particles would become available, but I don't remember if we came to any solid conclusion on that.

RICHARD APPELDOORN: I don't know why that would affect turbidity, as opposed to something else. What we haven't discussed is the colored dissolved organic matter. We had already said that that's

an important factor in turbidity.

VANCE VICENTE: Well, again, I mentioned that, and it's going to be very variable, and it depends on where -- Anywhere that you have a wetland that eventually has an outflow towards the ocean, it's going to contribute to dissolved organic substances. It is principally in Puerto Rico and associated with rivers, although nobody has measured it. In the Virgin Islands -- It's everywhere that you have decomposition of plant material, ferns and branches and things that will eventually produce dissolved organic substances.

In the Virgin Islands, you may have situations in closed embayments, and maybe Toby Tobias or Julian or other of the good biologists there can tell you, but definitely, where there is the composition of organic matter, of plant organic matter, like mangroves and any kind of wetland that eventually has a runoff, some kind of a direct or indirect runoff, to the ocean or to an embayment will contribute to it.

The only extreme case that I have seen in the Virgin Islands is St. Croix, and the discharge -- I don't know if any of you have landed in St. Croix, land at the airport, and you see this stream of yellow stuff coming out, and have you ever seen that?

RICHARD APPELDOORN: Yes.

VANCE VICENTE: Okay. Well, that's a very extreme example of gelbstoff, and that is a product of the sugar cane, where they use the rum slop waste, but, other than that, I don't know of any significant situation, but I would put a one, just to keep on the safe side, because, really, nobody has done any -- They have done water color analysis in Puerto Rico. You can more or less estimate if there is some upland material, but I don't know of any instances that it has been measurable.

I think it's significant, and I am specifically referring to Carlos Goenaga and his dissertation, and I read it very thoroughly, and he did sediment tracks and studies in La Parguera and in Mayaguez Bay, just in front of the discharges, and he did not find any significant difference in the sedimentation loads in either of the reefs, and he attributed it to something associated to dissolved matter in the water column.

He didn't measure it, but he suggested that, and then, from there on, I've been thinking, well, how important, how significant, it is, the dissolved organic substances in light attenuation is, in regard to our reefs, and I will leave it there.

JORGE GARCIA-SAIS: That's one of the major aspects of the research program at Marine Sciences, and there are studies on dissolved organic matter, and there are PhD students working on this, and it is a signature of the water optics within the surface mixing layer close to the land in Puerto Rico.

VANCE VICENTE: Good. Let us know about it.

RICHARD APPELDOORN: Ernesto Otero has done a fair amount of work measuring this, both across the platform here in La Parguera, which is where I am, and across the platform off of Ponce, and it's clearly much higher in Ponce, because of the inputs there, but, in both cases, you get the signature extending across the shelf, of course at lower levels as you get further out, and so, if you're happy with a one, I'm happy with that too, and I think that completes this internal connections of this sub-model.

VANCE VICENTE: Okay. I'm happy.

RICHARD APPELDOORN: Any other comments from anybody else?

GRACIELA GARCIA-MOLINER: Just to request that, any references that you have, please do send them our way, so that we can include them in the documentation for the conceptual models.

VANCE VICENTE: I sent you a few, and I can send you more.

GRACIELA GARCIA-MOLINER: Gracias.

RICHARD APPELDOORN: All right. Two points then. So this now represents Puerto Rico.

GRACIELA GARCIA-MOLINER: Richard, sorry to interrupt, but Sarah needs to ask you a question.

RICHARD APPELDOORN: Go ahead, Sarah.

SARAH STEPHENSON: I think he's about to answer my question, which is going to be how these scores related for the USVI.

RICHARD APPELDOORN: It actually comes down to real simple question, with maybe not a simple answer, but can this be modified for the Virgin Islands really quickly? In other words, we would be just really talking about what are the major contributions into turbidity, and you mentioned sediments would not be such a great input there, and then we're done, or is this going to take a lot of discussion, in which case I'm going to say tomorrow, and so,

Vance, what's your feeling on that?

VANCE VICENTE: I would like to hear from Toby Tobias and a biologist from St. Thomas, to see what their opinion is. It may be nothing dramatically different, but I think we have covered it, so as to include the Virgin Islands, but it's just the level of intensity of the arrows is going to be variable between Puerto Rico and the U.S. Virgin Islands, like we have discussed today. It's going to be different, and so you can put a range, maybe, if that helps, but --

RICHARD APPELDOORN: Of all the things we've looked at, we know there are ranges, and they vary not only over time, but over space.

VANCE VICENTE: I think it can apply, and it will apply to the Virgin Islands on a seasonal basis, regarding rainfall and seasons and hurricanes and things like that, where they do get into the sediments from the upland and from the very small agricultural areas, and so if we can put a value -- It will be seasonal.

What happens during the rainy season, the gullies get full up, but then they dry up, and you don't have any permanent streams in the Virgin Islands, period. There is none. It's not a matter of there is some and maybe a little bit more, but they don't have any, and so that distinction has to be made, to some level, and I don't know what to level, but we really have to hear from them.

GRACIELA GARCIA-MOLINER: I am looking to see if we have anyone on the call at this time from the Virgin Islands, but we don't, but we can pass along the request for information and have them look at this.

VANCE VICENTE: From the data that I have and the years that I monitored their areas, it's very, very seasonal and very, very localized, and, now that Hovensa has been shut down, these are very, very different.

I mean, these large vessels came in, and they resuspended sediments, and they caused local turbidity, but, again, there is other sources of disturbance there, related to tourism and the diving industry and boats coming in and out, but I find it very marginal in relation to, in comparison to, Puerto Rico, but that's my opinion, and we have to hear from them.

RICHARD APPELDOORN: Well, Hovensa was being re-opened, and I'm not sure what the oil price collapse has done to those plants, but, at least up until a few months ago, that was coming back online, and so I'm suggesting that we stop here for the day, but

we have a comment from Carlos, which reads, from his experience, and I assume this is in St. Croix, he agrees with Vance that, for the VI, it's seasonal and depending on rainfall.

VANCE VICENTE: Can you repeat that? I didn't hear it.

GRACIELA GARCIA-MOLINER: Carlos agrees with you, and it depends on rainfall.

VANCE VICENTE: Yes, that's what I mentioned. Okay.

RICHARD APPELDOORN: All right. I am suggesting that we'll break here for the day, and that will give a chance for maybe some further input from the Virgin Islands, and we'll keep this and keep in mind that we do have differences between the islands, and, if that's not feeding in from other things that are providing the drivers of these sediment loads, for example, then we'll have to come back and see how we can differentiate that for the island systems.

VANCE VICENTE: Okay. So far, I'm happy.

RICHARD APPELDOORN: Any other comments from the rest of the committee? Are you in favor of adjourning for the day?

WALTER KEITHLY: I'm in favor of it, and what time do we begin tomorrow? Is it ten o'clock again?

RICHARD APPELDOORN: Yes, ten o'clock again.

WALTER KEITHLY: Okay. Thank you. See you all tomorrow.

RICHARD APPELDOORN: Thank you, everybody.

(Whereupon, the meeting recessed on May 20, 2020.)

\- - -

May 21, 2020

THURSDAY MORNING SESSION (0:08)

\- - -

The Scientific and Statistical Committee of the Caribbean Fishery Management Council reconvened via webinar on Thursday morning, May 21, 2020, and was called to order by Chairman Richard Appeldoorn.

RICHARD APPELDOORN: Welcome, everybody. This is day four of the SSC meeting for the Caribbean Fishery Management Council. As with all other days, we need to do a roll call, and so let's begin. I am Rich Appeldoorn, SSC Chair. Joe.

JOE KIMMEL: This is Joe Kimmel, SSC.

RICHARD APPELDOORN: Doug.

DOUGLAS GREGORY: Good morning. Doug Gregory, SSC.

RICHARD APPELDOORN: Churchill.

CHURCHILL GRIMES: Churchill Grimes, SSC.

RICHARD APPELDOORN: J.J.

JUAN CRUZ-MOTTA: Good morning. J.J. Cruz, SSC.

RICHARD APPELDOORN: Walter.

WALTER KEITHLY: Walter Keithly, SSC.

RICHARD APPELDOORN: Reni.

JORGE GARCIA-SAIS: Reni Garcia, SSC. Good morning.

RICHARD APPELDOORN: Vance.

VANCE VICENTE: Good morning, everybody. Vance Vicente, SSC.

RICHARD APPELDOORN: Tarsila.

TARSILA SEARA: Hello, everyone. Tarsila Seara, SSC.

RICHARD APPELDOORN: Kevin McCarthy.

KEVIN MCCARTHY: Good morning. Kevin McCarthy, SSC.

RICHARD APPELDOORN: Jason Cope.

JASON COPE: Jason Cope, SSC. Good morning.

RICHARD APPELDOORN: Going back, Liajay.

LIAJAY RIVERA: Buenos dias. Liajay Rivera, council staff.

RICHARD APPELDOORN: Graciela.

GRACIELA GARCIA-MOLINER: Graciela Garcia-Moliner, council staff. Good morning.

RICHARD APPELDOORN: Nelson Crespo.

NELSON CRESPO: Good morning, everyone. Nelson Crespo, DAP Chair, Puerto Rico.

RICHARD APPELDOORN: Vanessa Ramirez.

VANESSA RAMIREZ: Good morning, all. Vanessa Ramirez, council member, commercial fisherman.

RICHARD APPELDOORN: Bill Cordero.

BILL CORDERO: Good morning. Bill Cordero. Ready to go.

RICHARD APPELDOORN: Okay. Carlos Farchette.

CARLOS FARCHETTE: Carlos Farchette, council member. Good morning.

RICHARD APPELDOORN: Alida Ortiz.

ALIDA ORTIZ: Buenos dias. Alida Ortiz, Outreach and Education Advisory Panel.

RICHARD APPELDOORN: Bill Arnold.

BILL ARNOLD: Bill Arnold, council EBFM TAP Chair. I'm doing laundry, if anybody needs any done.

RICHARD APPELDOORN: I will send some over.

ALIDA ORTIZ: I have to do that, too.

RICHARD APPELDOORN: Marcos Hanke.

MARCOS HANKE: Marcos Hanke, here.

RICHARD APPELDOORN: Miguel Rolon.

MIGUEL ROLON: Good morning. Miguel Rolon, council staff.

RICHARD APPELDOORN: Ricardo Lopez.

RICARDO LOPEZ: Good morning. Ricardo Lopez from Puerto Rico DNR Fishery Research Lab.

RICHARD APPELDOORN: Jocelyn D'Ambrosio.

JOCELYN D'AMBROSIO: Hello. Good morning. This is Jocelyn D'Ambrosio, NOAA Office of General Counsel.

RICHARD APPELDOORN: Orian Tzadik.

ORIAN TZADIK: Orian Tzadik, the Pew Charitable Trusts.

RICHARD APPELDOORN: Christina Olan.

CHRISTINA OLAN: Buenos dias. Christina Olan, council staff.

RICHARD APPELDOORN: Sarah Stephenson.

SARAH STEPHENSON: Sarah Stephenson, NOAA Fisheries.

RICHARD APPELDOORN: Michelle Duval.

MICHELLE DUVAL: Good morning. Michelle Duval, independent contractor working on the council's strategic plan.

RICHARD APPELDOORN: Maria Lopez.

MARIA LOPEZ: Good morning. Maria Lopez, NOAA Fisheries.

RICHARD APPELDOORN: Stacy Williams.

STACY WILLIAMS: Good morning. Stacy Williams.

RICHARD APPELDOORN: Caller 1. Kevin, would that be you?

KEVIN MCCARTHY: It may very well be, Rich.

RICHARD APPELDOORN: You're Caller 2, and so Caller 1 would be?

CARLOS FARCHETTE: Blanchard.

RICHARD APPELDOORN: Thank you. Tony Blanchard. As with the other days, the first thing is to take a look at our agenda, and we'll be starting off the morning continuing our discussion on the individual models, the individual sub-models, as indicated in the yellow. I am not sure how far we will get in the morning, and so I don't know if, in the afternoon, if we will be starting off with the adaption of that to the individual islands in particular, but that's our goal anyway.

I would also like to start off the meeting by thanking everybody, during the first three days, for dealing extremely well with the online nature of this meeting. I think everybody has performed really well, and the nature of comments have been very pertinent, and everybody has displayed the patience necessary to do work in this format, and so I thank you all for that. As the agenda --

GRACIELA GARCIA-MOLINER: Richard, what is yellow we brought from the previous day, and so, if you accept this change to the modification to the agenda, we will eliminate the yellow, and then it's just stating that, if we don't finish this, this will continue in the afternoon, and so we can add another continued discussion after the summary determination or somewhere in there, so that you can continue to finish all of the components of the models for the CM.

RICHARD APPELDOORN: Okay. While we're doing that, I'm reminded by Graciela that I was supposed to state the date, and so today is May 21, 2020, and we were starting the meeting at 10:01.

GRACIELA GARCIA-MOLINER: You also have -- We have one comment from Bill Arnold that would like to address the SSC at some point, and so I sent you a copy of his message.

RICHARD APPELDOORN: Yes, and that's pertinent, because I was actually going to ask Bill something that looks like what he wants to address, and so, Bill, would you like to go ahead and make your comment?

BILL ARNOLD: Yes, I would, Richard. Somebody had mentioned the other day, or there was at least a brief discussion, of quantitative models, and I just want to let the SSC know that the Technical Advisory Panel, and what was previously our EBFM planning group, has been working for several years on developing, or acquiring and analyzing, the baseline information that would be needed to transition conceptual models, qualitative models, or even semi-quantitative models, because, when you guys are putting numbers on these paths, you're kind of adding a quantitative component, but it's not fully quantitative.

I mean, I know you guys, a lot of you guys, are assessment folks, and are very good modelers, and so you certainly understand what I'm talking about, but I did want to make it clear that there's a lot of data in the Caribbean, in the U.S. Caribbean, but there's not every piece of data we need for every analysis we would like to run, and so the conceptual models, as we go through this process, are hopefully going to let us focus our energy and efforts on those things that we would like to be able to quantify.

Then we will combine that with the data that are available, and the statistical analyses that we have at hand, and really J.J. and Stacy and Tarsila got money from Lenfest, and they're doing now, under that funding opportunity -- They're working on statistical and quantitative approaches to develop these quantitative models that we're going to need, and so it will also help us to identify where important data are lacking.

If we've got some really high-level need that is derived from the outcomes of the conceptual models, and everybody agrees this is something really important, but we don't have the data to quantify it, then that would be a very good outcome of this, to help us direct our funding and energy to obtain those data, and, as you well know, it can take years and years to get enough data to be able to make sense of these things.

Really, I wanted you to know that we are, ultimately, driving towards quantitative models, models that I hope the council can use, and others, to make predictions about what decisions will mean, quantitative predictions about what decisions will mean, so that, ultimately, this whole EBFM approach and the fishery ecosystem plan and ecosystem status reports and everything we're working on will have a sensible conclusion, and not really conclusion, and that's not a good word to use, but it has a sensible direction for the council.

At the council meeting, I think we will want to discuss with them further why an EBFM approach, conceptual model, et cetera, et cetera, are of value to them and will be able to be used in a management context, because I know there's still a lot of concern, or confusion maybe, on the part of the council, and not just the council, but high-level leadership, as to exactly how all this EBFM stuff is actually going to translate into what the council and NOAA do, which is manage fisheries. I just wanted to reassure you that we are working along those lines, and that's all. Thank you.

RICHARD APPELDOORN: Thank you, Bill. That wasn't quite what was keeping me up yesterday. I think the approach that we were taking when we're drawing our lines and giving values there was kind of a strength of connection interpretation, and that's very different from volume of flow, and so, for a particular example, we talked about both commercial and recreational fishing and their contributions to bycatch, and the connections are very direct, but the flows are really small, and so, since this is conceptual, and if we're looking at things in that way, that's fine, but that would be very different than how you would implement that in a

quantitative model, where flow rates would actually be important.

BILL ARNOLD: No argument there, Richard. I am hoping that -- Remember that we're going to get multiple conceptual models for each island, and those are going to distill into a single overarching model, or a single, perhaps, and this might be pushing a little bit, but a fisheries sub-model, or whatever those sub-models the council and the council-associated folks feel are important, would shake that out.

Maybe, when it shakes out, you find that, well, okay, there's a link between this and that, but it's not important enough for us to focus our initial energies on. Maybe down the line, but what we really want to do is identify those outstanding relationships that really could influence management decisions, and so we're not -- Now is not the time to be making those decisions.

I think the approach you guys are taking -- I am really pleased and really impressed, and I would rather get too much in a model than not get enough, and another thing I really like about this is how much everybody is learning about how everybody else thinks and what's important to them, and even the SSC members are learning more about how their co-members think in a higher-level ecosystem-type context, and so I just think this is -- There have been previous meetings on conceptual models, and they've gone well, but they haven't gone this well. This one has gone superbly, and so we're no longer meeting in-person, and we're always going to do it by remote venue, and does that help, Richard? I am kidding about the last thing, of course.

RICHARD APPELDOORN: Yes. Thank you, Bill.

JUAN CRUZ-MOTTA: Can I add something?

RICHARD APPELDOORN: Go ahead.

JUAN CRUZ-MOTTA: Thank you. Yes, I just wanted to say that the relationship between the conceptual model and the competitive model is -- The conceptual model is an explanation, or a set of explanations, that different people are given to explain how the system works, right?

Why is that important? Because then, from that model, we can extract specific hypotheses to be explored by the quantitative model. If we don't go through this process that we're going through now, and we say to the quantitative model to develop anything, any potential model, we have fifty-something boxes with hundreds of variables in some of those boxes, inside of those

boxes, and anything multiplied by the number of boxes by number of lines by number of variables, and that would be a humungous amount of potential hypotheses to be tested and interactions of those hypotheses, and so the good thing about this exercise we're doing now is that, then, it will help us to identify specific hypotheses to be tested with the data.

That's one thing, and I will give you an example of what you mentioned before, Rich. You said, talking about the commercial versus the recreational fisheries, right, and, after the discussion yesterday, we said that one would be more important than the other, the minus-three and minus-two, but then now we can test that, right?

It might be the other way around, that the recreational is more important than the commercial, right, or not important at all, and so, in summary, what I wanted to add to what Bill said is this process will help to extract a specific hypothesis to be tested with the quantitative model. Thank you.

BILL ARNOLD: This is Bill again, and J.J.'s point is very good, and the reason you want these models to be expansive is because what the SSC or J.J. or the council identifies as important hypotheses -- There are other groups out there, like CARICOOS or EPA or whatever, that may use these same models, and they may pull separate hypotheses and say, okay, this is something that we're going to test, and so that's why we want these to be public and broad-based, because we're hoping that this will provide a common ground for lots of different groups to operate in a manner that is coherent.

TONY BLANCHARD: Good morning. This is Caller Number 1, Tony. I just wanted to make sure that I was recognized by the Chair. I wasn't sure if I had gotten through. I'm Caller Number 1.

RICHARD APPELDOORN: Yes, and thank you very much, Tony.

JORGE GARCIA-SAIS: Richard, just a brief comment, in the sense of -- We were talking about this yesterday, about conceptual and mathematical models, and that I do agree that it is a very good idea to have this conceptual framework for each of these sub-components of the system, but, in my opinion, it is good to have in mind where is the data that we can put into a mathematical model further on.

That is why I was introducing these new elements on the conceptual model, for example things like rivers and things like the regional treatment plants, because that's where the data is, in terms of

the land-based uses, and I think that, for the other components that we are looking at, it's good to have the conceptual framework, but knowing where is the data, so that, when we go from the conceptual to the mathematical model, we have a footprint to follow, you know, and that is my point.

That is why I sort of like insisted a little bit yesterday in my presentation on trying to introduce from now into the conceptual model blocks where data is available, so that we can go into the hypothesis-testing procedures and all that, and that's all.

RICHARD APPELDOORN: Okay. Thank you, Reni, and, yes, I think you made that point well in your presentation yesterday. We need to, for the committee, adopt these changes that are in yellow, so we can get on with the day. Is there any disagreement from the committee? Hearing none, there is a consensus to adopt. Thank you.

At this point, we're at Number 6, which is the socioeconomic and cultural drivers, and this is probably the big beast of the sub-models, and Tarsila has graciously accepted the challenge of leading us in that discussion. Thank you. Go ahead, Tarsila.

GRACIELA GARCIA-MOLINER: Tarsila, do you want to be the presenter?

TARSILA SEARA: That might be easier, just because I might need to jump between slides a little bit, if you don't mind.

GRACIELA GARCIA-MOLINER: So I will make you the presenter. Okay.

SOCIOECONOMIC AND CULTURAL DRIVERS (21:50)

TARSILA SEARA: This is where we ended the last meeting. this is the model, but I also have a slide with the matrix, because, when I looked at the matrix as we had it after the last meeting and the actual model, there were some discrepancies, and so there is -- Not all the connections that were in the matrix were actually reflected in the model, but this is essentially just to show that we actually had gone through this sub-model, and we had created some -- We actually went relatively far, and we had strengths of relationships for most of these connections.

Really, what I did was I spent some time looking at this and really reflecting at what was going on here, and I made some notes to sort of guide us through what I was thinking when I began to create some recommendations as to how we could improve this.

I was really trying to focus on what are direct and indirect

relationships, and so I was looking at the model as a whole and trying to look at some of the other sub-models and what variables are available in the broad model that could provide some of these indirect connections, to try to avoid having too many connections, because, really, my inclination, and I think this is kind of the nature of the socioeconomic and cultural components, is that it's really easy to just think everything is connected, and you just want to put arrows everywhere, and so I was trying to be conscious of that and trying to see where there are indirect connections that would be more useful.

At the same time, I didn't want to lose any possibilities here, because, in terms of thinking of future hypotheses that we could test, and, as Bill was saying, where we could focus our efforts, in terms of future research -- Actually, for the socioeconomic components, we have very little data, and I also didn't want to potentially miss any important correlations, and so I did make some what I'm loosely calling loose connections here, just so that we could capture those.

One of the things that I did was actually include one more variable, and it's okay, and we still have sixteen, and I didn't actually increase that number, because there are some that were eliminated, and I should say this, that the matrix that I am going to show in one second that has my recommendations also reflects some of -- It reflects Walter's recommendations, and I did ask for his input, especially with some of the economic variables.

I should say that I didn't give him too, too much time, and so, if there is anything that doesn't look right, I will take responsibility, but one of the things that I did was to add this population composition variable, because I thought that we should be able to capture the facts of changes in demographics, and so that's one recommendation.

A couple of other notes, and this is just to guide some of the discussion, when we actually get down to looking at the components and how they're connected, and I was struggling a little bit with some of the components that perhaps would be helpful for us to define a little bit further. For instance, the regulatory structure, the regulatory process, for compliance, are we talking in terms of a fishery context only, or are we expanding that, and that will be very important to think about, especially when we do the inter-model relationships, and so I would like to spend a little bit of time discussing that.

I was more inclined, in my approach here, to think about this in the fishery context, because I think that that would be more

useful, but there might be some other connections with some of the other sub-models that might perhaps need us to broaden that a little bit, and so that's something that we could discuss.

The other thing that I wanted to just make clear, before we start discussing individual components, is that we have, in this sub-model, some very complex components, and that will naturally increase the number of connections and sort of the two-way relationships, and these complex components also make it sometimes very, very difficult to define relationships as positive or negative.

I have examples here of what I mean by these complex components, and I think these two are perhaps some of the most complex, and so we have the coastal community resilience and wellbeing, and, just within this, and this is not entirely comprehensive, there are lots of different -- Each one of these boxes could be split up into multiple boxes, and so we're trying to contain a lot, and this is, of course, going to sort of complicate things a little bit.

I think it's okay that we're keeping it simple for now, but this is just to illustrate the reason why we're going to have a lot more connections with these boxes, because, in reality, they are multiple boxes. We can spend some more time here if we want to go back to defining some of these complex components, but I just wanted to sort of show you what I have right now.

I looked at the matrix and what we had, and I made some recommendations, and so that was kind of my approach, was just to come in and make recommendations, so we can discuss my -- Again, I should say that Walter's recommendations are also reflected here.

It might be -- I think it would be a lot more helpful if we actually work with the matrix, because, when you look at the actual model, it looks like the Jackson Pollack picture that Richard had in his presentation, and so I tried to simplify this a little bit, to see if we could work with the actual model, by using two-way arrows, but it still looks very busy, and so I think that it would be easier for us to work with the Excel file, perhaps.

Really, my suggested discussion points for this sub-model would be to go through the recommendations in the presentation and see what kind of discussion the committee wants to have about those, and maybe spend a little bit of time just thinking in terms of the definition for some of those components, especially the regulatory and compliance, and just to make sure that we're all on the same page.

Then we can discuss how to deal with the connections. They are difficult to characterize, and some of these connections are -- I know this is not just for this sub-model, and we're going to have the same issue for other sub-models, as came up already, but, since there is a lot of that going on here, maybe we can discuss a little bit of how we're going to deal with this.

Then hopefully we'll get to interactions with other sub-models. I have already started to create some recommendations, because, as I was looking at those indirect connections, I was already looking outside of this sub-model. That's pretty much it for the presentation, and, if we want to look at the Excel sheet, I can put up the Excel sheet.

RICHARD APPELDOORN: Let me make a comment. This is also one of the models under discussion last week where we were in fact making explicit links to other sub-models, and that wasn't incorporated into the information that you were sent for the sub-models, just looking at the internal connections, and did you have the picture that showed the external connections when you were thinking about that in your current review?

TARSILA SEARA: No. Do you mean just as just something like this?

RICHARD APPELDOORN: Yes, but it would have been a picture of the connections between these components and components to other sub-models. I actually had a -- In my introduction, I had a picture of that that had been prepared by Liajay, and so this is getting ahead of us, because we're not really looking at the external connections, but, when we get to that point, it looks like we have two starting places, what you've been looking at and what we kind of already did, and so just kind of keep that in mind.

TARSILA SEARA: Okay. Yes, I can go back to it and start from there. In this presentation, I was just really thinking in terms of the sub-model, but, yes, that's a good point, to go back to that.

RICHARD APPELDOORN: The other point I would like to put out, and this is certainly my perspective, but, if the committee feels otherwise, but, for at least the first part, when we're talking about discussing a little bit more the definitions of these, the various components, to me, seeing this figure helps me focus on that definition. In the matrix, it doesn't work for me, because, here, I can see what it's supposed to be doing and what our thinking was behind that, and the matrix is just -- Each component is just a component, and that's good for actually scoring the things, but

conceptually understanding what we were thinking about when we defined a component, to me, is easier to see with the diagram, and I don't know if anybody else feels the same way or not.

JASON COPE: I do think having both -- I see both perspectives, but having both at hand, that we can kind of just go back and forth with, I think that will really help, and I don't know if everyone else should maybe open this up on their own device, to be sure that we have this, at a minimum, so we can look at it, but I do think that this visual does bring a different angle to this that will be very useful.

RICHARD APPELDOORN: As I said, this is just for the discussion of those components where, as Tarsila said, we perhaps need a better definition, or a more comprehensive definition, of what we mean here. Once we get into the actual making the connections, yes, let's go to the spreadsheet.

TARSILA SEARA: For the definitions, I think the two that I was most concerned about, and, again, we can go through everything, but maybe that's a place to start, was the regulatory structure and compliance and whether or not we're talking about these within a fishery context only, and especially in terms of the regulatory structure, if we're just talking about the regulatory structure for everything, because, when I was looking at this, in terms of, for instance, I think maybe the ecosystem sub-model, and I'm thinking about interactions between this and some of the other organisms, mammals and turtles and whatnot, are we thinking in terms of regulatory structure as including legislation and policy that would also oversee some of the connections with these other organisms, or are we just talking about it in terms of what oversees the fishery and the fishery resources? The same would go for the economy and the public health. Are we talking about regulatory structure that is overseeing everything?

RICHARD APPELDOORN: Well, "everything" is a really big word. I think my thinking was certainly a little bit more expansive than the actual just fishing process, because regulatory structure certainly has a strong impact on water quality, coastal development, and other things that can -- Land use practices, getting back to both Reni's and Vance's presentations that are going to affect what's coming into the systems that can perhaps have strong impacts on those, and so it's a broad look at regulatory structure, and I'm not sure how far you want to go with that.

I mean, in Puerto Rico, we certainly have had experience where, when they changed the tax definitions, relative to full-time and

not-full-time fishermen, that had a big impact on people, but that was coming out of the tax program, which is perhaps beyond what I was thinking, but there's an example of where it had a big impact.

TARSILA SEARA: Yes, absolutely, and that's a very important variable, a very important box here, and it's going to be very important where it connects with all the other sub-models, and that's why I think it's important that we think about it, and I don't know if it would even be -- If it would even make sensed to maybe split it up and have something that is specific fishery regulations and fishery legislation and then have another box that is a little bit broader, and I don't know.

RICHARD APPELDOORN: Nor do I. I mean, that would make sense. You could have fisheries, and you could have broader conservation, and then you could have -- I don't know, but you could, obviously, split this up. The socioeconomic and cultural drivers is a sub-model that is as complex as like the rest of the system we're trying to model, and so we're trying to keep it down, but, as you said, that could cause some problems in how we try to connect these things, and I don't have a solution. I would like to punt and just say I'm a biologist.

TARSILA SEARA: I think, again, this was something that was said at some point yesterday too, and maybe, once we begin to connect the sub-models with each other, it may become clearer what would make sense to split up, but I think that -- And also island-specific and whatnot, but I think, maybe for the regulatory structure, for as long as there is an understanding that we are including -- It's fisheries, but we are also including other broader aspects of the regulatory structure, and that's fine.

I just want to make sure that we discuss that and that that's clear. I took extensive notes on all these relationships, mostly for my own benefit, but I am happy to share all of these notes as well, and I think that maybe defining these a little bit further would also be helpful.

RICHARD APPELDOORN: Go ahead, Walter.

WALTER KEITHLY: Thank you. The model is pretty complex as it is, and I usually like to keep things simple. Having said though, I see -- I think it may warrant to break out the regulatory process between fishing, or those regulations that directly impact the fishermen, versus those that may directly impact the population of fish.

In other words, measures that will prohibit effluents into the

water will influence the stocks of the fish, and the regulations that impact the fishermen work through the system to impact the population of fish, and so you have those regulations that impact the populations of fish and the stock of the fish directly, versus indirectly through the fishermen behavior, and I think that may be a concept that we may wish to think of, and I think it will make it easier that way to combine the sub-models in the end. Thank you.

TARSILA SEARA: It might also make it easier to understand and visualize if we do that, because we're going to end up with a lot of connections with that box.

RICHARD APPELDOORN: Again, I am agreeing with Walter.

WALTER KEITHLY: Something is wrong then.

RICHARD APPELDOORN: Yes, and this is like the third time I've had to admit that.

JOE KIMMEL: I agree with both you and Walter, too. The presentation shows a very complex relationship here, with all these arrows, and, if it can be simplified and make the end product a little better, I would go with that.

TARSILA SEARA: Okay, and so, just to be clear, we're talking about splitting that into a specific fishery regulation box into one that is a broader regulatory process box?

JOE KIMMEL: I think that was Walter's recommendation.

TARSILA SEARA: Okay. Yes, I think that makes sense.

RICHARD APPELDOORN: You had -- Compliance was the other box that you were interested in discussing?

TARSILA SEARA: Yes, and so I think this is maybe the last complicated one in the regulatory structure box, but, at some point, when I was thinking about this, there was also a similar concern with are we talking about compliance, and this is just fishermen compliance, fishing regulations, or are we talking about compliance, again, in general, and so would this affect some sort of pollution context, where there is lack of compliance or something like that, that it doesn't necessarily link back to the fishermen.

RICHARD APPELDOORN: Well, it doesn't necessarily link back to fishing, per se, but say, in Puerto Rico, being a much bigger

island, and kind of the points that Vance and Reni were making yesterday, there has been a fair amount of habitat degradation in the coastal environments because of basically lack of compliance of what's happening with land use, and, yes, it's kind of the same thing, do you want to start those things, but I think there are strong habitat-associated problems that are arising that are not due to the fishermen and the compliance among fishermen. It's other sectors.

VANCE VICENTE: Richard, I agree with Tarsila and Walter, I mean, regarding the complexity of the model, but, the more I look at it, and the more I remember of discussions during previous meetings, on regulatory structure, I mean, it's very complex. I am even thinking, or suggesting, to have a whole different sub-model, which would include just regulatory structure, but it's under regulatory structure that you have the U.S. EPA Environmental Quality Board dealing with water quality standards and compliance, and then you have regulatory directly related to fisheries, and you have another section under regulatory structure which strictly deals with protected resources, and that's just a suggestion, because I really think that this regulatory structure really is contributing to the complexity of this sub-model. That's my comment.

JORGE GARCIA-SAIS: I second Vance's suggestion. That's a good idea.

WALTER KEITHLY: I think, and I'm not sure exactly where Vance was going, but it seems to me that, with most of these sub-models, you would have a regulatory structure and compliance, and so, again, it adds to the complexity, but I would -- Again, trying to keep this sub-model related to fisheries, I would put a regulatory structure and a compliance in the other models, sub-models, and, again, I think that would make it easier to link the different models, again stressing the fact that regulations and compliance in the other sub-models will relate directly to population of the fish or the fish stocks. This model will work directly to regulation and compliance, and this model will work directly through impacting the fishermen, which then indirectly impacts the fish stocks. Thank you.

RICHARD APPELDOORN: Walter, to clarify that, some boxes then -- Some sub-models would get that extra regulation and compliance boxes and some would not. For example, ecosystem components and habitats, I would say yes, because there's a lot of regulatory activity that's affecting both of those directly, which then indirectly affects fishing, and water quality would also be another one, but something like abiotic factors or whatnot probably doesn't have -- We can't really regulate what the temperature of the water

is going to be or how hard the wind is going to blow, within at least the framework we're dealing with here. Is that kind of what you're thinking?

WALTER KEITHLY: I believe so, if I understood you correctly. In other words, with habitat, regulations, assuming they are enforced, with respect to habitat, protecting the habitat, would directly impact the stocks of the fish. We cannot put regulations on some of these other sub-models, and I think the example you used was temperature of the water or something, and so, for those sub-models, where regulation is an important consideration, we -- Again, I hate to make things more complex, but I think, in the end, to bring the models together, it will simplify things to put a regulatory structure and a compliance in those other sub-models.

RICHARD APPELDOORN: I think, in this case, you're right. It would be perhaps a case where more actually then becomes less, more sub-components actually becomes less complicated.

TARSILA SEARA: In this case, would we move the regulatory structure and compliance from here to -- Or we wouldn't have it here, and we would just have it in other sub-models, linking back to this, and so, in this case, I was thinking mostly in terms of fishery regulations and compliance, and so this would actually move to the fishery sub-model.

WALTER KEITHLY: I hadn't thought of that part. No, I would leave it in regulations impact the fishermen, and I would have to go back to the fisheries sub-model to remember it, but -- I can't remember enough about -- I don't think the fishermen were in the fisheries sub-model, and Jason can correct me, but, as I remember it, I would leave the regulatory structure here, because that's what most directly impacts the fishermen.

RICHARD APPELDOORN: You remember, from our discussion yesterday, that we didn't have effort in that fisheries sub-model, and that's something that we have to make sure is accommodated, and so that may be a box that we actually have to add to the fisheries sub-model.

WALTER KEITHLY: No, I would not add that, because, when you're putting effort into the fisheries sub-model, then the regulation would impact the fishermen. I am glad you said that effort is not in the fisheries sub-model, and that suggests, to me, that the regulatory structure is appropriate in this sub-model.

RICHARD APPELDOORN: Yes, or that was our initial thinking anyway.

JASON COPE: Just as a reminder, the regulatory process came in through the fisheries sub-model through the spatial, temporal, or gear selectivity sub-components, and so it feeds directly into there, which would presumably be altering effort, which I was thinking, being presumptuous, would be reflected in the arrow moving forward, but, if you think that there's a fishery effort that needs to be I guess an umbrella under or over those, and I'm not really sure where you would slip that in, but we can revisit that.

WALTER KEITHLY: I forgot about that. I don't know what the answer is. It may simply be taking them out of the fisheries sub-model and put them this model, but I hate to get into each one. Just say the regulatory structure includes things such as area closures and so forth, and leave it at that. Again, that may -- That would simplify the fishery model some, and if you just list the different regulatory aspects, or specific regulations or whatever, and say regulations on area fished, on seasonality, and so forth, just list them here.

That would resolve the issue of having to put regulatory structure in the fisheries model. Again, I would argue that the fisheries model is geared directly, or should be geared directly, toward the stock of fish. This sub-model works through the fishermen to impact the stock of fish. Again, where I think about it -- Again, I'm thinking about both models simultaneously, and I would kind of argue that anything dealing with spatial closures and area closures and so forth probably should be in this model, rather than the fishing sub-model. Thank you.

TARSILA SEARA: I agree with Walter, and I think maybe the way to go would be to just create a strong definition for what we mean by this, because I think, no matter where that box is and what sub-model it is -- I mean, we can create connections between all sub-models, going back and forth between this box, but, for as long as we are clear as to what is contained within that box, I think that that would be enough. I don't know. Any other thoughts about regulatory structure?

JORGE GARCIA-SAIS: I'm just trying to see how -- Well, the thing is that you have a box here that is presumably regulating a big chunk of the fisheries here in the Caribbean, which is the market demand, and I have been trying to follow-up on this concept that guys from the USVI have brought up for a long time, many years.

They have been saying that their fisheries are market driven, and you have this box here, and it's just one more box with a lot of boxes and a lot of arrows, and, in my opinion, that should be a

main idea. That should be really important, and perhaps it could be the central point, in my opinion, of this model.

What are the things that affect ups and downs in market demand, because, if we have fisheries that are market driven, and the USVI was telling us, for many years, that their fishery was market driven, and look what happened just now. The Puerto Rican fishery right now is market driven, because there is no market, or a very small market, and that is what is driving the fisheries, and now you heard the fishermen yesterday saying that they are not doing much. Why? Because there is no market, and that is the point.

Anything that could be done to make that information flow across the market demand, for me, would be important. In the other sense, I see the regulatory structure being another aspect of what is -- It has to do with the market demand, but, at the same time, it has all these other sub-components, for example, of the seasonal and permanent closure areas and the size limits and all these sub-components of the regulatory structure that we have in our fisheries right now.

I pretty much jumped on the idea that Vance brought up to separate these two areas, the regulatory versus the market-driven and the market structure, and I believe that those two could stand by themselves. I mean, from the standpoint of being two large sub-components in which you are dealing here with and has resulted in this super web of interactions.

WALTER KEITHLY: I would like to -- I have kind of lost track now of where we're at. Are we still on trying to decide what the regulatory structure should be moved -- I shouldn't say removed, but the regulatory structure associated with this sub-model, the socioeconomic sub-model, should include factors such as area fished, or whatever it was called in the fisheries model, and spatial components and temporal components? Should we include those under the regulatory structure here? Are we still on that subject? We seem to have evolved a little bit, and taken out of the fisheries model?

RICHARD APPELDOORN: I think we are still on that. I was actually trying to find a copy of the final version of the work we did with Jason yesterday, and I don't seem to have the updated one.

WALTER KEITHLY: It would be nice if we could get that while we continue with this sub-model.

RICHARD APPELDOORN: If you think of the ways in which the structure is going to affect the fishermen, there is only a few of

them, and it's season, it's area, and it's gear, and it's quota, and size limits probably can fall either under gear or quota in that sense, and so there's just a handful of regulatory pathways that are going to affect how the fishing proceeds into that, and it would be easy enough to take those small components and stick them into the regulatory structure here, and what I was trying to find out is how those things leak into the other boxes.

With the exception of gear, which we had the derelict gear thing, I think all of them just moved into commercial and recreational catch, which means they're all behaving the same, and that might simplify things.

JASON COPE: That's correct. I can put that up, if you guys want to see it, on my screen, but one thing I'm struggling with though is the fact that, outside of regulation, those factors still exist, even in a -- Let's just call it a naturally-managed system, where there is complete deregulation, and those factors still are going to contribute how fisheries interact with ultimately creating a fishing mortality.

It just so happens that we have recognized that those are levers which we can pull and push, in order to do regulation on these systems, and so, if it gets taken out, I feel like that's admitting that those things are purely there, their existence is purely there only for regulatory processes, whereas, when they exist outside of the regulations process, they just so happen to be really convenient levers, or not always convenient, but they are levers that which regulation can act on, and so that's where I have a one-foot-in-one-foot-out opinion on where that should go.

RICHARD APPELDOORN: Jason, is that in the sense that say a fishery can expand into new areas as it develops, which would be outside of regulation, or is that use of gears could be driven -- Well, that's still regulation, but I was going to say by other factors, but it still works through regulations, like net bans and things like that.

JASON COPE: Right. Any sort of technological advancement is going to change a fisher's relationship with their gear or where they're able to go. With bigger engines, you get to different places and, with better technology, you can be more selective in your gear.

RICHARD APPELDOORN: Habitat maps and benthic maps.

JASON COPE: Absolutely, all that sort of stuff, and that exists outside of -- I mean, those can be -- Obviously, there can be an arms race here, where there's regulation, and then you try to

figure out how can you best maximize within a regulation more effort, and so there's all of that going on, but I think the regulations overlaid on it. If you took the regulation off, those things still exist, as far as sub-components and things that lead to the fishery mortality, which is ultimately what that sub-model is all driving towards.

TARSILA SEARA: I would agree with that, and, as you're talking about this, I'm thinking in terms of seasonality, too. I mean, there are other impacts, or other stressors, that could also come from the environment that could change that, and we probably don't want to miss that.

WALTER KEITHLY: I would agree with that too, and, again, we're talking about a human environment, which brings it into the concept of regulation, versus the natural environment, and there is seasonality in the populations, especially migratory species and so forth, and so, yes, I think -- The more I think about the seasonality components and the temporal components and so forth, or the spatial components I mean, it can be left in the fisheries sub-model, but then be included under the regulatory structure of the socioeconomic sub-model.

RICHARD APPELDOORN: So how does that work in terms of boxes?

TARSILA SEARA: Do we want to try to maybe split this box into two and just have one that is a fishery-specific and one that is just a broader regulatory structure box?

RICHARD APPELDOORN: I think we kind of agreed that that was a good suggestion. If nothing else, it simplifies our understanding of what we're doing here.

WALTER KEITHLY: Yes, and it becomes easier to link it to the other models, and, when you put the fishery regulatory structure in it, and, again, I'm speaking just for myself here, you can just put an A, B, C, D or whatever and put the different components, size limits and so forth, and not put separate boxes for each of those in this sub-model. I am afraid, if we do that, the model is just going to be almost too complex to be able to draw useful information from to quantify.

RICHARD APPELDOORN: Once again, I fully agree with Walter.

WALTER KEITHLY: In that case, I should get off while I'm ahead.

VANCE VICENTE: I don't remember, but is there a regulatory structure box in the fisheries model? I don't remember.

JASON COPE: There is not. There is only those spatial, temporal, and gear selectivity boxes, by which we presumed any outside influence affecting those would play through the system, and so there is no separate regulatory box.

VANCE VICENTE: I think that's where the regulatory structure box should be, honestly, because it makes more sense to me.

RICHARD APPELDOORN: I think what we said is the regulatory structure box belongs here, but we're going to keep -- That would feed into those separate boxes that actually are those things that are potentially under regulation, but also respond to things in the natural system, or the way fishermen might respond in the absence of regulation, and so we have a pooled box here for regulatory structure, but that is being split out already in the fisheries sub-model.

TARSILA SEARA: Okay. I think that is a good suggestion. Any thoughts on the compliance box? Do we see that as a similar situation, or is it okay as-is?

JOE KIMMEL: Wouldn't the compliance box go along with the regulatory structure box?

TARSILA SEARA: Yes, I think that's the question, and do we want to do the same thing, or just have a specific -- I mean, I don't know if, in that case, if it would be as problematic, because we have a lot more going on with the regulatory structure box than with the compliance box, and so, if we are -- If we define this as compliance, fishing-related and also other contexts, I think maybe we can just keep it as-is, and I don't know, and I just wondered if anybody had an issue with that.

WALTER KEITHLY: I think Joe was asking can we include the compliance with the regulatory structure, and my argument, if I understood Joe's question correctly, the answer would be no, because you can have all the regulations in the world, but, if you don't have compliance, then those regulations become meaningless, unless, in this case, the fishermen comply on their own, but it usually requires some probability of being apprehended if you're not following the regulations, and they have a probability of being apprehended, and the penalty if you are apprehended, and so you would not want to put compliance directly with the regulatory structure.

JOE KIMMEL: Thank you, Walter.

RICHARD APPELDOORN: As we were arguing, and you can see some of the arrows here, compliance also goes beyond kind of the core things that Walter was talking about, in terms of education and outreach efforts, and cultural preferences and norms seem to be important things that drive compliance. You know, do you have a history of being basically an honest society, and so, if you're going to -- Compliance is as much of a driver as the regulations, and so, to me, this is something else that has to be dealt with.

You can either have enforcement and fear of being caught or you can have education programs that show why the request for compliance to regulations actually makes sense, and, therefore, it's a good thing to try to go with.

TARSILA SEARA: I mean, I agree, and I'm sorry, Joe, that I misunderstood the question, but, yes, I mean, I agree with Walter and Richard, and I think that there's some aspects here too that I was trying to capture with compliance, which is the perception of fairness, and, in some of these other issues, that will also have an impact here, and so I think it needs to be its own thing.

I just wasn't sure if, once we get into the interactions with some of the other sub-models, if we're looking at this as just compliance in the general sense of compliance with any rules and regulations or if we were just defining this as within the context of fisheries, but, again, it's just a matter of definition, and I don't think that that's going to make a huge difference, but it's just so that, when we're connecting these boxes, so that we know -- That we don't lose sight of what it is that we're trying to capture.

WALTER KEITHLY: Since we're going to add a regulatory structure to the other sub-models, these compliance boxes for this sub-model will only relate to fisheries. Thank you.

KEVIN MCCARTHY: I've got a question about that. We've already got a box in fisheries right, this IUU fishing, and so how does compliance, as people see using compliance as a separate box, how does that relate to IUU? I could see, perhaps, if we're trying to get rid of -- If we're trying to simplify, maybe there's a spot to simplify. Maybe compliance isn't required in a fisheries sub-model, given that we've already got IUU fishing in there, and isn't that what we really mean?

WALTER KEITHLY: I don't think you would have compliance in the fisheries sub-model or the regulatory structure. We've already said that some of the sub-models will have it, and you are regulating discharges into the water and so forth, but, the way I

look at the fisheries sub-model, it's purely based on the nature and the ecosystem outside of the human environment.

The human environment comes through only when you connect the models at human activities that influence, eventually, the population of the stock, and then it would feed back into the fisheries sub-models, and so, again, I do not think that the fisheries sub-model would require a box for the regulatory structure or compliance. Thank you.

RICHARD APPELDOORN: Right, and, to go to the point being made, you would just draw an arrow from compliance in this model, sub-model, to IUU in the fisheries sub-model. As to the question of whether we should have two compliance boxes, I guess my question would be what would be the difference in all the other connections into those boxes?

If the same kinds of things are affecting fishing compliance as affect other forms of -- Compliance with other regulations, then one box fits all, because there is nothing unique about one versus the other.

TARSILA SEARA: That makes sense to me, and I guess it's just a matter of us defining that that's what we mean by that, so it's clear.

RICHARD APPELDOORN: I suggest we move that way, and then, as we go through the spreadsheet, if we find we're having problems, then we can revisit it.

TARSILA SEARA: That makes sense. Are there any other questions or comments or issues with these boxes, with the regulatory or compliance?

VANCE VICENTE: I am still trying to make sense of this sub-model. I mean, it's really complex, and I don't see any reliable or solid connectivity between the blocks. For me, it's very confusing, honestly, and this is something that I would like to make re-do. I am not satisfied with it. I mean, the more I think of it, and the more I look at it, the more confused I get.

TARSILA SEARA: Maybe it would be easier to go through it using the matrix, and that's what I was thinking before, maybe for just looking at the connections in the spreadsheet, and it might be a little less confusing.

VANCE VICENTE: Yes, I think that would be useful at this point.

WALTER KEITHLY: Before we do that, can I just make one correction? I think Richard may have misspoke. The connection between this model and the fisheries model will all be to the box, and I just downloaded what Graciela sent me, on fishing mortality and not say IUU fishing. What this box will influence would be fishing mortality in the fisheries sub-model, and I don't know if Richard would agree with that or not, but -- Which then could go back and influence IUU fishing and everything else, like stock changes.

RICHARD APPELDOORN: Well, I'm thinking that we basically have three sectors in the fishery model, commercial and recreational and IUU, and you could have compliance feeding into each one of those separately, because that's where compliance acts, in terms of what the fishing mortality is going to be.

The way we have it structured now, compliance would -- I don't see how compliance would go directly into fishing mortality, and it's got to go through some other mechanism that then causes the fishing mortality.

WALTER KEITHLY: You may be right, especially -- This model primarily focuses, the sub-model, it looks like, on commercial fishing. If this model had the other components, I would still argue that it goes straight to fishing mortality, but I will retract what I said earlier, and I think it may have to go from this model back to IUU fishing and so forth.

RICHARD APPELDOORN: Tarsila, do we want to wade into the spreadsheet?

TARSILA SEARA: Yes, we can do that. Here is the spreadsheet.

RICHARD APPELDOORN: You're going to add a new like fishing regulatory structure box?

TARSILA SEARA: Yes, we can do that. How do we want to do this? Just go through each line?

RICHARD APPELDOORN: Basically. You can make the cultural preference box, column, narrower, as well as the coastal community resilience.

TARSILA SEARA: Is that better?

RICHARD APPELDOORN: Yes, and, also, the fisher income revenue box could be more narrow. That seems like it's -- Now you can actually increase the font a little bit and still have it all on one page.

TARSILA SEARA: All right, and so, right now, we have gross income affecting marketing demand, tourism, and the regulatory structure, and so gross income, and, Walter, correct me if I'm wrong, we're talking about the nation-wide income, right?

RICHARD APPELDOORN: That would be like per capita?

JORGE GARCIA-SAIS: Tarsila, that's gross income for the fishermen?

TARSILA SEARA: I don't know if Walter is still here, but this was something that we actually talked a little bit about, and we were looking at this as the national gross income, I believe, but then there is some question as to are we talking about island gross income, or are we talking about national income, and that was a question that came up. I am not sure that we necessarily resolved that, and I would defer this question to Walter, if that's okay.

RICHARD APPELDOORN: Orian posted that, in our glossary, gross income was discussed in relation to population size and market demand, and so it would be something like the population gross income. Walter, were you going to comment?

WALTER KEITHLY: I am here, but I don't remember, and I would have to go back to the diagram to see where it fits in to determine my thoughts on it.

TARSILA SEARA: You mean the model? Do you want me to go back to that?

JORGE GARCIA-SAIS: Gross income is at the very top.

WALTER KEITHLY: Looking at this model, with gross income at the upper-right-hand box, it would be the national income, or it may be even international income, which then drives tourism, which then drives number of people coming to the island, which then drives the number of people purchasing fish and so forth, and so that would be the national, or even international, income, were my thoughts.

TARSILA SEARA: Are there any comments or questions on the interactions between gross income and other variables?

RICHARD APPELDOORN: Well, it's not my field, but it looks good to me.

TARSILA SEARA: Okay, and this is the one box that I actually added, and, of course, let me know if you agree with that. My idea was to be able to capture some changes in demographics that

could happen, that could be important, and this is just my suggestion of how this would connect to some of these other variables, that this population composition we're talking about, age or education or socioeconomic aspects of the population, and I had that influencing market demand, cultural preferences and norms, resilience, in the sense of this would be, most likely, some of those complex interactions that could be indirect, but I didn't want to miss that, in terms of how that could affect the ability of the community to bounce back from impacts.

The same in terms of wellbeing, and the composition will determine some of the relationships within, or it will change and influence some of the relationships within the community, and so this is what I wanted to capture with that variable. One of the things that I had in mind here too was in terms of impacts that will result in, for instance, migration and things like that that will change population composition and will, in turn, change some of these socioeconomic and cultural aspects.

JUAN CRUZ-MOTTA: My apologies, Tarsila, but I missed the definition of population composition. I was reading the line above.

TARSILA SEARA: I'm talking in terms of just demographic information, and so age, education, background, any sort of demographic information, is what I'm trying to capture with this.

JUAN CRUZ-MOTTA: Thank you.

WALTER KEITHLY: I understand the relevance of population composition, but, honestly, I just don't think we know enough about the population composition or its impact on any of these factors, and I have no idea whether a change in the composition will influence say market demand, and maybe, if we're getting an older population that cannot fish as much or something, and the younger generation may not be going into fishing, and the folks that are already in fishing would have less competition, because of fewer fishermen, which could increase fisher income and revenue.

Again, I just -- As much as I do see some relevance to this variable, this component, I just don't think we know now, nor will we probably ever know, enough to fill in its impacts with respect to these other variables in the model.

TARSILA SEARA: Unfortunately, that's going to be true for some of these, but, again, I think, given what you just mentioned, I think it's a very important point, in terms of young people coming into the fishery, migration, these kinds of changes that we know are

going to impact the fisheries in one way or another, and so my idea was that we should be able to potentially capture that, if we can obtain that information, or that data, in the future.

WALTER KEITHLY: You just said yourself impact fisheries one way or another. We have no idea how the population composition is going to impact fisheries, I don't think, and I guess we might be able to argue that, if we have an older -- Again, from what I hear, the average age of the fishermen is increasing and so forth, and, if the younger fishermen, or the younger people, are not coming into the fishery, then that may increase the income of the remaining fishermen or something, but I -- Again, generally, I don't mind putting a qualitative plus or minus on some of these factors, but, in this case, I wouldn't even know where to begin on any of them.

DOUGLAS GREGORY: What's to stop us from putting a question-mark on some of these connections, whether we're either not informed ourselves about them or there is no science on it at this point in time? I think keeping something in here now is good, because it will force others, as well as ourselves, to look at it in more detail going forward.

KEVIN MCCARTHY: I think if our bar is we don't know the impact, or we don't have the information, then we will have a very simple model indeed, because we don't know that for a lot of these things, and so I don't know that that ought to be our -- I don't know whether to include this or not, and it's not my field either, but I'm not sure that's our metric, because we don't know a lot of these things, and that's sort of the point of part of this modeling exercise, right? Let's use it to identify areas that we don't know much about.

TARSILA SEARA: I would agree with that, and part of the reason why I thought about this was just from hearing from changes in age makeup of the fishing community, and also the impacts of recent migration of especially younger people out of the islands, due to some of the hurricane impacts and whatnot.

RICHARD APPELDOORN: Before we continue, there is a comment, and then Graciela would like to speak. The comment comes from Vanessa Ramirez, and she says the population composition is a very important aspect to be analyzed. We have lost a generation of fishermen between the beginning of the regulations until now, and that we are having younger generations interested in coming back and get introduced to fisheries, and this is something that's happening more and more every day. She is making the point that this is actually a fairly important component, regardless of

whether we know exactly how it ripples through in this model, and so, Graciela, you had a comment?

GRACIELA GARCIA-MOLINER: I think that Tarsila was touching on my comment, and the population composition, in terms of the rapid events that we have gone through in Puerto Rico and the Virgin Islands in the last three or four years, I think that, even if we don't have the direct data, there is a lot of incidental or ancillary data from the newspapers and the number of people that have migrated from the islands to the states now coming back, when things get settled again.

That very much influences the market demand, what people are interested in buying, and, in this case, for example, how well the fishers are doing by selling their catch of species that were not their main targets, but they had to change to supply the demand that the local population has and that kind of thing.

Even if we don't know exactly how to go about it, I think that it's extremely important to have this here, but it comes at the right time, when changes are happening really quickly, one after the other. Thanks.

WALTER KEITHLY: This kind of goes back to a question that Rich had yesterday, and I can't even remember what the issue was, in what component, but he said are we looking at like from forty years ago or something right at this moment, and, I mean, we're talking short-term newspaper articles or something, with what Graciela said.

Again, I agree with everybody that the population composition is extremely relevant. My only argument is that we have no idea of its influence, long-run influence at least, and not what's going to happen tomorrow if somebody moves back, on any of these factors. Thank you.

DOUGLAS GREGORY: Walter, is that because the data doesn't exist, or is it because the makeup of this SSC is limited in its range of awareness that would feed into this model? I will claim ignorance on a lot of this, but I'm a biologist, and it's easy. We've got one social scientist, and we've got one economist, and the rest of us are biologists, and so I expect and accept that I'm not going to understand a lot of this.

WALTER KEITHLY: Doug, you may be the first one to ever suggest that economics is not a social science, but, having said that now, I don't think there's a lack. I think you could have twenty social scientists on this, and you would have absolutely agreement of the

influence of population composition on these other factors.

RICHARD APPELDOORN: I would like to read two other comments. Nelson Crespo wrote that, on the west coast of Puerto Rico, they are starting to see an increment of what he calls new blood into the fishery, and Vanessa comments that there are more younger fishermen with more technology and higher education levels that are coming into the fishery, but there are also fishermen who started fishing at seven years old, with their parents, maybe on weekends and things like that, and it helped maintain them to go to school, and so there is a lot of dynamics here. I think that's being reflected in these comments, and so I think everybody is agreeing that it's important. The question is how do we deal with in the sense that we're arguing now?

We don't know exactly how this ripples through, and it's not like, I think, in the fisheries sense, where your population of composition has some real significant impacts on what it means to the population and how it's going to respond to the fishery, but, in the human case, it's a lot more of a black box.

WALTER KEITHLY: If I could just make one more comment, and then it's going to be the last comment that I make on this component, but I think an additional problem is that population composition is a multidimensional factor, and we've talked about age and sex and race and ethnicity, and, again, all these -- Any time you get into a multidimensional concept, it makes it much more difficult to analyze its effect on other factors in the model, and the same thing will come about, I think, when we discuss anything dealing with wellbeing, or maybe even resilience. It's just these multidimensional concepts are just difficult to analyze. That's the last that I'm going to say on population composition. Thank you.

JUAN CRUZ-MOTTA: I just want to say that Walter is right on that, and it's a multifactorial, multivariable line, but that's true for most of the boxes that we've got. The boxes are multivariable, but especially in the habitat and in the ecosystem component. All the reports that are being done in the TAP group is basically to come up with ways to analyze these multivariable boxes. Thank you.

TARSILA SEARA: I just wanted to add to that, J.J., and that's a very good point. I mean, I think the idea here is that we're trying to capture that there's something there, and then, when we move to testing this quantitatively, or as we get more information and more data and whatnot, this would inform, potentially, these much more detailed analyses of how each one of these things are

contained within these boxes and how they actually affect all of these other aspects.

I mean, right now, I think the idea is just let's just capture that that's an important thing, and we have reason to think that it affects it. I think that, for now, for the conceptual model, that, to me, would be good enough, and then the idea is that we would later then test these things, or try to get more information. Does that make sense?

RICHARD APPELDOORN: Well, one of the parts, or reasons, for modeling is to find out areas where you don't know, and so they can start being addressed.

TARSILA SEARA: I think one question is how do we deal with -- I think that that was one of the questions that I had there, and some of these blue numbers here sort of represent this idea of just not knowing exactly how to characterize those relationships. I mean, is there a way, as far as how we're constructing this model, that we can indicate that these are these sort of unknown relationships, or something that we know is there, but we don't know exactly how to characterize it, and how would we deal with that?

RICHARD APPELDOORN: Any of you Mental Modeler gurus know how the program could deal with something like that?

GRACIELA GARCIA-MOLINER: I certainly don't know right away, but we can figure it out, but the thing is that, once you have this matrix, the Mental Modeler -- Really, what it's doing is visualizing what you have in the matrix, and so then we take these matrices out, and then you can either do -- I don't know how it would react with zeroes or question-marks, once you start analyzing, and I was going to ask J.J. if he has any idea.

If we identify them as you have them in blue, for example, then we can deal with it in the definitions and in the changes, but this is your best estimate of the type of impact that it would have, and most likely it will come up with empty cells when you start analyzing it, because, if we don't have any data, we don't have anything to put in there, and so it would be more part of the gap analysis than anything else.

JUAN CRUZ-MOTTA: Effectively, it's like you said, Graciela. We cannot put question-marks in that spreadsheet.

RICHARD APPELDOORN: Wait. Orian requested a turn to speak.

ORIAN TZADIK: That's okay. I actually think that J.J. was about to say what I was about to say, and so he can go ahead.

JUAN CRUZ-MOTTA: You go, Orian, because you have been dealing with the program. Go ahead, Orian. Thank you.

ORIAN TZADIK: Just to kind of echo what J.J. said, I mean, you can't have a question-mark. I mean, you can have it conceptually, and you can have it on the diagram that works, but part of the process here is actually adjusting these values to see what would happen in different scenarios, and so you can't just have a no value. You would want to have at least a placeholder value that you would see what happens, based on once you play these scenarios out.

The analogy I could give is just, if you were going to do any sort of multivariate stats, and you had an empty cell, it doesn't mean anything, and it would just get removed. You want to have something there, even if it is just your best guess at this point.

JUAN CRUZ-MOTTA: So how does that translate in this particular case? I don't have a clue. This is along the lines of Doug, and I don't have a clue what would be the relationship between the population composition, and so, me personally, I would rely on the experts, in this case either Tarsila or Walter, and the intention of those values is just basically to say, well, for that expert, is that relationship strong or weak or intermediate.

It does not necessarily mean that now we have the data to test that relationship, or it doesn't mean that that relationship is true, but the explanation that the expert is trying to do through this model -- For that expert, based on her or his experience, there might be a relationship, and, based on her or his experience, that relationship is high or is low, and that's what this matrix is trying to capture. Thank you.

RICHARD APPELDOORN: Okay. We have a request from Sarah to comment.

SARAH STEPHENSON: Orian and J.J. both addressed my comment that I was going to make. Thank you.

RICHARD APPELDOORN: I think we're at the point where, Tarsila, these represent your best guesses as to where and to what degree population composition is affecting the various boxes.

TARSILA SEARA: Yes.

RICHARD APPELDOORN: We've kind of basically admitted we don't really have anything to go against that, and so let's go to the next line.

TARSILA SEARA: I am happy to adjust, if anybody feels strongly about changing them, but -- Okay. Should we go to the next one?

RICHARD APPELDOORN: Yes.

TARSILA SEARA: All right. The population size, we have that impacting strongly market demand, and I had a couple of questions, and these were actually areas where I wanted Walter's input. I had a placeholder here, in terms of population size affecting the local economy, and the next one would be in terms of population size affecting community resilience, and this has to do with vulnerability and ability to recover from impacts.

JUAN CRUZ-MOTTA: I have a question, Tarsila. Wouldn't population size be one of the variables of the population composition?

TARSILA SEARA: You can have -- I think the idea here is that you can have different sizes, and you can have a very large population, and you can have multiple different types of compositions at different times without changing the size, but the size itself would be a variable that would affect some of these other things, sort of independent of that composition, and does that make sense?

JUAN CRUZ-MOTTA: Yes, it does. Thank you.

RICHARD APPELDOORN: Yes, and you could make an analogy to a fish population. If you're doing your sampling, and all you're looking at is the size structure, well, that gives you some information, but, if you don't have abundance with that, you don't know whether to say small size is driven by increases in recruitment or declines in the adults, and so you need both things to kind of say what is the state of the situation.

JUAN CRUZ-MOTTA: Thank you, Rich. Actually, I was thinking along those lines, actually. When thinking about fish assemblages, you cannot -- You have to look at those two things together. Thank you, Rich.

WALTER KEITHLY: Since Tarsila asked for my thoughts, again, population size should impact market demand. Now, feeding that back, an increased population will lead to an increased demand for the product, and I would argue that that would probably indirectly at least, then lead to a change in the fisher income revenue.

Now, whether it's up or down depends where you're at on the yield curve and how price would change with the change in catch. It would not influence some national concept like tourism, and it would not impact education, and it would not -- Very, very indirectly, maybe compliance, but I wouldn't get into that. I don't see where it would change cultural preferences and norms, and I'm sorry. I'm on the wrong line there. I will go back. I believe that there would be some impact on the fisher income, since you've increased market demand.

TARSILA SEARA: Would this be an indirect relationship, in that, in that case, we are capturing it with the impact of market demand on the income?

WALTER KEITHLY: Yes, it would be, actually, yes, because, again, it gets confusing like this.

TARSILA SEARA: Right.

WALTER KEITHLY: If we scroll over on the rest of them, you know more about coastal resiliency than I do. I don't necessarily see why the size of the population would influence resiliency, and the rest are zeroes, which I am fine with that.

TARSILA SEARA: To go back to the resilience question -- But does this look right to you, in terms of having a relationship between population size and a direct correlation with the local economy?

WALTER KEITHLY: Sure. You have a higher population, and you have a larger workforce, and so it should lead to an impact on your local economy, if you're measuring that in dollars or GNP of the economy.

TARSILA SEARA: Do you think this should be higher than one?

WALTER KEITHLY: Again, I am not getting into quantifications with any of this, and I just don't think we know enough to quantify it, and I said that at the last meeting, and I said it yesterday, I think.

TARSILA SEARA: Okay.

RICHARD APPELDOORN: I have a question. Does population size and its effect on the local economy include a diversification of that economy? Would that be a component of that?

TARSILA SEARA: I would agree with that. I think what I was trying to capture here is any kind of diversification and any sort of

changes that could influence the local economy that would come from a lower or higher population.

RICHARD APPELDOORN: Right, and so my next question is, if that is the case, would the impact on resilience come through that impact on the local economy and not directly from population size?

TARSILA SEARA: Right, and certainly there would be a direct interaction there. One of the things that I was trying to capture with this direct interaction with resilience was sort of in terms of the cost and priority of the system, and so, if you have like say the impact of a hurricane on a highly-populated coastal area, there would be some challenges to the recovery of that particular community that would come from the density of population in that particular community.

Whether that's positive or negative is not entirely -- That's why I have it in blue, but that's what I was trying to capture with that direct connection, that it wouldn't necessarily just come from the economy, but the actual challenges of recovery.

RICHARD APPELDOORN: Okay.

TARSILA SEARA: So are we good with this line?

RICHARD APPELDOORN: I guess.

TARSILA SEARA: Okay. So seafood imports and exports, and, again, I'm going to ask Walter for some help here, too. What we have right now is seafood imports and exports affecting market demand and the local economy.

WALTER KEITHLY: I was just going to say that market demand likely affects imports and exports. Well, again, it's simultaneously, is the problem. You have a situation where increased imports, other things being constant, would depress the price of the local product.

TARSILA SEARA: So the line is going both ways, and so we have demand affecting imports and exports, and we have imports and exports affecting demand.

WALTER KEITHLY: Yes, and go ahead and leave it like that. That makes sense to me.

TARSILA SEARA: Does it make sense to have that as a direct impact on the local economy, or would that be just through this relationship?

WALTER KEITHLY: Again, you've given this a lot more thought than I have, but it's certainly -- There is jobs related to importing seafood and exporting it, and the infrastructure surrounding the commercial industry, the infrastructure needed for imports and exports, would certainly generate income to the local economy.

TARSILA SEARA: That makes sense to me. I don't have, or we don't have, seafood imports and exports directly impacting anything else, since some of the relationships with, for instance, revenue are being captured through changes in market demand, I believe. Should we move to the next line?

RICHARD APPELDOORN: Yes.

TARSILA SEARA: Market demand, we have it impacting seafood imports and exports and strongly impacting fisher income and revenue and not impacting directly anything else, but there are some indirect relationships there.

RICHARD APPELDOORN: Would market demand affect compliance directly, or is there an indirect --

TARSILA SEARA: There is an indirect -- Let me think about this. You are thinking in terms of depending on if there is a demand for something that is somewhat restricted or you would -- Is that sort of what you're going with, because I think that maybe that could be -- Because we have a direct -- If I'm not mistaken, we have a direct correlation between --

WALTER KEITHLY: I might be able to help out a little bit here. You could argue that market demand is made into compliance, or impacts compliance, to the extent that -- At least two ways. The first being if the price -- Let's say the price is very low, and the fishermen are not making sufficient income, and it may give them an incentive to not comply with regulations.

The second way is, if you have a strong market demand for a product that is not being filled through properly following the regulations, it may actually give fishermen an incentive to not comply with the regulations, and so it works both ways, and so you could argue that market demand does influence compliance.

RICHARD APPELDOORN: Well, there is certainly, in Puerto Rico, for example, an underground demand for turtle, and there are people who try to meet that demand. During the previous closed season for conch, which overlapped the big tourist month of July, you could easily get fresh conch in the market, or in the restaurants,

because the demand was there, and people were going to supply it, and so that's what I was thinking. If someone really wants it and is going to pay for it, someone will go get it.

TARSILA SEARA: It makes sense. I was just trying to see if maybe we were capturing that some other way, but I think we can put something there so that we don't miss that. Do you have a suggestion for a strength?

RICHARD APPELDOORN: No, but I could throw out a two as a neutral value.

TARSILA SEARA: All right. Do we have any other comments on market demand?

KEVIN MCCARTHY: Did we not have a connection, and I don't know, and I'm just guessing here, but is there not some connection between -- Maybe it's the other way around. Never mind. We'll come to it later. I have the arrow going the wrong way.

RICHARD APPELDOORN: So that was a self-answering question?

KEVIN MCCARTHY: It was, but I will ask it again when we're pointed in the right direction, or I'm pointed in the right direction.

TARSILA SEARA: Are we ready to move on to income?

RICHARD APPELDOORN: I would guess yes.

TARSILA SEARA: All right. So we have fisher income and revenue impacting the local economy and resilience and wellbeing, and the reason why this is a somewhat low relationship here is because we're talking about the whole local economy, from what I understood of this, and then we have income, and, again, since this is coastal community as a whole and not just the fishing community, again, I had a somewhat lower value here, but this has to do with just the ability to recover, and I have strong relationship between income and wellbeing.

RICHARD APPELDOORN: Again, I will ask about compliance. If fishermen are doing well, there is really no incentive to cheat, or does that mean that there is room in the system for more effort, but maybe that wouldn't come through compliance and that would just be an impact of that on the number of people fishing legally, and I'm not sure where we would capture that kind of -- This would be kind of a supply-and-demand issue, right? If you've got a lot more supply, and so the price is high, that incentivizes others to come into the industry, yes?

TARSILA SEARA: That's an interesting point, because I'm not sure that we are necessarily capturing the size of the fleet, or are we doing that through catch, and could that be, or, no, not necessarily. Those are different things.

RICHARD APPELDOORN: Well, this goes back to my comment about not really having a box for effort, which is where I would think this would punch into, and so we'll have to think about how that connects over to fishing.

WALTER KEITHLY: Certainly fisher income, if it's high let's say, it will encourage additional fishing effort, but, assuming you can get a license without many problems and all, I don't see necessarily where it will influence compliance, unless you want to say that, the more fishermen that there are out there, the greater likelihood that some of them will not be complying with the regulations.

RICHARD APPELDOORN: I was kind of thinking, if people are doing really well, there is no incentive to go cheat. Why do I need to cheat if I'm already doing really well?

WALTER KEITHLY: That's what I said on the previous one, that, probably, if things -- If fishermen have sufficient income, it gives them less incentive to not comply with the current regulations.

RICHARD APPELDOORN: Yes, and that was my point here.

TARSILA SEARA: So should we add a number here?

RICHARD APPELDOORN: Minus-one or something like that. Well, maybe it's a positive. If income is going up, compliance would go up, and so it's a positive.

TARSILA SEARA: Do we have anything else?

WALTER KEITHLY: If I can make just one comment, again, this all is dependent on fishermen being able to enter the fishery or exit the fishery with no problems, and, again, I don't know if we're talking about Puerto Rico here, but am I not mistaken that they have a limit on the number of licenses in the Virgin Islands, in St. Thomas and St. Croix?

Nobody is answering, but, if they do have a limit on the number of licenses, if there is no -- If entry, or legal entry, is not allowed at current times, then certainly increased income among

the fishermen fishing legally may encourage illegal activities among those that do not have a license or are not able to secure a license.

RICHARD APPELDOORN: Yes, and we actually saw that situation in Puerto Rico with the queen snapper fishery, which is a limited-entry fishery, and we had a year or a year-and-a-half where, all of a sudden, people were technically allowed to enter that and were basically falsifying catch records just to get a license, or whatever record, but it screwed up the catch records substantially.

TARSILA SEARA: I think, if we have this link here, fisher income to compliance and compliance to IUU fishing, then that would -- Would that capture that?

WALTER KEITHLY: My point was that you don't even know the direction. It depends on other factors that, again, if you allow additional entry, then the direction is going to be positive. If entry into the fishery is allowed, then you would not expect a major change in compliance. However, if your entry is being restricted, then higher income by the legal fishermen may encourage non-legal fishermen to begin to harvest that species, and so that could be negative.

RICHARD APPELDOORN: Yes, and there's also recreational crossover that fits into that as well, and is this a case where this would actually run through another box, maybe the fishing regulatory structure or something like that, rather than a direct connection between the income and compliance?

WALTER KEITHLY: I don't think so. I think this is just one of those situations where, depending on other factors, you could have a positive or negative relationship.

TARSILA SEARA: I can just make this blue, which is kind of what's indicating these complicated connections.

RICHARD APPELDOORN: Well, if you want to make it more explicitly, you could put a plus or minus-one, or something like that, which satisfies our needs, but, of course, screws up the modelers.

TARSILA SEARA: Yes. I mean, I'm just going to do this, because, all the other blue ones, that's what it means, and then we can think of how we're going to do that, because, otherwise, I would just have to change all of them, and does that make sense? Can we do that for now?

RICHARD APPELDOORN: Absolutely.

TARSILA SEARA: Okay. All right. Anything else on fisher income? Again, I mean, direct and indirect, it gets really confusing, and that was a big challenge that I was having with this, but I think that, again, once we begin to connect this with other sub-models, we might be able to answer some of these questions and whether it's a direct or an indirect connection, and I'm hoping so. It's a good thing that we're capturing them here, I think.

All right, and so, for the local economy, I guess what we have is local economy affecting a lot of things, and, again, Walter, I would really appreciate your input on this. So it's impacting composition, size, market demand, revenue, and this is not necessarily relating to fisher income revenue that's coming necessarily from fisheries, and I think this is also capturing occupational multiplicity, and so that is the reason why that is not coming through catch. We have it impacting tourism, resilience, and the regulatory structure.

WALTER KEITHLY: I guess the only two issues I had is I'm not sure how the local economy affects tourism, other than maybe there is enough local -- It seems like tourism is going to affect the local economy, and not vice versa. As tourism increases, it puts more money into the local economy, and the other issue I had was with regulatory -- Which one are we on here?

TARSILA SEARA: Local economy.

WALTER KEITHLY: You have the regulatory structure, and I don't see how the local economy affects the regulatory structure, and so those are the two issues.

TARSILA SEARA: Okay. For the tourism, we do have it going both ways, and it's stronger from tourism to local economy, and I think this was trying to capture local tourism, and maybe tourism -- Again, maybe it's a definition thing here, and is it tourism and recreation, or what are we trying to capture also with that box, but that's definitely something we can revisit here, in terms of that. I think the local economy and the regulatory structure had mostly to do with funding, but, again, it's definitely something we should discuss.

RICHARD APPELDOORN: My recollection, getting back to the tourism thing, is we were making a distinction between local tourism and tourism coming off the island, and, certainly in Puerto Rico, for example, local tourism is important as a market for the seafood, and so, the better the economy is doing, the more people are willing to spend, basically high prices for seafood in restaurants,

and they're going out to the coastal communities and beaches during the summer, et cetera.

TARSILA SEARA: Yes, that was my understanding of it as well.

WALTER KEITHLY: Wouldn't that be an indirect effect then? It would impact tourism. Okay. I'm not sure how it works, and now we're getting into local tourism versus national tourism and all, and, if the local economy improves, or becomes stronger, you would expect an increase in market demand, and I don't know where it fits through tourism though, other than you would have some local tourism, as Richard says, coming from one town to another or something, but I think that's a pretty weak driver there.

TARSILA SEARA: We can decrease this. The other thing that I was thinking too, as we were talking about this, is how this could have potentially influenced infrastructure for tourism as well, and I don't know if that's something to consider.

RICHARD APPELDOORN: Do we want to define "local economy", because I'm thinking of local economy as the island, as opposed to gross income, which was kind of a larger income statement, because that's what was really generating external tourism, was how good is the world economy, if you will, or the U.S. economy, and that's what is bringing tourism in from the outside, but, to me, local economy was not the community, but the island platforms that we're dealing with, and that's driving a fair amount of internal tourism.

TARSILA SEARA: That's what I was thinking. I mean, that was my understanding, and I don't know if Walter had a different --

WALTER KEITHLY: I am not sure. I can't remember how we defined it, but, even if it's island-based, rather than more localized, I don't see how it strongly affects tourism, unless tourism is simply defined as moving from one town to another.

RICHARD APPELDOORN: For the purposes of recreation, and it's not just day trips, but it's someone is going to take a two-week vacation from San Juan over to Cabo Rojo, for example, and they're going to go to the beach, and they're going to eat seafood, and they're going to do what people do on vacation.

WALTER KEITHLY: Okay. That's fine with me.

RICHARD APPELDOORN: Isn't this is a factor in a state's economy? If things are good, people are more likely to go on vacation. Now, there is a question of whether you're going to stay in your state or go to someplace else, but, the more money that the people who

can engage in tourism have, the more tourism is engaged.

WALTER KEITHLY: Yes, that's fine. Go ahead.

RICHARD APPELDOORN: Again, from our glossary, Orian is pointing out that local economy had to do with the health and stability of island-specific economy, and so it's not the coastal community, and it's the island-wide economy.

WALTER KEITHLY: In that case, where does tourism come in, unless you're talking about going from one island to another? As income increases, which local economy is the -- As the income of say Puerto Rico increases, does that result in more local tourism, or tourism on the mainland U.S. or something? In that case, it's a negative relationship, but it's pretty unclear to me.

RICHARD APPELDOORN: Your point is well taken that this could go positive or negative, depending on where your economy is. If you have a lot of money available, you're likely to go someplace far for your tourism. If you have less money, you might stay more local, and, if you have still less money, you're not going to engage in tourist activities, and so I see your point.

TARSILA SEARA: Do we want to make this sort of undefined, as far as positive or negative?

RICHARD APPELDOORN: Well, I would just say, in my experience, being in a tourist destination community, what we see is, when the economy is good, there is a lot more activity here.

TARSILA SEARA: I think that also goes back to what I was saying before, in terms of infrastructure, too. If you have a stronger local economy, you will have better infrastructure for tourism, which would potentially increase that activity, or investment, in the sector. What do we want to do?

RICHARD APPELDOORN: I think I would like to leave it, but, if you want to put it in blue, I have no problem with that.

TARSILA SEARA: How about Walter?

WALTER KEITHLY: Again, I think it could be the positive or negative side, and, again, I'm not willing to say whether it's a one or a two or a three.

TARSILA SEARA: I think the other question was with regard to the regulatory structure.

WALTER KEITHLY: That's correct.

TARSILA SEARA: I think the thinking here was funding, or availability of funding, but I think that's the argument.

WALTER KEITHLY: I think I raised that at the last meeting, actually, now that I think about it, that as the -- From an economic point of view, or studied extensively by economists, as income goes up, there is an increased demand for environmental quality, and I guess that -- I don't know if that's actually an increased demand for the regulatory structure or just for specific regulations, and, again, I don't think it's as strong as you indicate, but I do believe that increases in income result in improvements in environmental quality, and that is via, generally, or through, regulation.

TARSILA SEARA: So we can just bring this down to a two, and does that --

WALTER KEITHLY: I don't know. I'm just saying that a three is a pretty strong relationship, and, I mean, I don't mind if you leave it a three, or a two, or a one, for that matter, but I think there is a relationship.

TARSILA SEARA: Okay.

RICHARD APPELDOORN: Two points. We actually didn't discuss that point under gross income, where we have a three under regulatory, and, secondly, and perhaps most important, we split regulations, and we haven't been talking about the last column here for any of these things, which I think would only be the two that we've talked about so far, where regulatory structure has been given some non-zero value.

TARSILA SEARA: That's a good point. I think I forgot about that, and so do we want to -- Let's go back here then. Do we want to talk about this value and changing it?

WALTER KEITHLY: Again, could we see the -- What does gross income refer to? Wasn't that the national, or international, level of income that then determined tourism and so forth?

RICHARD APPELDOORN: Yes.

WALTER KEITHLY: Then I don't think -- I mean, there is all sorts of connections, but I would argue that increasing the national income is not going to significantly influence the regulatory structure on a specific island, but I may be wrong.

TARSILA SEARA: Do you think there's a connection at all? I mean, we can just bring this down.

WALTER KEITHLY: Again, it just depends on how many steps you go through to get to that end point. Increases in gross income may result in more tourism, and, as tourism increases, more people go charter fishing. At that stage, an increase in charter boat fishing may lead to DNR to put more regulations on that fishing sector or something, but it's several steps removed almost, and I don't know if -- It becomes very nebulous the more steps you are removed from the initial component that you're looking at.

TARSILA SEARA: I agree with that, but I think this was mostly trying to capture funding for infrastructure, for instance availability of funding for enforcement and those types of things.

RICHARD APPELDOORN: I would accept that, but I don't think it should be a three, the way it's been explained, and then which box is it going into, the fishery or the non-fishery?

TARSILA SEARA: I would argue both, but I don't know. I would certainly put something here for both gross and local economy, and I think that's relevant, especially if we're thinking in terms of infrastructure assistance and enforcement.

WALTER KEITHLY: Now I'm getting even more confused. I thought our regulatory structure related only to the fishing sector at this point. Now you want to add the regulatory structure going back from habitat to this? Mr. Chairman, maybe it's time for us to take a break, and we can clear our minds a little bit.

RICHARD APPELDOORN: I have no problem with that, but we had originally talked about splitting the regulatory structure into the component directly related to fishing and those related more toward water quality and habitat preservation and the like.

WALTER KEITHLY: That's correct, but I thought that that was almost a stand-alone box, so that we could connect this sub-model to the other sub-models. Again, my argument was that the regulatory structure in these other sub-models influenced the fishery stock, and the regulations that we're interested in this sub-model were only those that would directly impact the fishermen.

RICHARD APPELDOORN: So you're saying the movement of regulatory structure to other sub-components is that first column, and I guess that's Q, regulatory structure, and therefore it would not be in this sub-model, and is that your understanding?

WALTER KEITHLY: Yes, that was my understanding, and maybe I'm thinking of it wrong, but the top box is regulation, and then you branch off, one branch being regulations not directly impacting fishermen, and the other branch being regulations that impact fishermen, and it's only those impacts that regulate the fishermen, that right-hand branch, that you would put in this model.

The other branch would be connected to the other sub-models, and I don't know if that makes sense, since you can't see what I'm suggesting, but you have an overall regulation, just a box with regulations, and then you have regulations that do not directly affect fishermen, but maybe affect water quality, and then come into eventually affecting the fish stock, versus fishing regulations that directly impact this sub-model through effort.

RICHARD APPELDOORN: Okay. I'm suggesting, as you said, that maybe we should take our break here and think about that and what to do about it when we come back. I'm going to read -- There have been some comments coming through, and some of them are not so directly to the points that we're talking about right now, but Vanessa commented that gross income matters, and there is an impact when you renew your license and permits and qualify for benefits with regulatory agencies.

It says most fishermen never put the real gross income, that is to say they are not reporting their full income, and so that affects the nature of the data. In an effort to move things along, can I declare that we're on lunch break until 1:45?

GRACIELA GARCIA-MOLINER: Okay.

VANCE VICENTE: Richard, just one comment before I leave. Regarding the income, and the economy in general, and regulatory structure, specifically on enforcement, I mean, the eight years I was in the U.S. Fish and Wildlife Service, and as director for some years, and enforcement has always remained.

I mean, there's no cut in the budget for enforcement and regulatory actions, and I believe the same thing for the Environmental Quality Board and enforcing water quality issues, and I don't know that much about DNR, and maybe Ricardo can comment on that, but it's not very significant, and, from my experience, it's not significant at all, I mean in relation to the economy and enforcement of regulatory actions. That's just a comment.

RICHARD APPELDOORN: All right. Thank you. We're on break.

GRACIELA GARCIA-MOLINER: See you at 1:45.

(Whereupon, the meeting recessed for lunch on May 21, 2020.)

- - -

May 21, 2020

THURSDAY AFTERNOON SESSION **(156:43)**

- - -

The Scientific and Statistical Committee of the Caribbean Fishery Management Council reconvened via webinar on Thursday afternoon, May 21, 2020, and was called to order by Chairman Richard Appeldoorn.

RICHARD APPELDOORN: Just to kind of ease into things, there was a question, I guess for Bill Arnold, of if you would like to give us a little background or advertisement, or however you want to do it, to the webinar on the ecosystem modeling effort that he's involved with that is coming up next week.

BILL ARNOLD: When we first started pursuing an ecosystem-based development scheme for the U.S. Caribbean, we worked with this Lenfest group that has -- It's kind of a Lenfest-NOAA group that has developed guidance for preparing a fishery ecosystem plan.

Tim Essington is on there, and Felicia is on there, and Phil Levine is on there, and a bunch of other people, all the big shots. All the big shots are on there. Tim and the Lenfest group were willing to work directly with us, and Tim came, and so did Charlotte Hudson and a couple of others. They actually came to St. Pete and met with us for like a week, and we went over everything, and that was sort of the beginning of all of this.

We've been using their guidance, and you will see that we used that circle that they have of processes that you follow to develop an FEP, et cetera, et cetera, and that's what we were working on as a fishery ecosystem plan development team before we were formalized. Jocelyn said, well, you need to get formal, and you need to get legal, and that's where the Technical Advisory Panel came from. It's basically just transitioning, in one way or another, the members of that group into a legal entity, and so that's where we are now.

We have been sitting there for like six months, because we made the transition, and we just haven't been able to meet, for a

variety of reasons, and then because of the Corona virus, and so our first meeting will be that webinar that is scheduled for June 1 and 2.

In the meantime, I had worked, and Orian was very helpful with this too, and Orian and I kind of worked with the Lenfest group, and I went to D.C. and met with them, and we talked about funding opportunities and stuff like that, and so we kind of laid the groundwork for that, but then the actual proposal was written by J.J. and Tarsila and Stacy, and they are the grantees of that proposal, which I think is around $300,000 for three years, but I don't remember, and J.J. will.

What that involves, a lot of that involves, is conducting -- Acquiring data, but acquiring data is something we were already doing, and so they are building off of that, and we're kind of working closely, inside and outside of the grant, and, by outside of the grant, I mean the council group, the TAP. All the people that are on that team are working with -- I think all three of them are, one way or another, are on our TAP team.

They may not be one of the eight direct members, and J.J. and Tarsila are, but Stacy and Maria and Sarah and others, Mandy, et cetera, et cetera, we consider them integral parts of the team, even if they are not formally identified by the council as one of those eight people.

That is what we're doing, and that's what the -- Lenfest wanted us to give a webinar, a national, and basically international, webinar to describe what we're doing, and that's an obligation that we have to them, and so that is what that webinar is, and the meeting is different from that, but, you know, these are the sorts of topics we'll be talking about at our June 1 and 2 meeting.

That might not have been the most coherent presentation of everything, but let me know if you have any questions, and, of course, if J.J., Tarsila, or Stacy wants to add in, they're more than welcome.

RICHARD APPELDOORN: Bill, when was that webinar, exactly?

BILL ARNOLD: Our webinar, the one for Lenfest?

RICHARD APPELDOORN: Yes.

BILL ARNOLD: Hang on a second. I have to look at my calendar. It's the 28th, from 9:30 to 11:00. Everybody is welcome, and anybody can tune in, as far as I know, but this is run by Lenfest,

and it's not run by the council or anybody, as was mentioned.

DOUGLAS GREGORY: Thank you for that. The email that was forwarded to us by Diana said it started at 10:00 a.m. Eastern Time. Has that been changed to 9:30?

ALIDA ORTIZ: The one I have is also 10:00 a.m.

DOUGLAS GREGORY: Let me click on the registration and see what they tell me.

STACY WILLIAMS: Can I clarify? Bill, I think that we have to join the meeting a half-hour earlier than the actual webinar, and that's maybe why you have on your calendar 9:30.

BILL ARNOLD: My calendar invite is from Lenfest, and so they've got us set up from 9:30 to 11:00, and I don't know what they're sending out, because they don't send it to me, or at least I haven't received it, and I don't know if J.J., Tarsila, or Stacy are getting it, but we're kind of operating behind the scenes on this thing.

DOUGLAS GREGORY: If you get, I guess, another announcement of it, if you would send it to us, because the link that I have took me to a page that wanted a user ID and password, and then it would not accept it, and so it's like they wanted me to be a member or join it, but I will just listen in.

CHURCHILL GRIMES: I think mine was the same way when I clicked on it.

BILL ARNOLD: I don't get those announcements, and I do not think you have to be any kind of member or anything, as far as I understand. Already the list of interested participants is very, very long, and Sarah and Maria may have a little bit better insights, because they're getting their stuff the same way you're getting your stuff, and so they might be able to help, somebody who is little outside of the process from me. I will tell you what. We can look at this and make sure that you guys all have the info that you need.

GRACIELA GARCIA-MOLINER: I requested that the invitation be re-sent, and then I can --

RICHARD APPELDOORN: Go ahead, Orian.

ORIAN TZADIK: It starts at 10:00 a.m., and, Graciela, I can send it to you, the invite, right now.

BILL ARNOLD: I'm glad that I could be of so much help.

GRACIELA GARCIA-MOLINER: Okay, and so I will forward it to everyone. Thanks, Orian.

RICHARD APPELDOORN: Thank you, everybody, for giving us an update on that, and hopefully setting us straight on how we're going to connect without problems. At this point, we want to go back to the spreadsheet that Tarsila was working on, or was presenting and leading us through, and discuss a little bit, again, about what we're doing with these regulatory boxes.

TARSILA SEARA: Okay, and so I think we were here, and we were discussing -- I think where we left off was about the impacts of the economy on the regulatory structure and also how we were going to deal with this split right here.

I don't know where we want to start, if we want to just go back to discussing the impacts of the economy on the regulatory structure as a whole, or if we want to just move into splitting the two and then figure out what to do about those connections.

RICHARD APPELDOORN: Well, I was going to make a suggestion, I guess following Walter's idea of this sub-model is going to deal with the fishery regulatory structure and that other regulatory structures will become components in other sub-models as necessary, and don't do anything with that yet, and so my suggestion, however, is, for the moment, we leave that column there, and we deal with it, and so, when we have to introduce these to other sub-models, we already have an idea of how this needs to connect. Does that make sense to anybody?

CHURCHILL GRIMES: It sounds good to me.

RICHARD APPELDOORN: So, in the final version of this sub-model, that column will be deleted, but, for the moment, we're keeping it, so we remember how this is supposed to link elsewhere.

TARSILA SEARA: Okay. As far as then moving on, I guess we can discuss how the variables that we have discussed so far impact the fishery regulatory structure, and would that be a good way to start?

CHURCHILL GRIMES: Can I ask a question? How exactly do you define, or how strictly do you define, fishery regulatory structure? I mean, is this just councils or states, or does it include ESA type of stuff and things that other agencies might

regulate that indirectly or -- Well, not indirectly, but affect fishing?

TARSILA SEARA: That's a great question, and I think that goes back to the initial concern about defining some of the boxes, and I think that it's a very important thing to do, and so I guess we can define it however we think is the best way. I would be inclined to go in a broader direction at this point, but it's whatever the committee feels like.

WALTER KEITHLY: I think we had defined it in the respect that those regulations that impacted the fishery directly through effort. In some way, the gear restrictions would be in the sub-model. Other regulations, let's say --

RICHARD APPELDOORN: Wait. Somebody has a mic open.

WALTER KEITHLY: Then indirectly affects fishery behavior to the other sub-models.

VANCE VICENTE: Walter, I can't hear you.

WALTER KEITHLY: I will try it again.

RICHARD APPELDOORN: I can hear you now. Somebody, I think, had a mic open, and we were getting a lot of interference.

WALTER KEITHLY: I heard that, too.

GRACIELA GARCIA-MOLINER: We just turned off all the mics.

WALTER KEITHLY: Okay. I thought we had concluded that those regulations that directly, or most directly, impact fishermen's behavior through effort would be included under the fishery regulation structure. If the regulation impacted say habitat, preserving fishing habitat, which then would indirectly affect fishing behavior through the fish stock, that those regulations would be considered in the other sub-models.

RICHARD APPELDOORN: I agree with you. That was my understanding. I think there's a question of where one draws the line on that, and so, for instance, the idea -- I think the MCD is an example. That was a closure that was put in that was largely driven, at least in regulatory sense, by protecting coral, but it has a direct impact, but that came from the council and the council process, and so I would include that in the figure for fishing regulatory structure, as you defined it, but then we had, by presidential decree, the creation of the coral monument south of St. John and

the expansion of the park and Buck Island in St. Croix, which were -- Obviously, it has a very similar impact, but it came through a very different regulatory process, and so that would be in that other group, in your thinking, Walter?

WALTER KEITHLY: Yes, it would be, but there is definitely going to be some overlap in some of these regulations, and it's just an unavoidable issue that you're going to have work around as we try to merge the different sub-models.

RICHARD APPELDOORN: Okay. It's messy, as everything else is.

VANCE VICENTE: One comment, Richard. The more that I listen, and the more that I look at the matrix and the graphs, the more that I believe that this has to be a regulatory structure model, sub-model, because, I mean, this shifting around is messing everything up. I mean, I am not going to repeat it again.

RICHARD APPELDOORN: Well, I don't think anybody disagrees with you. I just think that most people don't want to make things more complicated than they are, but the point you made about eventually linking this back to who has the authority to do what is what makes it, in the end, a way to make direct links from a particular agency, be it fisheries or water quality or whatever, to any kind of impact, and we're talking something that could actually be visualized.

VANCE VICENTE: I listened to you, yes.

RICHARD APPELDOORN: Does anybody else want to comment on whether we should go ahead and do a regulatory sub-model?

JUAN CRUZ-MOTTA: I have been thinking about this, and it all depends on how we're going to go about when we start connecting the different sub-models, and the question is, in general, are we going to attempt to connect individual boxes within each sub-model, or are we going to just connect, in a direct or indirect way, the sub-models, because, if it's the second, then I wouldn't see a problem creating another box for fisheries -- Another sub-model for fisheries regulatory structure.

RICHARD APPELDOORN: All right. That's not the way we've been operating, and we actually have a lot of inter-sub-model connections already mapped out from previous discussions, which we haven't gotten to yet. If we want to go to just, okay, this model leads to that sub-model, that is going to simplify everything immensely, and so, unfortunately, I'm going to kick it back to you guys and saying we're developing a conceptual model for your use,

and what do you want to see?

VANCE VICENTE: I think sub-models have to be strong enough to even stand by themselves, but eventually the questions start coming up about the whole inter connections, and everybody can go back to the sub-model, and they have to be strong, and they have to stand by themselves, and that's my problem.

This regulatory thing comes in and out, and sometimes very diffusely and sometimes solidly, but it's sometimes fragmented, and I still think that it should receive very specific attention and how we build in incorporating regulatory actions and structure and dynamics and flow is extremely important at this time.

WALTER KEITHLY: I think this model, and we'll call it the great overreaching model, which includes all the sub-models, is already complicated enough, and, in principle, I think Vance actually has a point for a separate model for regulations, for regulatory agency or structure, and you would be amazed at how much additional complication that might lead you to.

There is a tremendous amount of literature, economic literature, just on regulatory agencies. If we start making the agency an endogenous variable in a model, and, being endogenous, what is their goal? It's to increase their budget, so that they get an increased pay scale, and it becomes never-ending.

If we start getting into additional sub-models for regulatory structure and so forth, I think that's where we would end up, is a never-ending, or ever-expanding, model, which, in the end, I don't think it's going to give us a lot more additional information.

In listening to Bill this morning, he said some of this stuff we're going to have to drop out anyway, probably, when you get down to what the interest of this model is really for, which is for fisheries management, and, now, he did say that he liked the larger, expanded model, and then he simplified that, and I disagree, but, be that as it may, we're going to this expanded model, but I don't think we want to just keep expanding by adding still additional sub-models.

VANCE VICENTE: Walter, you missed my point. What I am saying, and I stand for, is that each sub-model should stand by itself, okay, and that's my point. It's not complicating things or making more sub-models. I am talking about strengthening each of the sub-models, but, eventually, when the partitioning happens, and we have to analyze each of these components -- I mean, you can put

everything beautifully, with all these neural connections, all these nerve endings, forming more or less a brain, but, eventually, you have to find out specifically where the problem is and where are the limitations, and so that is my main point.

WALTER KEITHLY: So you would want each of these sub-models to be a stand-alone model and so, with habitat, you have to put all the fishery information and the socioeconomic information in that model, and it seems the only way to have each model proving everything is to do away with the sub-models and just basically layer one big model that has all this stuff in it.

VANCE VICENTE: I understand, but, still, I think that the sub-models should have enough weight to stand by themselves in a sustainable form, in a defendable form, and that's my point. Maybe I am confusing things more, but that's what I am saying.

WALTER KEITHLY: I think you may be confusing things more, because, at least my understanding, and, again, we've never been given real detailed directions with these models, but, at some point, when you connect the different sub-models, what you arrive at, in the end, is one complete model, and it's just that this one complete model is comprised of several different sub-models, which then allows you to look at the direction all the way through. If you change one variable, or one component, you can look all the way through all the models and see where you end up.

VANCE VICENTE: The way I see it, Walter, is that what we're trying to create is an organism, an organism composed of different tissues, which are connected to each other, but, if there is some problem with the organism, we need to look at the components, in order to diagnose and fix whatever problem may arise in the future, and that's just my comment.

WALTER KEITHLY: The only thing I will say is I'm sure that we're going to run into a lot of problems with this, but it just seems that, eventually, at least the way I understand it, this will be one large model, with numerous sub-components that feed into each other.

RICHARD APPELDOORN: I don't think that what we're doing now precludes if we wanted to have some kind of regulatory structure sub-model, and I think what Vance wants to get to is who has jurisdiction for what in this regulatory structure, so that, if you're looking at a problem that involves regulatory structure, you know which agency, or agencies, are the ones who are supposed to be dealing, or causing, as you look at it, what the issue might be, or where do you need to go to improve something.

I don't think what we're doing now precludes that. I think, if we can just find out where we think regulatory structures are being impacted by these other things, and how they impact the other things, if we wanted to get to that point, we just pull out that box where the connection is already made and we split it out. I am kind of asking can we keep going forward the way we are now.

WALTER KEITHLY: I would say yes. The point I was making is that -- You have lost the whole idea of a conceptual model, and you moved to an actual model, and so I look at a conceptual model as being more broad in nature, rather than listing each individual agency or whatever other -- I will just leave it at whatever agency you're looking at.

RICHARD APPELDOORN: I want to go back to something that J.J. asked, and I am throwing the question back to him or Bill or whomever, but the point was made that we could either, as we've been doing, link individual boxes in one sub-model to individual boxes in other sub-models and getting to that one grand model that Walter was identifying, or we could just say that this sub-model connects with that sub-model, which connects with that sub-model, and so the only place you see the connections are going from sub-model to sub-model, which is another way of dealing with it conceptually, but you lose the complexity of that.

If the simple way of just saying this sub-model connects to that sub-model is sufficient for the purposes of what we're doing this for, we would save ourselves probably several more days of work, by just saying, okay, we're not going to look at connections between sub-models, box-by-box, but by just this sub-model connects to these three sub-models, but not to that sub-model, or something like that. So, like I said, we've been working towards this one large model, and, if that's really not what they want to see at the conceptual stage, we can save ourselves a lot of trouble.

GRACIELA GARCIA-MOLINER: Bill is requesting the overarching ecosystem model that Richard had in his presentation to the council, and so we can show that. Do you want to show that, Richard?

BILL ARNOLD: I would like to show it, Richard, and then comment on it, with regard to this discussion, if possible.

RICHARD APPELDOORN: Okay. If Graciela can put that figure up. You're talking about the one that I gave to the council, which was two meetings ago for us?

BILL ARNOLD: The ecosystem-level conceptual model will be fine with me, and I don't care if it's yours or St. Thomas, and any of them is fine with me. I just want to use it as an example.

GRACIELA GARCIA-MOLINER: Is that the one that Liajay prepared for you, Richard, with all the connections?

RICHARD APPELDOORN: No, and we had the individual sub-models, and then I had a page that she prepared that had all of the components of the sub-models, but it was only looking at the connections across sub-models that we had talked about in past meetings.

BILL ARNOLD: That's the point I'm going to make, is you just want your major components of your ecosystem model in your top-level model. If you start going into detail, you will have such a mess that it would be pointless, useless, and inapplicable, and it will be completely incapable of understanding for any reasonable person.

The idea is you have whatever the core of this thing is, and we had this in some of these overarching models. The DAPs have developed an overarching model for each island group, and they did a very nice job with it, and they might only have twelve or fourteen boxes in them.

Each of those boxes, and, of course, this applies to every box you create. Every box represents a sub-model, and it can have a whole bunch of connections into that sub-model, and it doesn't matter, as I said before, whether it's garbage dumps or airports or whatever.

You can take a garbage dump, for example, and then you're going to have all these things about number of trucks coming in and depth of burial and all of this stuff, and you can just go on and on with this stuff, and so this is a good example right here, and I can't say that I can see it super well, but the overarching model would only consist of the purple boxes, and then, if you wanted to look more closely within a purple box, you could, but, if you start connecting coastal birds to fishing mortality, you're going to have this, and two orders of magnitude worse, and, you know, most of the connections in what you're seeing on the screen have not been made.

Just imagine, in your mind, what it's going to look like when all those connections are made, and ask yourself if that's really where you want to go with this, and so, as I said before, this is all great stuff, and I said this yesterday, and it really is, and I'm

not trying to stop you from doing it, but, ultimately, your overarching model should be very compact, and it should have these sub-models, the major sub-models, in it.

If you wanted to, as an individual person, go into competing use of resources and look more closely at that, you could, but, within competing use of resource, you could also go into conservation and restoration, and that could turn into a purple box with twelve or fourteen boxes connecting to it, and then any one of those boxes could have another twelve to fourteen boxes connecting into it. It goes down to bacteria and ants, ultimately, and you don't want to go there.

Like I said, from a -- Overall, I value what you guys are doing, because, as I said this morning, I think you guys are doing a great job of really opening everybody's eyes to how the others on the SSC think, and it's really getting you to think about how this ecosystem functions, but your final overarching model, I would suggest, should not look anything like this. It should be, as I said, much more compact, and, really, as far as the council is concerned, the only sub-model that would matter to them, and maybe I'm being a little too liberal with this, but would be fishing, because that's what they do. They manage fishing.

They don't manage competing uses of resources, and I know they kind of do, and I get that, but they don't manage water quality. Somebody else does that, and it's nice to build the sub-model for the EPA to use, but the council is not going to use it, and the council --

You guys report to the council, and you don't report to EPA, and so that's why I urge that, while you could go through this, the much more important outcome of this meeting is to have three overarching models, one for each of the island groups, and to have intricate, intimate sub-models that have every detail in them, because, as it has been doing, in spite of the interest that it engenders, it is going to drag you down and prevent you from achieving your primary goal, and that would be my perspective on this.

VANCE VICENTE: Very, very good points

GRACIELA GARCIA-MOLINER: In terms of what the DAPs have presented to the council and what the council is also looking for -- I mean, it's true that we can only manage -- The council can only manage fisheries, per se, but these are the things that -- These other issues are directly related to the health of the fisheries, and, if they're not taken into account, you might be managing, or extra-

managing, a fishery that is in not as good shape as it should be, or there are issues with the fishery, but that are not directly related to fishing, which is where the council comes in.

It's not that you are making a model for EPA, but it's that the water quality is essential, and it's part of the essential fish habitat definition in the Magnuson-Stevens, and so water quality is indeed extremely important to the health of the fishery, and so this is where all these other sub-models come in, and how are they related to fisheries, and it's true that the council cannot do something directly about it, except that it does have the EFH consultation process, and that takes into account anything that has to do with construction and water quality, et cetera, out in the ocean, but it doesn't have the tools, until now, to look at the relationship between all these sub-models.

I think that, having said that, and having the fishing model as the center, you can put that as the core of the overarching model, but then recognize that all these other issues are real, and they are going to impact your fisheries, and so --

BILL ARNOLD: Graciela and everybody, that's exactly what I am trying to say. You could say, in fishing, water quality is going to affect fishing, and I'm just using this as an example, because Reni did such a nice job of building and presenting his model, but do you need to know the flow rates of the individual rivers?

Now, you might need to know that down the line, and so you could -- The council could say look, man, we're trying to manage silk snapper off the southwest coast of Puerto Rico, and we're having trouble, because our basic fishery management concepts aren't working, and so we need to look more closely at this, and so we want to look at our water quality sub-model.

You don't have to anticipate every possible thing that they're going to want to look at. If they want to look at water quality and develop a water quality sub-model, all the details that go into it, you could do it at that time, but what you guys are doing, and I don't mean to be critical, but this is what you're doing, and you are anticipating every possible issue that could arise in any aspect of the environment of the U.S. Caribbean and trying to build a sub-model, and sub-models under that, for that potential problem, and you could do this for months, months and months and months. You could never stop doing this.

All I'm saying is that, despite the attraction of doing all of that, you should prioritize what you want to get out of this meeting, and the priority is that overarching model for each of

the three island groups, in spite of the, I repeat, attractiveness of doing other things.

VANCE VICENTE: Bill, but that's what we were asked to do, okay? I mean --

BILL ARNOLD: I would like to see that request, because I wonder how you are interpreting your direction, because I'm not sure you -- So that's fine, but don't go any farther than that, and you just -- In my opinion, you guys are diving in way too deep on these conceptual models at this point in time. It's a step-wise process, and I just feel like you might be getting a few steps ahead of where you really need to be, but, again, this is my perspective on it.

GRACIELA GARCIA-MOLINER: Richard, if I may, this is the presentation that you gave to the council where all these sub-models are connected. The DAP from St. Thomas is actually hosting a meeting at some point with their regulatory agencies, because they think that that's the biggest issue with their conceptual model for St. Thomas/St. John, and so it comes at a time when you are also dealing with the regulatory impacts to fisheries, and regulatory in the larger sense, not only fisheries, but everything else, the EPA and the Clean Water Act, et cetera. They have also dealt with these issues that they believe are specifically impacting their fisheries.

BILL ARNOLD: What I want to emphasize is it's not everything else. When they get those agencies together, and I think you're accurate in saying, okay, they might want to talk about water quality or something, and they're probably not going to talk about socioeconomics. This isn't a socioeconomic group, and so the socioeconomic sub-model would not be taken into account, and so does the -- Clearly, the St. Thomas group has identified a need to look at a water quality sub-model, and so that makes sense to develop that sub-model, but that's not eight sub-models.

That's one sub-model, and that's what I'm talking about, where you need to focus your energy and effort on what you're in need of now, or what could be usefully and practically applied now, and other things are going to come up, and, as they do, you can go after them at that time, but I think they're trying to prepare for every possible eventuality is kind of overwhelming.

VANCE VICENTE: Bill, the way I see it is, at this stage, we have to be inclusive and not exclusive. We can be inclusive with the resources that we have right now, and it will be very dangerous to be exclusive and focus on things that we think that are the major

components affecting the fisheries and things that are regulated by the Magnuson Act, but, at this point, what I believe that we have been asked is to incorporate all the elements that we know of for an ecosystem which directly and indirectly affect fisheries, and that's where I see where our efforts have been put.

BILL ARNOLD: But sooner or later you have to be exclusive. You cannot possibly include every aspect of an ecosystem in a one -- Well, have we put four weeks into this so far? I mean, like I said, you need to ask yourselves how much you can really accomplish with a set amount of time, because you have to be exclusive sooner or later, and it's nice to say inclusive versus exclusive, but they are not mutually exclusive concepts.

It is a balance between what you do include and what you appreciate that you cannot include, and you can only drill down so far, in a reasonable sense, before it's becoming trivial, and that kind of went back to my discussion of the data.

You know, ultimately, we're going to have to look at this, and we're going to have to say, well, what kind of data can we actually bring to bear, and, if you have built 400 boxes, you might have data for twelve of them, and so the other 388 may be useful, or they may not be useful, and it seems to me that they won't be useful, because, if you ultimately want to end up with quantitative models, you've got to be realistic about the quantitative data that you have to calibrate those models, because, otherwise, you're just making stuff up, and that you want to avoid.

It's a balance, and that's kind of what we're going to do. We're going to get these conceptual models, as the Technical Advisory Panel, and we're going to look at them relative to the data we've been able to find and see what are tractable, from a quantitative modeling point of view, and try to focus on those, because, even at the higher levels, we will not be able to quantitatively address all of the boxes and all of the linkages, because the information just isn't there.

Of course, there is temporal and spatial components to this, spatially, and Orian knows this, because this is a lot of what we've worked on, is you might have really good data on the topic at hand for the southwest coast of Puerto Rico, but you may have nothing for other areas, and then, temporally, you may find that we've got one good year of data for this dataset that is absolutely essential to doing this analysis, and so we can do the analysis, and this is what we found. You can do the analysis for 1988 and 2003 and 2017, and, other than that, there are no data.

I recall meeting -- The Southeast Coastal Ocean Observing System asked me to speak to them about how they can use their data in a fisheries sense, and I told them, well, you can't, because you collect data, physical data, on the seconds to minutes timeframe, and we're collecting biological data on the months to years timeframe. You can't split your yearly fisheries abundance data out into seconds, and you can't compile your seconds data into years, and so you've got a fundamental disconnect, and so there's a lot of things going on with the actual data.

J.J. knows this, and so does Tarsila and Stacy, and this is what we've been working on, and that's why I keep emphasizing this, because it's nice to build these super elaborate conceptual models, but, as I keep saying, and as Mandy and Adyan taught me, when you come out the other end, they're going to be pared way down, and so I think focus, in my opinion, is a really important discipline to apply to yourselves.

I am not disregarding what Vance is saying, and I'm not disregarding what Reni has done, and I get it, and it's great stuff, but, if you take it in a step-wise sense, I would say it's something that should be done in Step 4 or 5 and not Step 1 or 2.

VANCE VICENTE: Bill, can I make two or three comments?

RICHARD APPELDOORN: Vance and then J.J.

VANCE VICENTE: Bill, two comments. I believe, again, just restating that, at least nominally, and very qualitatively, we have to be inclusive. I mean, that's my opinion. Second, understanding the very highly complex conceptual model, when other sub-models are put together, they can be very -- I mean, I don't know where it's going to go from there, and so I want to make a point that I think that the sub-models -- The compartments of the models have to scientifically-based, and so I believe that the sub-models can be an answer to your question about the complexity, but then the Southeast Fisheries Science Center and NOAA can decide that this is what we're going to focus on, then, okay, but we have these sub-models. We can develop on this. Those are my two main points.

BILL ARNOLD: Vance, I agree with you 100 percent. My question is what method, what strategy, do you want to apply to develop all of that, because, you know, Henry Ford developed the Model-T, and then they developed the Ferrari. They just didn't start with a Ferrari, and I think, as I keep repeating, you could take a much more step-wise approach to this and not be so detailed right now, and come back later and say, okay, look, we've got our overarching,

and we've got our fisheries model, and now we want to go into our water quality model and develop that, and that could take three days.

Then we want to go into our competing use of resources model, and that could take another two days, and, if you start looking at all of these and applying time considerations to them, you will find that you're trying to squeeze weeks of work into this five-day meeting, and I think that, on Friday afternoon, tomorrow, you're going to find that, once again, you have not achieved the goal. You have achieved a whole bunch of parts, but you haven't put one thing fully together, and I would ask that you focus on putting one thing fully together and then go to the next thing and put it full together.

VANCE VICENTE: I will let somebody else talk now.

RICHARD APPELDOORN: J.J., did you have a comment?

JUAN CRUZ-MOTTA: Graciela, can I be the presenter, to share something on my screen, or do you want me to send it to you?

GRACIELA GARCIA-MOLINER: You can be the presenter. Hold on a second. There you go.

JUAN CRUZ-MOTTA: I want to go back to something that Bill said, which is balance. In this balance, and from my point of view, all the work that we have done so far is very, very important and necessary. That means that, for example, the very detailed models that Vance and Reni presented yesterday will be extremely useful for what is to come.

On the other hand, as Bill said, we need to summarize this information somehow. What you see in this slide is an exercise we did a few years ago, and we applied something that is called structural equation modeling to model, in this case, four boxes, or four sub-models, what we're calling sub-models. In that slide, you have --

VANCE VICENTE: Can you enlarge the slide? I can read nothing.

JUAN CRUZ-MOTTA: I will do that.

GRACIELA GARCIA-MOLINER: You should have, on your screen, a plus or minus on the side, so you can move it around and make it bigger.

JUAN CRUZ-MOTTA: In this slide, we were trying to model four sub-models, environment, human impacts, distance, and it was used as

a spatial autocorrelation of very simple geographic coordinates, and the influence of those three in benthic assemblages, basically coral reef assemblages.

To come to this level that we actually used data that existed, we had to develop a more complex model that was very similar to what we have now, and that means environment was a lot more complicated than just sea surface temperature, precipitation, and UV.

What I am trying to say here is, for what is to come, it's very important what we're doing now, to have very, very detailed sub-models. For the next step, it will also be ideal to build all the potential relationships between individual boxes across sub-models.

However, we have to balance that with the time that we've got, and so what we can do is keep going on developing these very detailed sub-models and then the next step is to look at the relationships between the sub-models and perhaps identify, within each one of those sub-models, what would be the three most important boxes.

Now, how do we decide what are the most important boxes inside the sub-model? We have to define what is the central node. In here, it was the species composition of benthic assemblages, but, in our case, the central box would be the fishing, as Bill mentioned, and that's what the council is going to manage.

My specific proposition is let's keep looking at these detailed sub-models, as we're doing now. However, when we move to the next level, we do an intermediate, which is establish the final central node, fishing, and then see what's the relationship of all the sub-models to that central node, and, of course, potential relationships across other sub-models, and then, within each sub-model, identify one, two, or perhaps three, boxes that will, in our opinion, and it doesn't mean that it's true, but, in our opinion, it would be the most important influence on the central node. I hope this helps somehow.

VANCE VICENTE: I like it very much, J.J. Thank you.

RICHARD APPELDOORN: Thank you very much, J.J. I think that shed a lot of clarity on where we need to go and how we might get there.

VANCE VICENTE: Very good, J.J. Thank you.

JUAN CRUZ-MOTTA: Thank you, Vance. What I want to stress here is, even though we end up with what I think is a simple model, in this case for coral reef assemblages in the southern Caribbean, we

started with a Picasso, or with this very complicated picture that we have now, and so it's important that we go through this process, because our job is to then start working on these ideas and then simplify them. That's all.

RICHARD APPELDOORN: That sort of suggests that we continue as we are now, and we would not break out, at this point, a separate regulatory sub-model, at this point. Let's get through with this, and I think that would just leave us with two others, and I expect abiotic to go very quickly, and so we might be able to get through our sub-models, and so, unless somebody else would like to offer a different, and perhaps better, way to go about this, I would turn it back to Tarsila, and let's hammer through this.

JORGE GARCIA-SAIS: I think we should continue what we've been doing, because we are too far at the end of this to change anything. Just keep what we're doing, and with the vison that we have to try to synthesize the information tomorrow, but let's continue with what we've been planning.

VANCE VICENTE: I agree, Reni. Thank you.

RICHARD APPELDOORN: Okay. Tarsila, let's move forward.

TARSILA SEARA: All right. Are we still okay with the splitting here, and I don't know if there was a question about that, and I can't remember if we were questioning that or not.

RICHARD APPELDOORN: I think my suggestion was we leave it like that, and, if we want to move some component to other models, we can do that later, but we would have the information in Column 2 already set up to guide that, even though Box Q might not show up in this sub-model at its final product.

TARSILA SEARA: Okay. All right. We were talking about impacts of economy or gross income and local economy on fishery regulatory structure, and that's where we left off.

We were having some discussion about definitions, and I think that was one of the things that was -- That I identified as important too, especially in this sub-model, because all of these are very complex boxes, and we definitely don't want to open them up, but we just want to make sure that we have an agreement within the main components within each one of these, so that we can ask these interesting and hypothetical questions and capture what would be some important questions that we can answer in the future.

Here, I guess we're trying to capture if there is a relationship

between the gross income, and so this is the nation's income, and if that affects in any way the fishery regulatory structure in any way that we think is important, in any way that would answer a relevant question, for the purposes of what we're doing.

JORGE GARCIA-SAIS: Tarsila, I believe that there is, and it might even be of considerable influence, because, the better the state of the country or whatever is, the national gross income, the better resources you will have to establish the personnel and the expertise and the infrastructure to establish the fishery regulatory structure.

TARSILA SEARA: I totally agree with that. Do you have a suggestion here for strength?

JORGE GARCIA-SAIS: Two or three, maybe three.

TARSILA SEARA: Anybody else?

RICHARD APPELDOORN: I would argue two, and I would agree with I think it was Vance who made the statement that, when budgets get cut, and so going in the negative direction, enforcement isn't what gets cut. That seems to be the same, and we have certainly seen that in Puerto Rico, when things have gone bad, like the Rangers are one of the groups that is protected, doing their function, in terms of law enforcement or something, and so I'm not sure how -- I think there is a thing that, as things get better, you could have more training and things like that in there, but I'm not sure that it's a really strong connection, and so I would say a two.

TARSILA SEARA: Would you want to change this one to a two at this point as well?

RICHARD APPELDOORN: Or even a one, because that's getting away from the fisheries stuff, but that's not my area, and I'm just kind of guessing now.

VANCE VICENTE: From the federal agency side that I've been working with, the Department of Interior and Department of Commerce and the National Marine Fisheries Service, I never saw any limitations on enforcement, ever. I mean, it's irrespective of what the economic situation is. However, like I said in the discussion earlier this morning, I don't know whether the same holds true for state agencies, and that's why I asked for Ricardo's opinion. It may be different, but I wouldn't go more than a two. I mean, I say one or two.

TARSILA SEARA: I am trying to change it, but my computer froze, and so just give me one second. All right. Do we have any other comments here on how gross income will affect the regulatory structure?

RICHARD APPELDOORN: I don't think so, and then we go down to the basically same issue on the local economy, and I would argue it's the same.

TARSILA SEARA: A one here, too?

RICHARD APPELDOORN: Sure.

TARSILA SEARA: Okay, and so I think that was the last row that we -- Then I think we were here, right? Right now, we're looking at tourism and how it impacts all these other factors. I just wanted to make a note that, when we're talking about composition and size, these are potentially temporary, but I thought they were important, especially thinking in terms of cruise ships and things like that that could actually have a significant impact, even though they're temporary, and we can just go through everything.

RICHARD APPELDOORN: Well, I don't have a problem until you get over to the cultural preferences and resilience and wellbeing, and I'm going to say I don't understand, and I would have thought, if there is some kind of thing, it's working through something else.

TARSILA SEARA: I think the idea -- Yes, there is an indirect relationship, I think, with tourism and cultural preferences that could be through demand. I am just thinking that it's outside influence, is what my thinking was, in terms of if you have a lot of tourism and a lot of outside influence, and that could have an impact on cultural preferences and norms, but we could maybe discuss that, if somebody else has a different opinion.

RICHARD APPELDOORN: Are you saying the local communities are learning something from the tourists that are coming in that changes their behavior?

TARSILA SEARA: Yes, and not necessarily just the people, but I think just the increase in activity, in tourism activity, and, again, some of these might be indirect relationships that we might have other boxes that could potentially capture that, like the local economy or market demand that could be changing those cultural preferences and norms, but, yes, the idea would be that, if you have an influx of outside influence, that that would change cultural preferences and norms, but we could --

RICHARD APPELDOORN: This is a visual thing, but is there a way to light up that column, because I keep kind of not being able to track it across.

TARSILA SEARA: This one, you mean? The column or the row?

RICHARD APPELDOORN: Just like that is fine. The row. Sorry.

TARSILA SEARA: I agree that maybe the strength here could be more so from of the other indirect effects.

RICHARD APPELDOORN: You already have market demand -- No, you don't have market demand affecting any of those three, and so, if you had an indirect effect through market demand, we would have to go back and run it through there.

TARSILA SEARA: It's tourism impacting market demand, right, and then we have --

RICHARD APPELDOORN: We did not have market demand affecting --

TARSILA SEARA: Yes, it's the other way around. You're right.

RICHARD APPELDOORN: I mean, I don't care which way it goes. This is not a system that I understand well, and so, for capturing something, the best way you think it should be, that's fine with me.

TARSILA SEARA: It makes sense to me that there is a connection, and I just would be willing to maybe see if we are already capturing that through an indirect connection, but I still think that we should have something here, maybe perhaps not as strong, if we think in terms of evaluating some of those indirect connections that we might already have or that we might need to look at.

RICHARD APPELDOORN: I don't see any other indirect connection that would work that we haven't already looked at, and we didn't build it in, and so why don't you just leave it here?

TARSILA SEARA: Okay.

RICHARD APPELDOORN: As for me not knowing any better, I would yield to your informed opinion and accept that. Does anybody else want to say something in contrast to that?

VANCE VICENTE: No.

RICHARD APPELDOORN: Well, if Vance doesn't have anything to say,

we just take it as that's a given. Just joking, Vance. Let's move down to the next one.

TARSILA SEARA: To the next row or the next relationship?

RICHARD APPELDOORN: The next row.

TARSILA SEARA: Okay, but we need to just make sure that we're good with the regulatory structure.

RICHARD APPELDOORN: Thank you.

TARSILA SEARA: So tourism impacting the regulatory structure, that's where things got a little bit, I guess, complex here, in terms of the definitions, if we're thinking in terms of the overall regulatory structure or the fishery regulatory structure, and so this is a good time, I guess, to think about how tourism would impact those things directly.

RICHARD APPELDOORN: I would think there's a connection, because, at some point, you get just too many people involved with resources, and you have to take some action, if tourism is really expanding, and we've seen that in lots of places, where they really have to start partitioning who can do what where, and so I'm not sure the connections are threes, but I think they are there for both of those boxes.

TARSILA SEARA: Okay.

VANCE VICENTE: Richard, I don't know. I mean, I know of no regulations that establish, for example, a carrying capacity for a specific beach, for example, and I don't know how it's related, tourism and fishery regulatory structure. I mean, there may be a relationship, but I cannot think of any example right now.

RICHARD APPELDOORN: Well, I can't think of one in Puerto Rico, but I can think of ones in other islands, where they have put together basically marine spatial planning, and they say these activities are occurring at these locations, and they actually have limits to the number of people they will run out to certain islands, by the ones who are chartered to conduct that business, and so, while we may not have that here yet, I don't think it's something that is alien to the system.

VANCE VICENTE: I can see an example. For example, regarding tying of vessels to mooring buoys, and that can be regulated, and there is a relationship there, and all I know is that -- I mean, look at Caracoles Island. Everybody does whatever the hell they want to,

and there is no enforcement, but there is a connection, but I cannot think of any solid example right now.

TARSILA SEARA: Do we want to change the number to a two? I agree with the comments, and I think what I had here, in terms of notes, was zonation and those types of impacts, but are we okay with a three or a two?

VANCE VICENTE: I wouldn't change anything right now, because I am not knowledgeable enough to propose a specific value.

RICHARD APPELDOORN: Well, we're not thinking of anything really strong right now, and so I don't think a three is kind of where we want to be. Graciela brought up the case in Puerto Rico of, in Guanica, Gilligan's Island, which does have a limit on the number of people they're allowed to bring out to that island, and so that's something where -- But that's a really small example for Puerto Rico, and so that's not a good justification for a three, or maybe even a two.

Now, there have been a lot of people who have requested, including DNER, about carrying capacity, because they are concerned about the number of people who are getting onto some of the public beaches, but there hasn't been any regulations that have come down from that.

VANCE VICENTE: Take Caracoles Reef, for example. I mean, that's the most disastrous and embarrassing environmental situation that I have ever seen and documented myself while conducting transects during one of those long weekends. I mean, I have never seen anything so ignominious ever in my life, but the Vigilantes, they don't interfere. They are afraid to.

I mean, you have fifty people, with everybody drunk and cursing at each other, and, I mean, I don't see -- I have never seen any response, or any direct relationship, between excessive tourism, excessive demand for a specific natural resource, and enforcement and regulatory implementation, never. I mean, people here do whatever the hell they want to.

TARSILA SEARA: Do we want to change that to a one?

RICHARD APPELDOORN: Just to move along, yes, I would like both of them to be one.

TARSILA SEARA: Okay. Any other comments or questions on tourism? All right, and so, for education and outreach, right now we have it in compliance.

ALIDA ORTIZ: I would like to make a comment on that. I think that the connection -- I am not going to use the word "impact" at all, but the connection of education and outreach that you have already on the table is -- To me, it's correct.

The only thing is that I see a connection with market demand, especially when we educate the consumers, especially the homeowners and the people who buy in the fishing villages, about selecting a species that they know they are not under a closed season and fishes that are probably underutilized, but they are very good, and they are abundant, and they are not sold, because, a long time ago in Puerto Rico, they say that there is first-class fish and second-class fish and third-class fish, and the first-class is the one that everybody eats and they buy all the time, whether it's a closed season or not, and usually you can find them in the market.

When we educate a consumer, that market demand is impacted, and we would like to see more of the underutilized species caught and see how that fits into your table.

TARSILA SEARA: Alida, I completely agree with you. The way I thought we were capturing that was through cultural preferences and norms, because we have education and outreach impacting cultural preferences and norms and then cultural preferences and norms strongly impacting market demand. Would that capture what you're saying correctly, or would you still like us to have a direct connection there?

ALIDA ORTIZ: When you say cultural preferences, I thought of actually the history of the community and what do we eat and what time of the year. When I see market demand, it's that these consumers are going to the market and saying I want this species, and I want it prepared this way or the other, but regardless of whether that was the season or whether that was the historical time when they bought it, but probably, if cultural preferences and norms are that wide, that would include education and outreach, like you have prepared.

TARSILA SEARA: We can, maybe, if everybody agrees, make that connection, so that we don't miss anything, if you think that makes more sense to you.

RICHARD APPELDOORN: The way we were talking about it last time is that the way you affect demand is by the education altering the cultural preferences, and so you tell them that, hey, although you want this, this is not a good time of the year to be doing that,

for the resource, or, this thing that you thought was just really bad fish, because it's listed as second-class, is actually really good, and there are other reasons of how that system came to be, and so the way we originally viewed this was the connection that Alida is talking about, and it was through cultural preferences.

TARSILA SEARA: Yes, and that's how I was thinking about it too, but I don't know if there's anything that we're missing here.

ALIDA ORTIZ: To me, that would be fine then. The thing is that we have it in the cultural preferences and norms, but that would be good, absolutely.

GRACIELA GARCIA-MOLINER: Richard, you have some comments in the chat from Vanessa and Nelson regarding this.

RICHARD APPELDOORN: Vanessa is saying that she agrees with Alida. Also, with education, people start demanding other species, and Nelson was saying that they have started to receive people asking for different species that are not on the regular market, and Marcos is agreeing with that line, and education and outreach are working, and so they are reinforcing, I think, this connection between education and outreach and market demand, and I think that's secondary to what was the pathway to that, and we were talking about this being one where this education is altering the way people think, and that's altering their cultural preferences.

TARSILA SEARA: Yes, and they are both strong connections, the way we have it right now, and so we would certainly be capturing that. For education and outreach and, specifically, with fishery regulatory structure, initially there was a two linking education and outreach and just regulatory structure in general. Do we want to keep that or change that?

ALIDA ORTIZ: I think that could be a two.

TARSILA SEARA: Okay. I was hiding gross income, but I think we're okay. All right. The next row is compliance, and, right now, we have that affecting income, wellbeing, and the regulatory structure, and I think the main rationale for it affecting income had to do with a discussion that we had before, and this is about unlicensed fishers selling fish for less and other potential ways that lack of compliance could directly impact fisher income, and that's the one example that I can think of.

In terms of compliance and wellbeing, this has to do with conflict and community relationships, and, again, a good example here too is, if you have that happening, you may have issues of conflict,

and I think, with the regulatory structure, that's pretty straightforward. Are there any comments?

RICHARD APPELDOORN: I am asking about the signs on these, Tarsila. As compliance goes up or down, how does fisher income go up or down?

TARSILA SEARA: That's why it's blue. This is not entirely -- This is trying to capture the idea that there is a potential impact on a fisher's income if people were fishing without a license or selling their catch illegally for less than the market price, right, and so this would be a lack of compliance with unlicensed fishers, and this could be having an impact -- This impact on fishers' income, because of how it is impacting the market, and so I think that's why the number was there, but, again, we can certainly discuss that.

RICHARD APPELDOORN: Okay. I will accept that. The next one was the --

WALTER KEITHLY: Mr. Chairman, maybe you were going there, but I may just be not paying enough attention, but how does the compliance affect the regulatory structure?

TARSILA SEARA: I think maybe the rationale here is that, if you have less compliance -- Well, one way, I guess, would be indirect, through how that would impact the stock and how that, in turn, would impact the regulatory structure, but perhaps through enforcement, which is, again, maybe an issue of definition here, but I think the thinking behind this was how that would impact enforcement and any other mechanisms to --

WALTER KEITHLY: It seems a bit of a stretch. I think, really, it's regulatory structure that is, I would think, impacting compliance, more so than vice versa. For example, look at what's happening right now with the Corona virus, and some people think the regulation is too overburdensome, and they are going out and protesting and opening up their barbershops and so forth, and it just seems that the structure impacts compliance more so than vice versa, other than the fact that, if people are not complying, then they may have to restructure the regulatory system.

TARSILA SEARA: Yes. I mean, I think that would be a part of it too, but we can change that if -- I mean, I think there's a connection, and whether or not it would be a strong or a direct connection, but I do think that, whether there is compliance or not, that would have, somehow, an impact on the regulatory aspect, or the regulatory structure, but I would be willing to have a lower

strength.

RICHARD APPELDOORN: Yes, I would make it a lower strength. One can certainly think of, especially in the fisheries context, where compliance can affect the regulations, in the sense that -- The best example I can think of is, if you're thinking of a deepwater fishery, and you're going to put a size limit in that's impossible to enforce, all you're going to do is throw away small fish, and it's not possible for the fishermen to say go to an area where juveniles are not or something like that. Then you would say, okay, I want to regulate this fishery through some other mechanism, and so it influences that dynamic, but I don't think it's an overriding thing.

TARSILA SEARA: Is a one okay?

RICHARD APPELDOORN: Yes, a one would be fine.

TARSILA SEARA: I would just think this would be the same here, or maybe it's -- What do you think? Does that look good?

RICHARD APPELDOORN: Yes, that looks good. Can we go back to wellbeing? Just I'm not questioning the value, but I just don't understand it, and so how does compliance have a positive impact on wellbeing?

TARSILA SEARA: Probably not a positive. I think this would be one of those -- There is a relationship, but it would be difficult to perhaps characterize, but the relationship here, and so in terms of compliance, is -- Within that box of wellbeing, one of the things that we're trying to capture is conflict, cohesiveness, cooperation between fishermen within the community, relationships within the community, and so the issue of compliance would affect these relationships, in terms of, for instance, if you have unlicensed fishers or fishing and selling the fish for less, that could create some sort of conflict. Another example would be --

RICHARD APPELDOORN: You can stop there. I understand it. That's fine.

TARSILA SEARA: Okay, and gear conflict would be my other example. Okay. So next would be cultural preferences and norms, and, right now, we have that affecting market demand, and I think we already talked about that. Then compliance, simply because -- Compliance and resilience and wellbeing and regulatory structure, and, again, regulatory structure is where it gets a little bit complex, and so we can talk about that, but, as far as compliance, I think what we discussed here is norms and what is right or wrong behavior, in

terms of resilience.

We were talking about exposure, and so infrastructure and use of that, and the coastal area will be influenced by preferences and norms, and that will have impacts on vulnerability, and it will also affect how people will adapt to impact. Wellbeing is the same, if we're talking about cohesiveness and social capital and cooperation, and preferences and norms will also have an effect on that.

Then we get to the regulatory structure, and I'm not sure anymore what we're talking about here, but I think this had to do with preferences and norms affecting decision making, but, again, I'm completely open to discussion.

RICHARD APPELDOORN: I would think that's strong in both of those. You know, China can lock down eleven-million people completely with an order, and you can't do that in the United States, and so that's definitely two different cultures at work there, and, from what I have seen, culture has a lot to do with what people are willing to accept and how they are willing to react to proposed regulations, and so I would think that both of those are strong.

TARSILA SEARA: I agree.

RICHARD APPELDOORN: Next row.

TARSILA SEARA: All right. Now we have resilience, and so, again, just to clarify, resilience is one of those large boxes, but what we're trying to capture is vulnerability to impact and bouncing back from impact, and so this could be any kind of stressor. This could be a hurricane, or this could be a pandemic or climate change, and so factors that will affect vulnerability and resilience to impact.

I have that impacting population size, just because, in terms of your vulnerability to an impact like a hurricane, that would have an impact on how many people are directly affected by it, and, also, in terms of -- For instance, migration was another thing that I had in mind, in terms of how resilient you are to an impact, and that would determine the sort of population movement and survivability.

Then, moving on to income, this will -- Recovery will impact how fast fishers can go back to work, and so, if you lost all your gear, or if you -- If there is a significant loss to infrastructure, that would delay going back to fishing, and that would impact income from fishing, but, also, if we include here

that some fishers are fishing partially, that would also impact other sources of income, and so that's why I had it as a strong, and so an impact could have a pretty significant effect.

I do have that affecting the local economy as well, and, again, severity of impacts, like hurricanes or other natural disasters affecting tourism, affecting compliance, and the reason why I had that relationship here is this would, perhaps, affect -- Maybe, now that I am looking at it, I don't know if it would necessarily be a two, but the idea is that the amount of the impact and the challenges to recover could impact your willingness to comply or not with the regulation, depending on how much of your income was affected, but, then again, that could be an indirect relationship, and that's something to think about.

Also, I have that affecting cultural preferences and norms, and so this is the idea of capturing adaptation and learning, and so, with let's say a hurricane again, just for the sake of an example, this adaptation process, or sort of re-organizing, would have an impact on cultural preferences and norms, and that's in the process of adaptation and learning.

Then we have resilience impacting wellbeing, and I think, again, for similar reasons, and I also see resilience impacting public health, and this, again, has to do with vulnerability and adaptability to impacts, in this case, and we could use the pandemic, or any other of those impacts that I already have used as examples to argue here that there would be a connection, and then I also have that impacting the regulatory structure, and this has to do with -- I am not entirely sure anymore.

Again, we could discuss this, but I think my thinking here was, in terms of response to impacts, and so, for instance, if you are -- Depending on how impacted you are, that will have an effect on how much assistance, for instance, the size of that assistance to the disaster, and that will have an impact on the regulatory structure, and that's sort of the thinking here.

RICHARD APPELDOORN: I am with you on that so far. The next box, you -- So a storm comes through, like Maria, and government comes in, hopefully, and helps rebuild your shoreside infrastructure, and it gives you money to replace lost gear, et cetera, and that's government doing something, but they're not necessarily doing it through regulation, and so where does that kind of stuff fall in?

TARSILA SEARA: I think that's such a great question, and I think that that was part of the confusion here, at least for me, in terms of the regulatory structure, because, in my head, I was sort of

including all of these within the regulatory structure, because we don't have any other place to capture that, and so assistance and things like that, and so, in my head, it was under regulatory structure, but we should either define this and make sure that we're all onboard that that would be included here or perhaps think about how we would deal with that, because I know that especially disaster assistance is going to be a very important component here.

RICHARD APPELDOORN: Well, one could think of whatever that oil platform fire was in the Gulf, and that was actually set up with a bunch of regulatory stuff, or promulgated new stuff, that eventually generated fines which had direct pathways back to the communities that were affected by that, and so there is, in that kind of thing, a fairly strong link between regulatory structure and resilience. I'm not sure it's going -- Which way I'm talking about, and this may be regulatory structure impacting resilience, rather than the other way around.

TARSILA SEARA: It would go both ways, the way I would look at this though, because, if you become more resilient, and you have less impact, I would think that that would go both ways, because then you would, perhaps, need less or different kind of assistance, depending on your level of resilience to something, and, on the other way, that regulatory structure would also impact you being more or less resilient.

RICHARD APPELDOORN: Okay. I accept that.

TARSILA SEARA: Are we good with a two, also, or would you want to go higher?

RICHARD APPELDOORN: Two is a good default value.

TARSILA SEARA: All right, and so, if we're ready to move on, then we have wellbeing, and, again, this has to do with community relationships and conflict cohesiveness and collaboration, but also individual attributes, and I am also kind of including it all in that box too of mental health and physical health and job satisfaction and those types of aspects of wellbeing, but also financial and material, and so there's a lot.

It's definitely one of those big boxes, but, right now, what we have is affecting income, and so this has to do with aspects of reciprocity and cooperation and social capital and anything that could potentially affect familial income and community income, is what I was trying to capture here, but it was one of those things that I didn't want to miss the connection, and so I put a one, but I'm open for debate.

Then we have wellbeing affecting compliance, and so, again, it has to do with those aspects of conflict and cohesiveness and perception of unfairness, and so just maybe going back to some of the things that we talked about before when we were talking about compliance going the other way, and so this is kind of just a two-arrow relationship, the way I see it.

We have that affecting cultural preferences and norms, and so, again, just in terms of how it affects perception of behavior. Community resilience, these are interrelated, and so they have arrows going both ways, and wellbeing and public health, and so, again, we're including some of those individual attributes, like mental health and physical health here, and so I had a connection to public health.

RICHARD APPELDOORN: Tarsila, shouldn't that be -- Is public health driving wellbeing, or is wellbeing driving public health?

TARSILA SEARA: I am going to say that it should go both ways. It's stronger going that way.

RICHARD APPELDOORN: Okay.

WALTER KEITHLY: It definitely goes both ways, because at least, in terms of income -- I will use income as a proxy for wellbeing. As income goes up, you stay healthier, and yet the health also determines your wellbeing, or your income.

TARSILA SEARA: Yes, and so we have income affecting wellbeing, and there's a stronger relationship going that way, and is that what you're --

RICHARD APPELDOORN: My point was now I'm getting it. I didn't quite get what you were saying before, and so I'm fine.

TARSILA SEARA: Okay. So where are we?

RICHARD APPELDOORN: Regulatory structure, I think.

TARSILA SEARA: Okay. The thinking here, I think, was, since we're talking about conflict, potential conflict, and lack of cohesiveness, and that was the idea of that impacting the regulatory structure, but that would be within the fishing context and not necessarily here anymore, but, again, that's definitely something we can discuss, because this is when I was thinking about this in a very, very broad sense.

RICHARD APPELDOORN: Well, I think, since we're narrowly defining regulatory structure for the fishery aspect, that that leaves open -- What's the term when you have participatory -- A co-management structure for maybe beach areas or things like that, which indirectly affects say habitat quality, but we're not talking about actual fishing mortality there, and so I would see that there would be a connection there.

TARSILA SEARA: Yes, and so should we put it in both, or are you arguing for just in the fishery context?

RICHARD APPELDOORN: I am arguing for both.

TARSILA SEARA: Okay. That's what I thought. All right. Perfect. As far as ciguatera, there were some questions here, and I think that maybe there would be some people in the room that would be able to help, and, I mean, actually, Walter, that might be also a question for you, in terms of -- I don't know if ciguatera impacts seafood imports and exports, and I don't know if it's a big enough of an impact that it would have some sort of -- That it would hinder exports or imports of seafood.

WALTER KEITHLY: It's certainly conceivable that it would, if they cannot get sufficient product from the island, from local fishing, due to ciguatera. That may lead to imports, and vice versa. If people from off the islands are concerned about the ciguatera on the crop produced on the islands, it may lead to a reduction in exports, but, again, I have no idea, in terms of how large of an effect that may be.

ALIDA ORTIZ: I would like to make a comment, if possible.

RICHARD APPELDOORN: Go ahead, Alida. Then I have Marcos. Sorry I haven't been catching up on the comments.

ALIDA ORTIZ: Okay. When we say ciguatera, we are referring just to one type of poisoning from fish, but then there is many, many others, like the different toxins that the fish can have, and also even the unsafe handling of the fish when they are at the fish market. Why don't we use the word "seafood or fish poisoning/ciguatera", which is only one of them? That's my --

VANCE VICENTE: Alida, ciguatera has very specific symptoms, which are recorded in the hospital, and they can distinguish between other types of fish poisoning. However, fish poisoning may also be include as a part -- I mean, poor handling of fish, and we discussed this in the last meeting, but ciguatera has very specific hospital symptoms, and the data is there, and it's significant,

and I would not eliminate it, and that's my opinion.

ALIDA ORTIZ: I am not eliminating it, but I am just saying where else in this type of table do you put the other conditions that may be as bad as ciguatera?

VANCE VICENTE: I agree, and I remember Graciela making a comment during the last meeting, in which we said there is also poor handling of fish, which may be less important or more important, and I don't know, but fish handling, which would fall under public health, and maybe that is a different compartment.

RICHARD APPELDOORN: We have Marcos, who is waiting for a turn to speak.

MARCOS HANKE: I understand the point that Vance is bringing, but, in reality, when you are talking about seafood imports, either ciguatera or food poisoning, it's exactly the same way on affecting or being related to the seafood imports.

A lot of the restaurants in Fajardo don't serve local seafood, because of the risk of ciguatera, or they don't want to take a chance, and they sell halibut and imported mahi and things like that, and that is already on the market, and that's a very strong connection between ciguatera and food poisoning and the mix of similar symptoms of seafood poisoning. They all react the same, or have the same interaction, with the seafood imports, which is what we are discussing now. This is important.

VANCE VICENTE: Marcos, the thing is that there are very, very specific symptoms of ciguatera, okay, and there is a sequence of intensity, and so you can easily distinguish between poor handling of fish and the ciguatoxin impact on the neurological system. I mean, that's been well established, and I'm not saying that imported food may or may not have ciguatera, but all I'm saying is that ciguatera should stay as an item, because it stands by itself. We are talking about 20,000 to 30,000 cases of Puerto Ricans in Puerto Rico a year.

I remember Nelson Crespo making a comment in the last meeting regarding the ciguatera, especially during the holiday season, holy week and the Lent period, in which they just select fish to -- Big groupers and big snappers, which could be ciguatoxic, and they sell it as something else, and maybe Nelson, and maybe Julian, and maybe Carlos -- I mean, I would like to hear the other opinions of the other fishermen.

MARCOS HANKE: Just a follow-up, if I may.

RICHARD APPELDOORN: Go ahead.

MARCOS HANKE: I don't disagree with you, Vance, but I am helping in some ciguatera studies, and the truth is that the protocols identified between the ciguatera and the other poisonings have been very blurry, and they have not been followed by the hospitals and the doctors with very good clarity.

One of the things is that those data are mixed. The numbers of ciguatera cases, a lot of people believe that they are not totally correct, and, because of that reason too, I think that it's not -- For the purpose of lumping this together, of something that has the same effect on about every single item of the table, recognizing that ciguatera is something specific and more measurable and has maybe more data behind it and so on, but the effect is about the same, and that's my point, and I don't disagree with your point, but it's just a different way of saying it. Thank you.

VANCE VICENTE: But ciguatera is a neurotoxin, okay, and then poor fish handling, which causes indigestion and bacteria in the intestinal digestive systems are very different.

MARCOS HANKE: I understand.

VANCE VICENTE: I understand how in the hospital a doctor probably doesn't know anything about ciguatera or how to distinguish it from others, and they just may call it ciguatera, which it could be not, and, I mean, I agree with you on that point, and that could definitely happen.

MARCOS HANKE: I agree with you. Thank you.

RICHARD APPELDOORN: Plus, you have the general who doesn't go seek medical attention, who just says, oh, I just had ciguatera, because that's what they associate any kind of seafood illness with, and so the reactions all get blended, and so I actually don't see a problem in having our ciguatera block representing these other forms, just because how they -- Biologically, they may be very different, but how they affect the response in the communities and the other components I think is largely the same.

I would like to read some comments from Vanessa. Ciguatera has become a big issue in communities, because some stakeholders are bringing in fish from other areas and selling them as if they're from the west, and this has caused a lot of cases around the west region, and, when they have checked into this, it looks like they

are coming from the south and east, without any permit or license. Ricardo Lopez has posted a contact for if we want to know about cases of ciguatera in Puerto Rico.

Carlos Farchette has said that St. Croix has not had a reported ciguatera case in over ten years, and, of course, they don't export their fish, other than conch, and that's an inter-island export.

VANCE VICENTE: Richard, thank you. Remember, when I brought up the point of ciguatera during the last meeting, or, actually, during the last two meetings, I was basing my statistics on a master's degree thesis of Florida State University, and, I mean, that's where the numbers came, and, after that, I have not seen any other paper, any scientifically-based publication, on ciguatera, but that paper distinguished the systems between the ciguatera and other types of fish poisoning.

That was the basis of my point, and that thesis was probably fifteen years ago, and I can't remember the date, and I can look it up, if you need me to, and I can select the reference and send it to you all, but there might be some other different types of information, more recent probably, which we need to update. That was our point, or my point, on this.

TONY BLANCHARD: Rich, can I make a comment?

RICHARD APPELDOORN: Go ahead, Tony.

TONY BLANCHARD: I can speak from experience, and I have been poisoned four times by my own fish, and a lot of the problem comes in where people mistake the ciguatera poison for food poison, because a lot of the symptoms are almost the same.

The only real way, to my knowledge, that you could actually put the ciguatoxic poisoning as a guarantee is to take the contents of the vomit, for lack of a better word, to the hospital and have it tested, but a lot of the cases is mishandling of fish, that the fish is actually going bad probably before they cook it, or, in very few cases, it's ciguatoxic poisoning, because a lot of these guys know where to avoid catching the fish and what type of fish needs to be avoided to avoid that situation, but a lot of the symptoms share the same symptoms as food poisoning or bacterial poisoning. That is just my comment.

VANCE VICENTE: I'm sorry, but I really could not hear well, and so, if somebody understood well what he said and can summarize it, but I didn't get it from here.

RICHARD APPELDOORN: I think I can summarize it. He was commenting that, first of all, he's had personal experience in having had ciguatoxins four times, and he said the only sure way to really pin it down, because the symptoms are overlapping, largely, is you would actually take your vomit and take it over to the hospital for testing to detect the toxins.

The last part was that a lot of the ciguatera probably can be attributed to poor handling of the product, that people wait too long to cook it, and it gets bacterial buildup or something like that, and so I think he's kind of reinforcing the idea that, although there are unique diseases, from a practical point of view, they are really lumped together.

VANCE VICENTE: Okay. That's a very good point.

ALIDA ORTIZ: So I want to go back to my point. I am not eliminating, whatsoever, ciguatera. That's a very, very important issue, but then the fact that there are other ways of getting poisoned, and fish can go in there, and I see that, when you get to public health, it doesn't make any contact to ciguatera, and so, Vance, it cannot be put in public health, and it has to be poisoning related to fish and seafood, or to fisheries, whatever you want to. If you want to put ciguatera first, great, but there are many other conditions where people get poisoned with fish that should be included. That's my summary.

VANCE VICENTE: That's very well understood.

DOUGLAS GREGORY: I've got a question. From my understanding, ciguatera is found mainly in snappers and groupers and jacks. The other poison, the only other poison I know about, other than tetrodotoxin, pufferfish, is scombrotoxin, which is found in tunas, and scombrotoxin occurs when the fish is not iced properly, and cooking doesn't get rid of it, and you end up with flu-like symptoms, and ciguatera is a whole different animal.

Cooking doesn't get rid of it, and icing properly doesn't stop it. It's only the location and the type of fish, and so I'm surprised that people might be eating mahi or tuna and getting sick and thinking it's ciguatera. Are there -- Do you all know of tunas and mackerels and mahi getting ciguatera, because snappers and groupers can't get scombrotoxin, and so they're like two different problems, and I thought they had two different types of symptoms, but they're both sicknesses.

VANCE VICENTE: Yes, I agree.

TONY BLANCHARD: Rich, can I comment on that?

RICHARD APPELDOORN: Yes, Tony. Go ahead.

TONY BLANCHARD: I am not sure who the individual was that was speaking about it, relative to the tunas, but he's absolutely right. I never hear of ciguatoxin poisoning in the tuna or the dolphin. I believe what he's talking about is -- I'm not sure what they call it, but it's when the antihistamines in the fish get so high that it causes a different type of sickness, but, as for ciguatera, I have never heard of it being in dolphin or wahoo or tuna.

Now, you will find the ciguatoxin poisoning in kingfish, or mackerel, because of -- Most of the time, I have never heard of the dolphin having that problem, and I'm not sure, because they move so often from area to area, but the ciguatoxin from the ciguatera poisoning comes from a microalgae, and the smaller fish feed off of it, and then the bigger fish feed off of them, but that's usually a localized sickness or certain species, by how they feed, would have that sickness, like the snappers, like he was suggesting. You will find it in the jacks and the barracudas and the mackerels and kingfish, but I have never heard of the ciguatera in dolphin or tuna.

RICHARD APPELDOORN: Okay. Thank you for that clarification.

DOUGLAS GREGORY: I have no strong feeling about keeping it as-is or changing it to just toxins or something like that, something more generic. The only difference, in my mind, is, when I hear of ciguatera from an area, I am afraid to eat any fish from that area, but the other disease is more mild, and it's easily solved by handling the fish properly, by icing the fish and keeping it cold, and it doesn't instill the same fear in me as knowing that fish from a certain area is ciguatoxic.

RICHARD APPELDOORN: Well, the question here comes back to how this ripples through this sub-model and how it might go through to other sub-models. The only differences I could see would be, if we're talking purely ciguatera, we're going to potentially put a ban on a species, like barracuda in Puerto Rico, as an example, or you're going to have an impact on where fishing is allowed or does occur, and the areas south of -- I think it's south of St. John that commercial fishermen avoid, not because it's illegal to fish there, but they know they will kill their market if they do.

That's a self-regulating, if you will, impact, but those are the only two things I can think of which separate ciguatoxia from these

other diseases. Otherwise, they're kind of treated the same, because the public just deals with it -- Whatever they name they give it, they just deal with it as a fish disease, because they don't know any better, and so I don't see any reason, frankly, that we can't just put them all in one thing, because I don't think the numbers are going to change going across here. In terms of complexities of boxes, this is one of our least complex.

Tarsila, the only one I'm going to ask about is, is there a link between, in this case, it would be ciguatoxia, or it could be all the forms, but, if there's an increase in that, does that increase education and outreach activities to inform the public about these?

TARSILA SEARA: That was one that -- I am glad that you mentioned that, because that was one of the questions that I had too, because I don't know if, going in that direction, if we're thinking in terms of things that would influence education and outreach strategies, because then, if we're doing that, then we should probably go back and add a lot more arrows going into education and outreach, and I wasn't sure if we wanted to do that.

RICHARD APPELDOORN: I will come back on that and say or is it done through it becomes a public health issue, and public health then stimulates -- We do have a very strong connection there, and so I would say, okay, let's leave it a zero, because it runs through the public health interaction.

TARSILA SEARA: Actually, we don't, but we should. Right here, right? Is that where you're saying?

RICHARD APPELDOORN: Yes, and I must have been a column off when I looked at it.

TARSILA SEARA: I think that could be an interesting way to make that connection, because then we can capture other aspects of public health that would also influence education and outreach, and so that would be -- Is that a good way to go about it?

ALIDA ORTIZ: I think it is.

TARSILA SEARA: Would that be a three?

ALIDA ORTIZ: I would say so, probably a two or three. I really don't know much about those numbers.

TARSILA SEARA: Richard, a two?

RICHARD APPELDOORN: I would say two is usually good default value.

ALIDA ORTIZ: So make it a two.

TARSILA SEARA: Just to go back to this, did we have any sort of -- Did we reach any conclusions here? I think, based on the discussion, I think this would be a relationship, and I'm not sure if we agreed on the strength.

WALTER KEITHLY: I don't know about the strength, but I did hear, in the discussion, and I believe it was on the west coast of Puerto Rico, that they will not even serve local product, due to ciguatera, and, therefore, they use imported product, and so it does sound like there is some relationship, at least.

TARSILA SEARA: Yes.

RICHARD APPELDOORN: I think that was for Fajardo on the east coast.

TARSILA SEARA: Should we go with a one or a two?

RICHARD APPELDOORN: How about a one, since we're not really sure what's going on.

WALTER KEITHLY: If I could raise a question.

RICHARD APPELDOORN: Please.

WALTER KEITHLY: Are we saying that ciguatera has no influence on income?

TARSILA SEARA: Not a direct. I think maybe through market demand is what --

WALTER KEITHLY: I can see it at least two ways, and one would be through the market demand, especially if it's widely advertised, when people get sick or something and it's the newspapers, and that definitely shifts demand down, which then reduces either the quantity being supplied or the price, but, also, and, again, I don't know how to handle it, but it's kind of like what Rich said earlier about I think it was St. Thomas, and I kind of fell asleep, that there was a certain area where fishermen will not even fish, due to concerns of ciguatera, and so basically it's an MCD, and so fish in that area that eventually move out, or are spawning in that area move out, I can see where it might increase the population of fish outside of that area.

It may be another example of, again, closer to home, when I go

fishing in the Keys, we will take the small barracuda, but not the large barracuda, because they have been on the reef too long, and we'll make ceviche with the small barracuda, and so, basically, it's another de facto protection on the spawning stock. I just think it may influence income in many different ways.

RICHARD APPELDOORN: You are talking about loss of a fishable product on the one hand, but maybe that loss, due to protection of the spawning stock, enhances your supply of at least the juveniles, which could be -- Or recruitment into areas that are not subject to ciguatera.

WALTER KEITHLY: I don't know, but there's so many throughout this whole process, and not just ciguatera, but any number of these that you can find examples and interrelationships throughout, and there's been a lot of discussion on ciguatera, and I've been relatively quiet on most of the others, but I do wonder whether we should indicate some possible influence on fishermen's income.

RICHARD APPELDOORN: Our default position on that has been to just give it a different color. I don't know if we want to continue doing that or let it ride the way it is.

VANCE VICENTE: Let me make just one comment. I want to revise the basis of my statement. Yes, there are 20,000 to 30,000 cases, including Puerto Rico and the U.S. Virgin Islands, and the study was done back in 1989, and so things might be different now, but I just verified it.

TARSILA SEARA: So are we talking about just adding a connection, direct connection, between ciguatera and the fisher income box?

RICHARD APPELDOORN: There's a comment from Vanessa, which is cut off on my screen. Graciela, do you have the full thing that you can read?

GRACIELA GARCIA-MOLINER: Certainly. More education for fishermen and for the people who work at the fish markets to help to manage the catch, to avoid poisoning, and the difference between the ciguatera problem and other species that have ciguatoxins or other poisons.

In Puerto Rico specifically, the hogfish has a high demand, and everyone knows the only one from the platform from the west, but there is no way to control the trading from other areas, and so they have had a direct impact on their income, especially when already they have experience 2019 hogfish, when the price went down and they went unsold on the west coast of Puerto Rico for a

number of months, and the amount of cases that the restaurant -- The amount of cases that they have had of ciguatoxins from hogfish, the restaurants have stopped buying and serving them. It's a big issue on the west coast with one specific species.

RICHARD APPELDOORN: Yes, and an important one, and so I think they're trying to make the argument that this has a direct impact on the fisher income.

TARSILA SEARA: Other than through the demand?

GRACIELA GARCIA-MOLINER: On the income, because it was a hot-selling item, and now they can't move it.

RICHARD APPELDOORN: That means it went down, and so it's through demand.

GRACIELA GARCIA-MOLINER: She's talking specifically about hogfish.

MARCOS HANKE: Just one example, for the point of Vanessa, Tommy Forte has been requesting to meet to connect with the people that are doing the study of ciguatera at this time, to support him in a study to see which test or whatever can be developed to allow him to sell the big hogfish, because he doesn't feel safe and secure to sell big hogfish, and that is costing him a lot of money, and there is a big impact on the income of some fishermen. Thank you.

VANCE VICENTE: It is still advertised in restaurants for the Caribbean. If you watch FOX News, you will see the big hogfish there a major source, because the fish is delicious. I mean, it's been commercialized, but, again, this is just a few commercials that I have seen, which have alarmed me, but, according to the fishermen that I work with, which I rent boats, they say that they don't have any problems with ciguatera with the hogfish on the north coast.

RICHARD APPELDOORN: For our discussion here, the question is are we running this impact through the effect on market demand or directly, and I think, to me, through market demand is how that income is lost. Therefore, the way we have it there now is correct.

TARSILA SEARA: I would agree with that, but do we want to change the strength, if everybody agrees that it is going from market demand?

RICHARD APPELDOORN: Well, we can see, in the specific case of

hogfish, yes, that would be higher, but, overall, I don't think it would be, but what do I know?

TARSILA SEARA: I guess, if there's no more discussion, I guess we could go back to it, if needed.

RICHARD APPELDOORN: Well, I have a question further down. You just have a magnitude of one under public health, and is that the level we want for that?

TARSILA SEARA: I had a magnitude of one on everything, because I think there were a lot of questions here, and so it was just sort of placeholders for discussion, because I wasn't sure how much of an impact -- I don't think that we really reached any conclusions at the time, as far as the strength of these relationships with the ciguatera, and so we can certainly discuss all of these strengths.

RICHARD APPELDOORN: Well, going back to Vance's statistic of how many people were supposedly getting ciguatera a year, that was something on the order of an order of magnitude more than have been documented with COVID-19 on the island, and so I would think this is a significant health problem.

TARSILA SEARA: Right, and so a two or a three?

RICHARD APPELDOORN: Well, I don't know. Again, two is a good compromise, but it could be a three, and I don't know if anybody else wants to comment.

TARSILA SEARA: I don't know if we want to go back to the relationship between ciguatera and cultural preferences and norms, and I think this had to do with the perception of risk rather than the actual risk, and so I don't know if we want to discuss the strength here, or the relationship itself.

RICHARD APPELDOORN: I don't think that I want to discuss it. I'm going to accept some vagary there.

TARSILA SEARA: So then we have impacts on the regulatory structure, and I'm assuming this has to do with closures and prohibitions, I guess, that refer to ciguatera specifically, but, again, I think this might move here, if that's the case, and then we can --

RICHARD APPELDOORN: Yes, I think that would be what we're talking about.

TARSILA SEARA: So would this be a zero then for the overall --

RICHARD APPELDOORN: There might be some way that fish handling and public health requirements get modified for the handling of fish that we don't have now, especially if we're talking beyond ciguatoxins. There could be requirements, say, that fish should be on ice all the time, which is certainly not the case here, and so I think there are mechanisms there, but I don't think they're very strong, and I'm not sure what's in place at the moment, and, obviously, if you're selling fish, you have to meet certain requirements from the health department to be licensed to do that.

TARSILA SEARA: That makes sense. So are we good with the ciguatera row?

RICHARD APPELDOORN: Sure. Why not?

TARSILA SEARA: All right, and so public health. Maybe do we want to start with the regulatory, since we have a new box here?

RICHARD APPELDOORN: I guess my only comment would be, the previous ciguatera box on fishery regulations, would that go through public health? I don't think so, and, if that's the case, I really can't think of other things that affecting fishing mortality from the public health arena.

TARSILA SEARA: So it would be a zero under fishery? Is that what you are --

RICHARD APPELDOORN: I am saying that. Of course, when you make a regulation that says, because of COVID-19, you can't go out on your boats, that certainly has an impact on fishing mortality, but I'm not sure that's the kind of thing we're talking about, generally.

TARSILA SEARA: So do we want to just put a zero under fishery?

RICHARD APPELDOORN: Yes, I wouldn't have a problem with that, and, while you're doing that, I'm going to read a comment from Vanessa. I think it's talking to the previous point. In PR, sadly, it doesn't work like it's supposed to. Many of the stakeholders don't have any permits or knowledge of food management or licenses here. Many are just paid without getting a course, and so it kind of -- I would certainly agree with that being my experience. There should be -- If you're selling food, you're supposed to have certain requirements, from a public health standpoint, but a lot of that, as she's saying, doesn't really work that way.

TARSILA SEARA: Are we okay with the strength for this relationship?

RICHARD APPELDOORN: I wouldn't make it any larger.

TARSILA SEARA: All right, and so now we have impacts of regulatory structure in general and the new variable of fishery regulatory structure on all of these components. Some of these are now probably going to change, in terms of links and strengths, since we are not considering the fishery under the overall regulatory structure, I would assume.

RICHARD APPELDOORN: Seafood imports and exports generally -- The regulations affecting those are not directly affecting say fishing mortality, and so I think where we have that value is correct.

GRACIELA GARCIA-MOLINER: Except when you actually regulate -- For example, the spiny lobster has a minimum size that can be exported out of Puerto Rico and can be imported into Puerto Rico and the Virgin Islands, and that's specifically a fishing regulation.

RICHARD APPELDOORN: Okay. Thank you. So there would be something in the fishery regulation as well.

TARSILA SEARA: Would a one be okay?

RICHARD APPELDOORN: Well, it's fine with me, but I'm not the only person on this committee.

JOE KIMMEL: I would agree with that, considering it's 4:20.

RICHARD APPELDOORN: So the next one we're looking at is fisher income.

TARSILA SEARA: Yes, and I think this has to do with licensing and fines and penalties and anything that could directly impact income, because it will also be directly impacted by anything that is affecting the fishery itself for the catch, but I think that this had to do with some of these potential direct relationships.

RICHARD APPELDOORN: I am going to ask Walter. In your construct here between the regulatory structure of fishing and fishing mortality and the others, the kinds of things we're talking about here, licensing and whatnot, is that one box to the other, or are we getting a mix of that?

WALTER KEITHLY: Well, my thoughts, when I made this recommendation

originally, is that we have what's now called the regulatory structure as separate item, almost just outside of everything, which allows us to connect the sub-models through fishing mortality. To me, many of these factors -- Which are we talking about? Income, and regulatory structure affects income through the other sub-models.

If you are protecting the seagrass or the coral, let's say, through regulation, that protection then leads to a higher population, all other things being held constant, which then would enhance fishermen income.

RICHARD APPELDOORN: Right, and so I accept that. Then we did say that we were going to move that, and we're just kind of keeping it here as a placeholder, so we know where it's going to fit in, but the question was things about licensing fees and permits and whatnot, and is that really more the other one, the fishery regulation?

WALTER KEITHLY: Yes, and I would argue that licensing and so forth would be considered under fishery regulations.

RICHARD APPELDOORN: Okay. Thank you. That's what we needed to know. Would you like to speculate about the strength of that?

WALTER KEITHLY: No.

RICHARD APPELDOORN: Okay. Vanessa was saying that it does have an impact on income.

TARSILA SEARA: I think the argument for the strong relationship is that it's a regulation that is going to determine whether or not you are even able to obtain a license or whether it's a full-time or a part-time, or if you can keep the license. I mean, I think these are the mechanisms that would be directly influencing, plus any fees and whatnot.

RICHARD APPELDOORN: Vanessa's comment says, in her experience, the direct impact caused by regulations and licensing procedures is very difficult for the real fishermen, but it's something that the people with money can deal with very easily, and so it's not something that affects them in that way, but it does affect the basic fishermen significantly.

WALTER KEITHLY: I am confused. You may have a license that only allows someone to fish part-time, and I don't know the situation, and that may negatively affect his income, that fisherman that only has a part-time license. On the other hand, it leads to

protection of the stock, due to less effort, and therefore it enhances the income of the full-time fishermen, and so I still don't see -- Well, I would say there's a relationship, but I would not --

RICHARD APPELDOORN: Well, one certainly argues that the cost of the license has a negative impact on their income immediately, and then there's the question of what are the benefits that are supposed to accrue from that, and would that generate something in the long term that benefits them, and that's a more complicated pathway.

TARSILA SEARA: We are still capturing that through the fishery sub-model and the impacts that -- Anything that will impact the population will feed back into increasing or decreasing income. The fact that we have this direct relationship, it's not going to eliminate that other pathway.

RICHARD APPELDOORN: Yes, and so I would keep it as a positive relationship.

TARSILA SEARA: Should we go to a three or a two?

VANCE VICENTE: Just one comment regarding fisher and fishery regulatory structure. The fisherman that I use mostly for the monitoring of the submarine cables has been unable to renew his license, because there are no employees at DNR right now. They are all working from their homes, and so re-licensing is a major problem.

WALTER KEITHLY: More to the point, in the short run, regulations may -- Fishery regulations may well detract from income. The purpose of the regulation is to potentially rebuild the stock, which, in the long run, would hopefully increase income, but certainly just go to any fisheries meeting, and fishermen complain about regulations. Why? Because, in the short run, most of those regulations negatively impact their income.

TARSILA SEARA: I think, if we have something here, and also affecting it through catch, we're going to be able to capture both of those things, is what I am thinking.

RICHARD APPELDOORN: Yes.

TARSILA SEARA: Should we go with a two?

RICHARD APPELDOORN: Sure.

TARSILA SEARA: Are we keeping this?

RICHARD APPELDOORN: There are other regulations that govern the licensing of boats, that they have to be properly equipped with safety gear and things like that, and there's probably a bunch of other things that I can't even think of that affect them.

TARSILA SEARA: Yes, I agree. Are we okay with a --

WALTER KEITHLY: I agree that there's other sorts of licenses, but what those other licenses are is just a cost, which we were just talking about a minute ago, and so, again, I don't see how you can say that it's a positive relationship.

RICHARD APPELDOORN: Yes, it should be a negative relationship. Walter, you were talking about both, yes, because we're talking about this as a cost?

WALTER KEITHLY: I was thinking of fisheries regulations, and I am not even saying that it should be a negative. I'm just saying that it's a very complex relationship that is in some cases positive and others negative.

TARSILA SEARA: I agree with that. I think that's one of the ones that are very difficult to characterize, and so I'm just going to go with blue for now, and then we're going to have to see how we're going to deal with those.

RICHARD APPELDOORN: Okay. In terms of the one above it, I would imagine that most of this is also -- Well, I don't know. It's also going to be a plus or minus, depending on the particular regulations that you're talking about. Walter had talked about the habitat issues and things like that, that if those are eventually short-term costs that result in better habitat, and therefore higher productivity of the species, then there's a return, and so it goes both ways.

WALTER KEITHLY: I assume that it could go both ways, but, in that case, I am thinking that it would primarily be positive, that you would hope that the regulation not directed to a fishery would, at a minimum, have no effect on the fisheries, and, oftentimes, again with habitat and so forth, it would benefit the fisheries, and there may be a cost to other sectors in society, those people that won't be able to build condominiums on the beaches and whatever, but, unless the regulatory structure negatively impacts the fish stock, I would assume that would be either insignificant or positive.

TARSILA SEARA: Well, I was also thinking here -- I mean, if we're including any regulations that are going to oversee the use of the coast, for instance, and so coastal zone regulations and access and things like that, then that could potentially have a negative impact, and so I just think it's one of those complicated ones, again.

WALTER KEITHLY: That's kind of like saying no regulations could affect the fishing stock too, and I'm thinking in terms of the regulation enhances the stock. To me, it's almost a lack of regulation that would detract from the fisheries stock.

RICHARD APPELDOORN: I mean, history is certainly strongly showing that, in the lack of regulations, fishermen are the big losers.

TARSILA SEARA: Right.

RICHARD APPELDOORN: So next box.

TARSILA SEARA: All right. Next, we have the economy, and so, Walter.

WALTER KEITHLY: I don't know. This would be on the fishery regulatory structure?

TARSILA SEARA: I guess both.

RICHARD APPELDOORN: Or either one.

TARSILA SEARA: Yes.

WALTER KEITHLY: I am at a loss to tell you. It depends, in theory -- Regulations are put in place to enhance at least the welfare of society, and it may lead to a reduction in income, and, in other cases, it may lead to an enhancement of income, and there's an argument that goes both ways on it, and, as you can see in the current environment, with the current national President and so forth, he argues that, by taking regulations off, it will enhance income. I guess I don't have an answer for that.

RICHARD APPELDOORN: In other words, getting back to what you had mentioned in terms of like condominium building and things like that, that have a negative impact and displace fishers, and it can have bad impacts on the environment, but, on the local economy, those things are allowed to happen, probably because they are stimulating those local economies substantially, but it's just that the fisheries sector is a loser in that battle.

TARSILA SEARA: So there is certainly a relationship. Are we okay with a one, or should we increase that to a two?

WALTER KEITHLY: Have we decided that is a positive relationship?

TARSILA SEARA: I think we decided that's a complicated one.

WALTER KEITHLY: Okay. With that, I agree. Okay. Given that it's a complicated one, which I agree with, I have no idea what number should be assigned.

RICHARD APPELDOORN: Again, the default would be a two, and I guess it's a blue two.

TARSILA SEARA: Do we want to think in terms of -- Since we're thinking local economy and regulatory structure, do we want to just think in terms of just fishery regulatory structure as well?

RICHARD APPELDOORN: Well, yes. Again, this is kind of like the same issue. There's a short-term cost and a potentially, or by design, a longer-term benefit.

TARSILA SEARA: Yes.

RICHARD APPELDOORN: So treat it the same way.

TARSILA SEARA: All right, and so the regulatory structure affecting tourism.

JOE KIMMEL: How would that happen? How would the regulatory structure affect the amount of tourism to Puerto Rico or Florida or the Virgin Islands?

RICHARD APPELDOORN: How about a hotel tax that's too high?

JOE KIMMEL: Got you.

TARSILA SEARA: Or I guess a coastal zone use as well could have an impact on that.

JORGE GARCIA-SAIS: Also, there is a lot of tourism that actually pursues and targets areas that have a lot of regulatory structure, in the sense of closed areas that have big fish. There are some people that go for ecological tourism that pursue areas with high regulatory structures, so that there is no fishing, for example, and you have the opportunity to dive and video the areas with a lot of big fish and stuff like that, and that is important for tourism.

JOE KIMMEL: I understand. Thank you for the explanation there.

TARSILA SEARA: What about in terms of the fishery regulatory structure? Is there any direct interaction there?

RICHARD APPELDOORN: There are -- Well, this is probably -- I am not sure which one it falls in, but there are regulations that are affecting the charter business, for example, and you also have established programs, like the FADs off the north coast, which are directly impacting how the charter industry is exploiting the resource, and so that one I definitely agree would be something that would be in the fishery regulatory structure, because, actually, the commercial fishers also use those up on the north coast as well.

WALTER KEITHLY: While I agree with you, I'm certainly not convinced that that would affect the overall level of tourism in any meaningful way. The question is why do people come to Puerto Rico? If they came primarily for charter fishing or something, then your argument may hold water, and, again, I don't know enough about it, but I would be a little bit surprised if charter boat fishing, or fishing in general, is a major reason for people to come from say the mainland to Puerto Rico.

RICHARD APPELDOORN: No, and the fishing tournaments are important, both for local tourism and the big billfish tournament out of San Juan brings in its own level of tourism, but, on the scale of tourism as a whole in Puerto Rico, I am probably going to agree with you.

TARSILA SEARA: So do we want to have a zero there?

RICHARD APPELDOORN: Well, I think that opportunities to fish does drive a limited amount of tourism in Puerto Rico, since most of the tourism is coastal and marine oriented.

MARCOS HANKE: I am a charter operator, and I understand the charters go out to the whole tourist industry is not very important, but that has been growing a lot in Puerto Rico, and it took a big hit with the hurricane, but there is a tendency to keep growing, and look at the potential that it has in the future, and what happened with a similar area that we can compare, which is Florida, and there is other elements with the tourism and fisheries, and there is a lot of clients, or tourists, that don't go on a charter, but they fish on their own on the shorelines.

Don't forget also the activity in the fishery related -- I know

that we don't manage that, but related to fresh water and other kinds of activity, and there is at least sixty charter operators in Puerto Rico, and this is the last number that I have, and, at a minimum, each of them are making close to 200 or 250 trips a year, and that's my estimation. Thank you.

WALTER KEITHLY: I don't argue that tourists fish, but I think it comes down to is that one of the primary reasons for visiting the islands, and someone can correct me, but I would be surprised if fishing is one of the primary reasons why tourists visit the island. I think there's a lot of other reasons that are the primary reasons for visiting.

GRACIELA GARCIA-MOLINER: You are right, except for tournaments, as Richard mentioned earlier, the big marlin tournaments and stuff like that, and that's not a primary reason for visiting.

WALTER KEITHLY: Again, you can always find an exception to a generalization.

RICHARD APPELDOORN: Graciela was agreeing with you.

WALTER KEITHLY: I am just saying, in general, there is other reasons for tourists to visit.

GRACIELA GARCIA-MOLINER: That is correct, yes.

RICHARD APPELDOORN: So a zero, or blank.

TARSILA SEARA: All right. So regulatory structure and education and outreach.

RICHARD APPELDOORN: Well, I will use the example of running through the council's activities and the kind of stuff that Helena has been doing, and Alida as well, and a lot of effort is spent with the fishers trying to have them become acquainted with the regulatory structures associated with fishing and why they're there and to try to keep compliance, and so, in that sense, the regulatory structure is kind of driving that activity, or, actually, compliance is driving the activity, and so maybe there should be -- If there's a box that runs through that, maybe that's sufficient.

TARSILA SEARA: I think that also maybe consider that the regulatory structure will enable some of these strategies, right?

RICHARD APPELDOORN: I guess.

JOE KIMMEL: I know the council, and maybe the DNR, spend a fair amount of time putting out brochures and educating the public about what fisheries regulations are, and so, if that fits in the box here, I would say that it would have at least a two.

RICHARD APPELDOORN: What I'm saying is that it runs through compliance, which is the next box, which you can see we originally had a two there, and so the driver for that increase in education and outreach is compliance, and we already have regulatory structure strongly affecting compliance, and then the degree of that compliance affects the education and outreach, and that's how I view it.

TARSILA SEARA: I think my thinking was in terms of -- Thinking of the regulatory structure in a broader sense, it would be sort of the mechanisms that would enable these education and outreach strategies, and so just even just having an education and outreach committee or something that would allow for these things to happen, and I think that's part of the rationale, but, if we're narrowing it down --

RICHARD APPELDOORN: Well, one is one box, and the other is the other box. If you're going to do it that way, then we're saying there is two different mechanisms, and so I wouldn't put a three there. I would make that a one and have the compliance a two, and that takes care of that.

TARSILA SEARA: Yes, and so would it be a one for both?

RICHARD APPELDOORN: I guess. I mean, you're the one who has that concept going, and so, if you think it applies to both, fine.

TARSILA SEARA: Then this would be a two, right? Is that what you are saying, Richard? I'm sorry. Regulatory structure going into compliance?

RICHARD APPELDOORN: Yes, and then compliance will affect education and outreach activities.

TARSILA SEARA: Would it be a two for both regulatory structure in general and the fishery?

RICHARD APPELDOORN: Good default values.

TARSILA SEARA: Yes, that works for me.

RICHARD APPELDOORN: Next column.

TARSILA SEARA: Now we have regulatory structure impacting preferences and norms, and I think this had to do with regulations that will restrict and change behavior and norms.

RICHARD APPELDOORN: Is that direct, or is that going through education and outreach? They might be handled differently for fishery and --

TARSILA SEARA: I'm not sure if it would necessarily always go through education and outreach, because that may not necessarily be in place, right, and we could still have an impact, right, a change, is what I am --

RICHARD APPELDOORN: Okay. I will accept that.

TARSILA SEARA: Okay. For me, they would be the same here. Here would be any sort of aspects of the regulatory process that would affect the ability to recover, and, again, this goes back to the idea of disaster assistance and how that impacts resilience, whether that disaster assistance was present or not and how that would impact, and also other types of regulations and aspects of the regulatory structure that would increase or decrease a community resilience to impact and ability to adapt, and that, to me, would be a strong relationship, I would argue for both, though, maybe if we're considering the coastal community as a whole, perhaps the fishery could have a lower value.

JOE KIMMEL: I am going to follow your lead. I would go with the number that you choose.

TARSILA SEARA: Is that okay with everybody?

VANCE VICENTE: It's okay with me.

RICHARD APPELDOORN: We're almost finished. Going over to the next column, with the same rationale, then we would put a one there?

TARSILA SEARA: Well, actually, this would be the opposite, right, because now we're talking specifically if the fishing community --

RICHARD APPELDOORN: Right. Okay.

TARSILA SEARA: Maybe just perhaps a --

VANCE VICENTE: Negative-one.

RICHARD APPELDOORN: No, I think it's a two. Vance was asking what is the direction?

TARSILA SEARA: From the regulatory structure to --

VANCE VICENTE: From regulatory to fishing community, negative, negative-one or two.

TARSILA SEARA: In general regulatory structure or the fishery regulatory structure that you're referring to?

VANCE VICENTE: In both.

TARSILA SEARA: Okay.

RICHARD APPELDOORN: But, there, you're talking about perception and not exactly what the benefits of those might be. They may actually benefit substantially from that, even though they bitch about it.

TARSILA SEARA: Yes, and I think this is another one of the blue. It's relationships that could go either way, and I would argue that that would be for both, and I would say that, in the case of fishery regulatory structure, that would be a stronger relationship, if we're talking in terms of the fishing community wellbeing.

RICHARD APPELDOORN: Okay.

VANCE VICENTE: Short is negatively and then the long-term is positively.

RICHARD APPELDOORN: It's another one of those examples.

TARSILA SEARA: Yes. I would agree with that, yes. Okay. So overall regulatory structure and ciguatera and fishery regulatory structure and ciguatera. We have ciguatera affecting the regulatory structure, and the argument there is that you're going to have closures and whatnot. I don't know --

RICHARD APPELDOORN: I don't think that changes what's happening to ciguatera in the wild.

TARSILA SEARA: Right. Exactly.

RICHARD APPELDOORN: It changes the possibility of contracting ciguatera, and so maybe there's a feedback loop there that, once everybody knows how to control ciguatera, that there are benefits

that accrue through some of these other things, but I think, if you just think about are we affecting the natural process of ciguatera, the answer would be no.

TARSILA SEARA: I agree with that, yes, and so it would a be a zero for both?

RICHARD APPELDOORN: Yes.

TARSILA SEARA: So regulatory structure and public health, I think now, if we're thinking of this in a broader sense, we might want to revisit that number.

RICHARD APPELDOORN: Certainly, in the largest context of regulatory structure, it would be very strong, because you're talking about all of society and all the regulations that are there for public health, but, if we're trying to keep it down to fishing and coastal communities and that kind of stuff, I think it would still be fairly strong.

TARSILA SEARA: I would be fine with that. Are we going with a three?

RICHARD APPELDOORN: Sure.

TARSILA SEARA: What about the fishery regulatory structure?

GRACIELA GARCIA-MOLINER: Would that include the prohibition of species that is just because of public health rather than anything else, the prohibition on take?

RICHARD APPELDOORN: Yes, but the action is through fishing mortality, and so I would think there is something there. It's not a big set of species, and so maybe it's not a three, but we did identify ciguatera as a public health problem, and so the regulations would be trying to improve that relationship.

TARSILA SEARA: Would this be a way to maybe capture other aspects influencing public health that are not ciguatera, and so some of the other --

RICHARD APPELDOORN: Yes, in the same way, although I think -- Well, some of that is going to be the non-fishing regulations associated with public health and how you're handling the fish, but what fish you're taking.

CHURCHILL GRIMES: What about like mercury contamination and that sort of thing?

VANCE VICENTE: Mercury is way offshore in tropical pelagics, and I would put a one there. That would be my last guess for the day.

RICHARD APPELDOORN: I'm going to go with Vance on that. Why not?

JOE KIMMEL: I will, too.

TARSILA SEARA: Are we defining these in terms of positive or negative or --

RICHARD APPELDOORN: Well, for the fishing regulation and public health, they're in there to improve public health, and I think that's the same way for the other one. The idea is to improve public health.

TARSILA SEARA: So the same here. Okay. All right.

RICHARD APPELDOORN: Do the two regulation boxes have any impact with each other?

VANCE VICENTE: That's why regulatory should be in a different model, but no comment.

RICHARD APPELDOORN: We have sort of tried to make these somewhat mutually exclusive, although there will be overlap, and so I am going to argue that they're both zeroes.

VANCE VICENTE: Agreed. Zero.

TARSILA SEARA: That's fine with me. Are we good with that?

RICHARD APPELDOORN: We're not only good with that, but it's five o'clock, and so this is a great place to stop, and we will pick it up again tomorrow morning.

GRACIELA GARCIA-MOLINER: Richard, the agenda says until noon tomorrow, and so, in the morning, you're going to extend it, or do you want to talk about it right before we close?

JOE KIMMEL: We could go until Saturday.

GRACIELA GARCIA-MOLINER: I have to go see my newborn calf, and so no.

VANCE VICENTE: We're all locked in, and it doesn't matter. Sunday, Monday, Tuesday, it doesn't -- I don't give a damn.

RICHARD APPELDOORN: Okay. Joe is going to lead that Saturday discussion, and Vance will lead the Sunday one. I think we can get through the two other sub-boxes tomorrow, and then I guess I would like to see where we are, because if we're just going to kind of connect our sub-models together, without looking at the -- Well, I don't know. Let's just get through the latter two.

The de facto situation, I think, really, that we've been doing here, just because of the bias of expertise on the committee, is we really have been building the Puerto Rico model, and so that may simplify things, and it's also so generic that I'm not sure how it would differ, but that's to be discussed, and so let's pick this up tomorrow.

GRACIELA GARCIA-MOLINER: Okay. There has been a request on the information on the time, and so do you want to tell them that you will be doing the -- The introduction to the status report.

VANCE VICENTE: We should start at 9:00.

GRACIELA GARCIA-MOLINER: You can go a little bit over, because people will stay, and then you can break for lunch in the afternoon.

JOE KIMMEL: I am not in favor of the nine o'clock start.

RICHARD APPELDOORN: Nor am I. How much time do they want for that presentation?

GRACIELA GARCIA-MOLINER: Joe has the slides, and Kevin has the -- They are prepared with the PowerPoint, and I think that the abiotic factors is pretty much completed.

RICHARD APPELDOORN: Not about the sub-models, but I'm asking about the presentation.

GRACIELA GARCIA-MOLINER: I told them fifteen minutes, and so I sent to everyone the presentation that Kelly is going to give tomorrow.

RICHARD APPELDOORN: I would say we can fit it in. Our morning may run a little longer, and I really am trying to like not use Friday afternoon. My eyes staring at a screen has really reached its limit.

GRACIELA GARCIA-MOLINER: Right.

RICHARD APPELDOORN: So I think we could certainly accommodate

that period of time, fifteen or twenty minutes, but it would be towards the end of the morning.

GRACIELA GARCIA-MOLINER: Okay. I will let them know. Thanks.

WALTER KEITHLY: So a clarification then. The meeting starts at ten o'clock Eastern Time tomorrow?

RICHARD APPELDOORN: Yes.

WALTER KEITHLY: Okay. Thank you.

RICHARD APPELDOORN: Thank you very much. I will see everybody tomorrow at 10:00.

(Whereupon, the meeting recessed on May 21, 2020.)

- - -

May 22, 2020

FRIDAY MORNING SESSION **(0:00)**

- - -

The Scientific and Statistical Committee of the Caribbean Fishery Management Council reconvened via webinar on Friday morning, May 22, 2020, and was called to order by Chairman Richard Appeldoorn.

RICHARD APPELDOORN: Good morning, everybody. This is Friday, the 22nd of May, and this is day five of the SSC meeting. Again, I would like to start off with the roll call, with the committee first, committee members first. I am Rich Appeldoorn, SSC Chair. Church.

CHURCHILL GRIMES: Churchill Grimes, SSC, present.

RICHARD APPELDOORN: Doug Gregory.

DOUGLAS GREGORY: Good morning. Doug Gregory, present.

RICHARD APPELDOORN: Walter.

WALTER KEITHLY: Walter Keithly, present.

RICHARD APPELDOORN: Kevin McCarthy.

KEVIN MCCARTHY: Good morning. Kevin McCarthy, SSC.

RICHARD APPELDOORN: Reni Garcia.

JORGE GARCIA-SAIS: Reni Garcia, SSC.

RICHARD APPELDOORN: J.J.

JUAN CRUZ-MOTTA: Good morning. J.J. Cruz, SSC.

RICHARD APPELDOORN: Tarsila.

TARSILA SEARA: Hello, everyone. Tarsila Seara, SSC.

RICHARD APPELDOORN: Joe Kimmel.

JOE KIMMEL: This is Joe Kimmel, SSC.

RICHARD APPELDOORN: Vance Vicente.

JASON COPE: This is Jason Cope, SSC. Rich, you were breaking up, and so I don't know if you said my name, but I am present.

RICHARD APPELDOORN: We'll come back to Vance.

GRACIELA GARCIA-MOLINER: Richard, is it you that's breaking up? Richard, can you hear me? The problem is the audio connection. Give me a second, please.

RICHARD APPELDOORN: Can you hear me?

GRACIELA GARCIA-MOLINER: Yes. Let me just read what's on the -- I think the last one that I heard was Jason. Jason, can you --

VANCE VICENTE: You have not finished with the roll call.

GRACIELA GARCIA-MOLINER: I know, but who was the last one?

JASON COPE: This is Jason Cope, SSC.

RICHARD APPELDOORN: Okay. That completes the committee's roll call, and let's go back to everybody else. Graciela.

GRACIELA GARCIA-MOLINER: Graciela Garcia-Moliner, council staff.

RICHARD APPELDOORN: Liajay.

LIAJAY RIVERA: Buenos dias. Liajay Rivera, council staff.

RICHARD APPELDOORN: Vanessa Ramirez.

VANESSA RAMIREZ: Good morning. Vanessa Ramirez, council member and commercial fisherman.

RICHARD APPELDOORN: Nelson Crespo.

NELSON CRESPO: Good morning, everyone. Nelson Crespo, DAP Chair, Puerto Rico.

RICHARD APPELDOORN: Alfredo Sfeir.

ALFREDO SFEIR: Good morning, everybody. Alfredo Speir from Shellcatch.

RICHARD APPELDOORN: Sarah Stephenson.

SARAH STEPHENSON: Sarah Stephenson, NOAA Fisheries.

RICHARD APPELDOORN: Orian Tzadik.

ORIAN TZADIK: Good morning, everyone. This is Orian Tzadik from the Pew Charitable Trusts.

RICHARD APPELDOORN: Alida Ortiz.

GRACIELA GARCIA-MOLINER: She's on mute. She might be having internet connection problems. It's Friday morning.

RICHARD APPELDOORN: She's unmuted, and we heard her earlier. Let's continue on. Carlos Farchette.

CARLOS FARCHETTE: Carlos Farchette. Good morning. Council member.

RICHARD APPELDOORN: Okay. Bill Arnold. Bill Arnold, if you're there, unmute yourself.

GRACIELA GARCIA-MOLINER: They are unmuted on this side, and so they need to unmute the microphone on their side.

RICHARD APPELDOORN: He may be out getting coffee. Who knows? Let's move on. Jocelyn.

JOCELYN D'AMBROSIO: Hello. This is Jocelyn D'Ambrosio, NOAA Office of General Counsel.

RICHARD APPELDOORN: Michelle Duval.

MICHELLE DUVAL: Good morning, everyone. Michelle Duval, independent contractor, working on the council's strategic plan.

RICHARD APPELDOORN: Ricardo Lopez.

RICARDO LOPEZ: Buenos dias. Ricardo Lopez from the Puerto Rico Department of Natural and Environment Resources Fisheries Research Lab.

RICHARD APPELDOORN: Christina Olan.

CHRISTINA OLAN: Buenos dias. Christina Olan, council staff.

RICHARD APPELDOORN: Kelly Montenero.

KELLY MONTENERO: Good morning. This is Kelly Montenero calling in from NOAA AOML, and I'm working on a project with the Southeast Fisheries Science Center.

RICHARD APPELDOORN: Maria Lopez.

MARIA LOPEZ: Good morning. This is Maria Lopez, NOAA Fisheries.

RICHARD APPELDOORN: Mandy Karnauskas.

MANDY KARNAUSKAS: Hi, everyone. Mandy Karnauskas, Southeast Fisheries Science Center.

RICHARD APPELDOORN: Marcos Hanke.

MARCOS HANKE: Present. Good morning, everyone.

RICHARD APPELDOORN: Okay. Bill Cordero.

BILL CORDERO: Your trusty language interpreter, ready to go.

RICHARD APPELDOORN: Then we have Caller Number 4. Is that Kevin again?

TONY BLANCHARD: Tony Blanchard, CFMC Vice Chair.

RICHARD APPELDOORN: Thank you, Tony. Caller Number 2.

KEVIN MCCARTHY: I think Caller Number 2 is me, Rich.

RICHARD APPELDOORN: Yes, it is. Then Caller Number 1.

JULIAN MAGRAS: Julian Magras, DAP, St. Thomas/St. John.

RICHARD APPELDOORN: Thank you, Julian. That's everybody that I have, I think.

BILL ARNOLD: Richard, Bill Arnold, EBFM TAP Chair.

RICHARD APPELDOORN: Thank you, Bill.

GRACIELA GARCIA-MOLINER: Damaris Delgado just joined us.

DAMARIS DELGADO: Good morning.

RICHARD APPELDOORN: Good morning, Damaris. We need to turn to the agenda, and we're going to try to just work through the morning, and hopefully finish our sub-models, and I don't know if that's a realistic goal, but we'll try to go as far as we can. We also have a presentation on the Caribbean Ecosystem Status Report, which we will try to get to at the end of the day, and then, Graciela, you have the e-reporting update.

GRACIELA GARCIA-MOLINER: That's correct, and so you need to amend the agenda. Today, you had it in the Federal Register from 10:00 to 12:00, and so do you intend to finish at noon with whatever you have up to that point, or do you want to amend it to continue into the afternoon?

RICHARD APPELDOORN: I do not want to amend it to continue into the afternoon, but I think it is likely, as every other day this week, that we haven't broken at noon, and it's been closer to 12:30, and we may even go to 1:00, if it allows us to finish something, and so if you want to -- It's going to be where we have a convenient break and we can get these other presentations in.

GRACIELA GARCIA-MOLINER: Okay. Perfect. But you don't intend to go after lunch, and that's what I'm asking, so that we can amend the agenda now if you intend to have an afternoon session.

RICHARD APPELDOORN: No, I don't intend to have an afternoon session. I can't take this anymore.

GRACIELA GARCIA-MOLINER: Okay.

RICHARD APPELDOORN: I would like to flip the two items to be discussed, and I would like to have abiotic factors first, because I think we can get that out of the way quickly.

KEVIN MCCARTHY: I certainly hope so.

RICHARD APPELDOORN: I am relying on you, Kevin.

KEVIN MCCARTHY: Put me in, Coach.

RICHARD APPELDOORN: Just don't drop the ball. Then, under Other Business, I think we would like to hear the ecosystem status report first, because that's following on the same line of work that we're talking about with the sub-models.

GRACIELA GARCIA-MOLINER: You mean before the second part, which was the three different ecosystem models, right, and so bring that to Other Business, or just leave it like that?

RICHARD APPELDOORN: What are our options here? I thought that we were trying to accommodate these talks here.

GRACIELA GARCIA-MOLINER: Definitely.

RICHARD APPELDOORN: Okay. Then, at some point, we're going to run out of time for the rest of the goals, and we're going to just stop and go to these items.

GRACIELA GARCIA-MOLINER: Okay.

RICHARD APPELDOORN: Are these changes okay with the committee?

JASON COPE: Yes.

CHURCHILL GRIMES: Yes.

JUAN CRUZ-MOTTA: Yes.

KEVIN MCCARTHY: Yes.

JORGE GARCIA-SAIS: Yes.

JOE KIMMEL: Yes.

DOUGLAS GREGORY: Yes.

RICHARD APPELDOORN: Okay, and so we have support. What I am hoping for is that, if we can actually get done quickly with the sub-models, we could then turn to just linking the sub-models together, and not the components of the sub-models to other components of the sub-models, but just one sub-model to the other sub-models and do a matrix on that, if that could go quickly, and then the next thing, which we probably won't get to, would be J.J.'s suggestion of then, within the sub-models, what are the two

or three really key things that are driving those connections, if we can -- I am not sure we will get to that stage, but that's where I saw our task going, to try and pin that down, to get the full one conceptual model staked out.

If anybody disagrees with that kind of idea and where we're heading, let me know now. Silence is supporting, and so let's go ahead then and adopt this agenda. I think I was supposed to announce the time, and so we started about 10:02, I believe, in the morning.

GRACIELA GARCIA-MOLINER: Okay.

RICHARD APPELDOORN: All right. Kevin, abiotic factors, and do you want to be the presenter or pass on that responsibility?

KEVIN MCCARTHY: It doesn't matter. Either way. What's easiest for you, Graciela?

GRACIELA GARCIA-MOLINER: What do you prefer? If I make you the presenter, then you just share your screen, and we're on the move.

ABIOTIC FACTORS (17:46)

KEVIN MCCARTHY: Sure. Abiotic factors, this first one is just the abiotic factor corner of the larger model, and these are our definitions, and I will say that I took, and I can't believe I'm saying this either, but I did take Doug's presentation as my cue, and so you will see it's presented in a similar way, and so thanks, Doug, for being one of the first to get yours out there to be copied.

This was the model that was provided in that batch of information that Graciela sent out, and so we don't have a lot of connections here, and so thanks for doing most of the work, Graciela. This is a matrix with many more connections than was in the model, and so I went in and added those lines. I haven't put numbers in, but, if you look in the upper-right, the lines themselves indicate the numbers, and so dotted is a one, and the thinner line, solid line, is a two, and so on, with the red being a negative-one.

These were all of the connections that came out of the matrix, and, when I went through the minutes, or rather the transcript from the last meeting, the term "abiotic" showed up seven times in all of the 500-plus pages, and so my recollection is we didn't talk a heck of a lot about this, but maybe I am remembering incorrectly, but it certainly doesn't show up in the record that way, and so maybe we've got some more discussion to have about

this, but probably not a lot.

This next one, the boxes in yellow here, we've got no arrows coming out of them connecting to anything else in the model, and maybe that's complete, but certainly I'm open to discussion, and then this last one is jumping ahead of where maybe we want to be, and these are the connections to other sub-models, and the other sub-models are in whatever this color is, and the blue lines show those connections.

Backing up to this one, I am open to thoughts about what other connections might there need be, and are we content with the magnitude of each of these connections, and we could start -- We can just start with this periodic oceanographic phenomenon, and those are things like El Nino, as opposed to major disturbances, things like hurricanes. If we just start with periodic oceanographic phenomenon, are there other connections here that are not yet represented?

JASON COPE: Kevin, just looking at this, and being not a chemical oceanographer in any way, having oxygen there, is it -- I am just looking through, and it seems like not having carbon or nitrogen or some other element in there -- Is that intended? Is that something we do want to add, because it seems like there would be a couple of other connections that could be made if those were added, and those seem important for some things.

Then, just while my mic is on, just another question I had was salinity and water temperature seems like they would have some sort of feedback to each other, which that connection is also not there, and so it's just something as a consideration.

KEVIN MCCARTHY: Okay. What does the rest of the group think? Do we want to add things like carbon and nitrogen? Do we want to make some more connections, like temperature and salinity?

RICHARD APPELDOORN: The reason that oxygen is there with a connection to temperature was because, as temperature goes up, oxygen, dissolved oxygen, goes down, and that is predicted to have major impacts on the growth of all marine organisms as temperatures heat up, due to global warming, and so that's why that was there.

I think the comment about some of the nutrients is a valid one, and one of the things about this clustering was really that it was -- This is where we're putting all those abiotic factors, if you will, into one thing, and there weren't necessarily going to be strong connections between all of them, but they should be connecting some place, and so we don't have --

We aren't tracking nutrients in this, and one of the periodic oceanographic phenomena would be the Oronoco plume, and that does bring nutrients and other things into the system, and we only have it linking into temperature, for example, and so that might go out into the eutrophication, or nutrients, box, which we -- I think Vance had it in the water quality group, but, as you had it, oxygen went nowhere, and so that's a problem. If it doesn't link outside the sub-model, then it's a hanger, and we have a problem.

KEVIN MCCARTHY: Right, and that may just be that we hadn't gotten that far.

RICHARD APPELDOORN: I think, actually, last time, we didn't discuss this model too much, because it was fairly simple, and we were connecting other places to it, or this to other places, but this was not one of the models, and so you would actually have to go back to the previous meeting, I think, to get some of the discussion on this.

KEVIN MCCARTHY: Right, and so those outside connections are clearly going to be a big component for abiotic factors, but, yes, I don't think we've got that far in any of the previous discussions.

RICHARD APPELDOORN: So we don't, in any place, have something for like growth, other than some things that might impede that through indirect channels, but something like temperature and oxygen affecting growth, which would be a concern as we're looking at long-term effects of global warming, we don't have those connections built in, I don't think, yet.

VANCE VICENTE: I think the issue of oxygen -- I remember Reni and I discussing back and forth, and I believe that we agreed that it is an issue as a limiting factor in enclosed inshore lagoons, but not a significant factor in the offshore or coastal, open coastal, systems, and that's what I remember. Regarding the temperature, the higher the temperature, the less is the solubility of oxygen, and that we didn't mention, but that's all I recall from the issue of oxygen.

CHURCHILL GRIMES: I have a question, also not being a chemical oceanographer, and I'm reluctant to say anything, but what exactly is the connection between ocean acidification and oxygen? I mean, isn't it CO2 concentration, I thought, that is the main problem with leading to increasing carbonic acid in acidification?

KEVIN MCCARTHY: These are the connections that came out of -- All

of those arrows are coming out of this table, and so I didn't add anything. I just elaborated on this earlier model that just had a few of our connections, and I then took this table and added those additional lines in, as per that matrix.

GRACIELA GARCIA-MOLINER: Are you moving the slides?

KEVIN MCCARTHY: I was moving the slides, yes.

GRACIELA GARCIA-MOLINER: So it might be us over here, because I cannot see any movement on my screen.

KEVIN MCCARTHY: Okay. What are you looking at? That's because my internet just went away, and so maybe it would be better if you presented, Graciela, so everybody is able to see things while my internet sorts itself out.

GRACIELA GARCIA-MOLINER: No problem.

KEVIN MCCARTHY: I was just on the model that is Slide Number 5. I haven't added any editorial comments here, and I haven't added any additional lines that were not included in the matrix, which is Slide 4. Slide 3 is the model, I guess where we stood, that was in part of the package that Graciela supplied, along with the matrix -- Well, really, it's the first four slides, and so I took that matrix and added to Slide 3. If we think that there are lines on here that we want to revisit, I am open to that.

RICHARD APPELDOORN: So you're saying that the matrix that you're presenting came already filled out?

KEVIN MCCARTHY: Correct, and I don't know how that happened, because I don't remember a lot of discussion about the sub-model connections, and, in looking at the transcript that Graciela also supplied, like I said, abiotic shows up in there, when you search for it, a total of seven times, and so there wasn't -- At least at the last meeting, there wasn't a lot of discussion about this sub-model.

GRACIELA GARCIA-MOLINER: But, at the previous meeting, anything that came from the meetings that you've had, that has been filled in as we go along, and so that's where those numbers come from, and anything that -- So that's as far as you got.

KEVIN MCCARTHY: Okay. Then that's Slide Number 5. That is all of those numbers filled in to the sub-model, and whether or not we agree with all of those is open for discussion, and so we may be missing certain things, and we may be missing some elements and

boxes, and some of these connections may need to be rethought.

VANCE VICENTE: I also recall that we did bring up, in the last meeting, or in the previous one, and I can't remember, that there are very specific regulatory standards, specifically water quality standards, for oxygen and water temperature and pH of the water, both for Puerto Rico and the U.S. Virgin Islands for all three types of water bodies, Class A, Class B, and Class C.

JORGE GARCIA-SAIS: What I think is that the linkage between water temperature and oxygen may probably be negative, right?

RICHARD APPELDOORN: Correct.

KEVIN MCCARTHY: Yes, and so, Graciela, can you change that water temperature to oxygen to red?

GRACIELA GARCIA-MOLINER: Liajay is the one driving today, and so she will do that.

KEVIN MCCARTHY: Okay. It's a three? I think a three is reasonable, a negative-three.

RICHARD APPELDOORN: Yes, I think that's reasonable. I think I would like to get rid of the connection between ocean acidification and oxygen.

CHURCHILL GRIMES: Yes, I agree with that.

KEVIN MCCARTHY: I don't have a problem with that either.

JORGE GARCIA-SAIS: Richard, just thinking about what you were asking a few minutes ago about the linkage or the connection between oxygen and other sub-components, I think that the connection is right there with water quality, water temperature being one of the drivers of the oxygen deficiencies, and the ocean deficiencies will have a direct linkage to water quality, because -- Well, you know, oxygen also affects the solubility of metals.

RICHARD APPELDOORN: Right, and I'm just saying we don't have the linkage built in at the moment. There isn't --

JORGE GARCIA-SAIS: No, but it's a potential linkage.

RICHARD APPELDOORN: It's an obvious linkage, but it's not one that is physically put in, but, the way we're going, at least in the short-term now, is we're just going to say abiotic factors as a sub-model links to water quality as a sub-model, and then we'll

state what are the major components here that drive that linkage, and so oxygen and temperature and acidification might all be the things that are linking over in that particular connection.

VANCE VICENTE: But also, Richard, there is a connection between salinity and oxygen, because the solubility of oxygen in water is very much dependent on salinity, and so there is that connection there.

RICHARD APPELDOORN: Okay. Let's add that line, and in which direction is it going?

VANCE VICENTE: Well, salinity to oxygen is negative.

KEVIN MCCARTHY: What magnitude?

DOUGLAS GREGORY: For open ocean conditions, is there really a strong relationship? I mean, salinity is not going to change that much anyway.

VANCE VICENTE: No, I agree that it doesn't change much, and, in open systems, it's not a problem. I mean, it's a constant, but definitely the more dissolved solids you have in the water, the less oxygen will be able to be dissolved. That's just my point.

RICHARD APPELDOORN: Again, with our Oronoco lens, which is all of the platforms, it does show that drop in salinity, and it's not, obviously, huge, but it's certainly measurable, both directly and remotely.

JORGE GARCIA-SAIS: Richard, it is a problem in coastal lagoons and at the mouth of the rivers with the salinity lens. You get strong oxygen deficiencies, and, in the coastal lagoons, usually, these oxygen deficiencies cause fish kills, and that typically happens when the coastal lagoon is closed and hypersaline conditions prevail.

JOE KIMMEL: I agree with Reni, but this salinity to oxygen relationship is much stronger inshore than it is in offshore waters.

JORGE GARCIA-SAIS: I agree.

KEVIN MCCARTHY: Given that it's localized, what do we want to call it for the system as a whole? Do we want to call it a one, or do want to make it a negative-one or make it bigger than that?

JORGE GARCIA-SAIS: I would give it a one, because coastal lagoons

don't proliferate very much in Puerto Rico, and there's just a few of them, but the point that I wanted to make was that, when the problem arises, it is a big problem. It causes a fish kill.

KEVIN MCCARTHY: I am just looking at whether it's localized or more widespread, and it sounds like it's a localized thing, and so maybe that one makes sense then.

JORGE GARCIA-SAIS: Yes, it's localized. One or minus-one.

KEVIN MCCARTHY: Do we want to stick with oxygen and the connections to and from, so that we can just work our way around it in a reasonably organized way?

RICHARD APPELDOORN: I think we just finished oxygen, if you make that line thinner.

JASON COPE: I am still struggling a bit with the sub-model, in the sense that there are a lot of, obviously, a lot of chemical reactions in these systems that aren't going to be captured here, but that are important to feeding back into the system that we do want to capture changes in, and then, before we started adding a couple more lines here, I almost felt like this abiotic sub-model was almost a catchall of just a bunch of abiotic factors that aren't necessarily going to be spent -- That we're going to spend time connecting them to themselves, but it's basically a basket where a bunch of these important factors are then going to get connected to other sub-models, and it's just a place to kind of collect them and send them out, and so I don't know if that was the initial intent.

The other thing to add here is that rugosity, to me, is more -- That's a metric of habitat, and I'm wondering -- Because we have habitat as a sub-model, and it's abiotic, in part, I am wondering if rugosity should just be taken out of this and just connected on the habitat side, and so the major disturbances are just going to affect habitat, and rugosity, if we want to capture that element, could be in that sub-model.

JOE KIMMEL: I agree with what Jason is saying.

CHURCHILL GRIMES: Likewise, and I think that's a good suggestion.

VANCE VICENTE: I think that sounds like a very good suggestion.

KEVIN MCCARTHY: So that means Doug has more work to do, right? Didn't you do habitat?

RICHARD APPELDOORN: Well, since it's specifically rugosity, you could just draw that line to the coral reef box.

GRACIELA GARCIA-MOLINER: Can I ask something? On Slide Number 6 and 7, and 7 specifically, you have a connection to other sub-models, and did you want to go that one?

RICHARD APPELDOORN: No.

GRACIELA GARCIA-MOLINER: Okay.

KEVIN MCCARTHY: I think we want to get the sub-model itself sorted out.

GRACIELA GARCIA-MOLINER: Okay.

KEVIN MCCARTHY: So is that our decision, that rugosity moves, or we're just drawing a line from here to habitat?

RICHARD APPELDOORN: I think I would just recommend that the rugosity box itself gets eliminated, and there would be a connection between major disturbances and coral habitats, or habitats, and it could be more than just the coral. Major disturbances can also affect seagrass beds, for example, and so that's an external connection, and I would just drop the rugosity box from this model.

KEVIN MCCARTHY: So rugosity would be out of the entire -- We wouldn't move it to habitat, and it would just be understood that major disturbances are -- We would skip the box and just go major disturbances to habitat.

RICHARD APPELDOORN: Correct.

KEVIN MCCARTHY: That makes sense to me.

VANCE VICENTE: That makes sense to me.

JORGE GARCIA-SAIS: Eliminating it and also that major disturbances also have an effect on mangroves. We lost a lot of mangroves during the hurricanes.

GRACIELA GARCIA-MOLINER: Okay, and so we're eliminating rugosity out of there and that line. Do you want to draw the line now to the habitat sub-model?

RICHARD APPELDOORN: No.

GRACIELA GARCIA-MOLINER: Okay.

KEVIN MCCARTHY: So anything else that -- Any other boxes that are in the wrong place or that need to be added? Have we made a decision about some other things, like carbon and nitrogen, or are we not trying to track that?

RICHARD APPELDOORN: Before we start adding stuff, the only other connection that I would link would be periodic oceanographic phenomenon to salinity, and that would be a Level 1 connection, and I am thinking of the Oronoco plume.

KEVIN MCCARTHY: So that's a negative?

RICHARD APPELDOORN: Well, salinity goes down when the plume comes, and so I guess that's a negative.

KEVIN MCCARTHY: Right. That's what I was thinking. As it currently exists, with rugosity out and all the other ones remaining, are we missing connections, or are the connections that perhaps don't make sense in the clear light of day?

CHURCHILL GRIMES: Again, what is that relationship between water temperature and acidification? Could somebody just tell me what that is?

JORGE GARCIA-SAIS: I know that major disturbances will have a direct effect on nutrients, because of the upwelling effect of hurricanes as they go by, but that's more water quality on the other sub-component. Probably so.

RICHARD APPELDOORN: Getting back to your question, I don't see the connection between water temperature and acidification. Obviously, CO2 is driving both of them, but I don't see a connection otherwise.

VANCE VICENTE: Looking here, I find that pH decreases with an increase in temperature, but this does not mean that water becomes more acidic at higher temperatures.

KEVIN MCCARTHY: So is that an arrow that needs to be dropped, water temperature to ocean acidification?

RICHARD APPELDOORN: Well, water temperature is not driving ocean acidification, in the context that we are dealing with it here.

KEVIN MCCARTHY: So that connection should come out?

RICHARD APPELDOORN: I think so, and ocean acidification would --

JOE KIMMEL: I agree, and maybe there should be an arrow between the periodic oceanographic phenomenon to ocean acidification. I don't want to eliminate that box, the ocean acidification, because it's an important one.

RICHARD APPELDOORN: Well, I disagree with your connection. We're not eliminating the box. As Jason reminded everybody, this is a catchall sub-model, if you will, and it's perfectly legitimate to have something in here that is not connecting to anything else in here, and it's just where we park it.

Ocean acidification is obviously going to have an impact on particularly coral habitat, for example, but probably, if it goes far enough, primary productivity, because we start losing our calcifying phytoplankton, et cetera, and so we have a built-in trophic system so much here, although the ecosystem component sort of has that, but we don't have -- We don't have it so tightly coupled, but this is obviously something that is going to impact other parts of the sub-models that we have, and so it can stand here alone and not be connected.

JOE KIMMEL: Okay. That's good for me.

RICHARD APPELDOORN: I mean, just for now anyway.

VANCE VICENTE: I am looking at another article, and it definitely says that temperature plays a significant role in pH measurements. The higher the temperature, the lower the pH, but the thing is that, in seawater, you have a -- This is my own thoughts now, but you have the carbonates and the bicarbonates, which act as a buffer, picking up the extra hydro ions, and so that's why the pH is normally so stable in seawater.

RICHARD APPELDOORN: Given that, I think I would leave it the way we have it, because we're not doing freshwater systems, where this would be more of a problem.

KEVIN MCCARTHY: Because of my internet issue, I can't see what changes have been made, and so, right now, ocean acidification is a box on its own with no connections, and is that correct?

RICHARD APPELDOORN: That's correct.

KEVIN MCCARTHY: Okay. Yes, that doesn't cause me any consternation, because I think it will be a lot of arrows from this abiotic factor box to a lot of other things. Did the arrow

from periodic oceanographic phenomenon get to salinity? Again, I can't see what's been changed.

RICHARD APPELDOORN: Yes. It's there, and it's a negative-one.

KEVIN MCCARTHY: Right, and so are we -- Is there anything, for these existing boxes, that requires an additional connection?

RICHARD APPELDOORN: Not for me.

JOE KIMMEL: It looks good to me.

KEVIN MCCARTHY: If not, are there additional boxes that are required? I have heard carbon and nitrogen and just sort of a general nutrients.

RICHARD APPELDOORN: Well, we have a nutrients box in water quality.

KEVIN MCCARTHY: So, if that's the case, do we need to be more specific in this sub-model, or will that cover it for us, the nutrients in another sub-model?

RICHARD APPELDOORN: For me, at this point in our development, I think we're good the way we are, and we can always get more complex, but, as Bill has pointed out, we'll never get done.

KEVIN MCCARTHY: If we get too far down that path, we'll certainly be outside of my comfort zone, and I will be looking towards a chemist for some assistance.

RICHARD APPELDOORN: Well, I'm not hearing a lot of demand to do any further modifications, and so I would suggest we say this is it for the moment and we move on to the last one and put Joe on the screen.

KEVIN MCCARTHY: Agreed. I thought this would be a fairly quick one, and I'm glad it was, after yesterday.

GRACIELA GARCIA-MOLINER: Richard, do you want to go to Joe's?

RICHARD APPELDOORN: Yes, I do. Joe may not want to, but I think I would.

JOE KIMMEL: I didn't want to from the beginning, but -- So, Graciela, I will go ahead and run the show, and so I have to turn on my mic and share the screen?

GRACIELA GARCIA-MOLINER: Right, and so let me make you the presenter. Hold on a second.

COMPETING USE OF RESOURCES (56:29)

JOE KIMMEL: Okay. I've got the competing use of resources sub-group for the ecosystem model, and I was a little reluctant to take this responsibility, and I expressed myself, and I hadn't been to the last two meetings, and so I didn't hear all of the discussion, and I had never used the software that I'm using today, and so please bear with me.

Anyway, this is the competing use of resources sub-model for the ecosystem major model, and I'm going to show you this slide, because I think it demonstrates -- Number one, it shows a picture of an animal, and I haven't seen one of those since we started, since Monday, but this shows a picture of a great blue heron, and he's standing on my pool deck and drinking water out of my pool, and he also goes out on the dock and messes around, and, anyway, I think this is a -- We're competing for the pool and dock resources, me and this great blue heron, and it's a positive relationship, because I enjoy looking at the behavior of this guy, and there is a negative aspect to it though, because he does make a mess every now and then, and I have to go by and clean that up. Anyway, I just wanted to show a picture, and that was my excuse.

In this sub-group, there were fifteen elements, none of which I feel expert at, but, nonetheless, I have had experience with some of them, and recreational diving, marina activities, boating, research, mariculture, light contamination, the energy sector, artificial reefs, waste, conservation and restoration, large-vessel shipping activity, noise generation, military use, coastal development, and marine development.

These elements are all competing for space or parts of the ecosystem with fishing. At the time of the October SSC meeting, this is the way it was left, and there was one large-vessel shipping activity to noise generation relationship drawn.

After much experimenting, I generated this slide, which is very colorful, and there are lots of lines, and there are lots of ones and lots of twos, and some negative numbers, but I think we are going to need to review this at some point, to make sure that I did the right thing here. I have to admit that this was a complex thing for me to do, and I will need your help to refine it to be better.

This particular slide shows what I think are the intra-

relationships among the elements of the competing uses of resources group, and I'm sure we'll come back to this and spend some time.

This is the competing group over here for this -- This competing sub-group over here, with all the elements, and you can see, and this was left from the last SSC meeting too, and there are a lot of connections, and it's very complex, but I don't think it's as complex as it will probably get, and so there's that.

Let me go to the worksheet, or the Google sheet, and that's what it's called in my Chromebook, and this is the matrix that we have all been looking at with other sub-groups.

This is the matrix that I worked from, and this is primarily the Puerto Rico one, and I went over it several times, and, every time I go over it, I change the numbers, and I lose thought about the direction it's supposed to be in, and so I'm going to need the SSC and the DAP to help refine this. I've got the same thing, and let me go through the same exercise that I did before.

This one is for St. Croix, but I haven't been there in twelve years or so, and I don't really know whether these connections are right or wrong, and I have another one for St. Thomas/St. John, but it's pretty similar, and so which one would you like to go back and discuss, the --

RICHARD APPELDOORN: Puerto Rico.

JOE KIMMEL: Puerto Rico. Okay. Graciela or Liajay, maybe, at this point, I could switch over the controls to you guys, because I am really bad at reading across all these lines, and it's a really long matrix, and it's even worse for me with the sub-model arrows and numbers aspect, and so you could you guys take control, and I will try to read the discussion about how I got to where I got, and, if there are changes, you can put them in?

GRACIELA GARCIA-MOLINER: Okay. Liajay will pick up your Excel file and present that.

JOE KIMMEL: So, as I went across from marine development towards the right, I got marine development and coastal development, and I had an interaction, because, if you have a development offshore, oil or wind or some sort of development offshore, it oftentimes will cause some development inshore too, because people need housing and parking lots and boat ramps to get out there, and so I had a low relationship between marine development and coastal development. Any problems with that one that I've got there?

RICHARD APPELDOORN: No, and I think that's good.

JOE KIMMEL: When I go down from marine development to military use, I saw no really relationship there. Any problem with that?

RICHARD APPELDOORN: Treat silence as consent.

JOE KIMMEL: Okay. Next is noise generation. I put a one there, because, if you're developing something anywhere, there's going to be some noise generation, and so I put a one in that box, and maybe it's short-term, but, nonetheless, there is noise generation. I don't hear any problems with that. Okay.

Then marine development, when it gets to large vessel and shipping activity, I put a two, because, if you're going to do marine development, you're going to usually have at least a large vessel, depending on the size of the development that you're doing, and I was thinking big here, I guess, and I put a two there, and maybe it should be a one. What do you guys think?

JUAN CRUZ-MOTTA: Perhaps one, Joe, as you suggest.

JOE KIMMEL: Okay. Anybody else? Okay. Then marine development, when I get to waste, again, I put two there. There is always waste when you're developing stuff, and maybe that one is too high as well, but, nonetheless, my first and second and third go-round, I selected a two. I'm not married to it, and I will accept any comments.

JUAN CRUZ-MOTTA: I don't know, and perhaps Vance correct me, and Reni, because they know more about marine operations here, but I think, when you have a major marine development, they have these regulations that they have to comply with, which minimizes not the production of waste, but at least the amount of waste that is left behind. Consequently, I would reduce that to one.

JORGE GARCIA-SAIS: I think a one, too.

JOE KIMMEL: Okay. I'm agreeable with that as well. Any more discussion on that particular point?

VANCE VICENTE: I think we had a discussion where we're going to be saying, instead of marine development, marina development. Didn't we discuss that at some point? I don't remember exactly, but there was some kind of a discussion among us whether we were going to be referring to marina or marine development in general, and I'm not sure, and I'm just asking.

RICHARD APPELDOORN: There's a separate category for marina activities.

VANCE VICENTE: Okay. Thank you.

RICHARD APPELDOORN: Joe, I will start off with a question about why marine development would connect with artificial reefs.

JOE KIMMEL: Well, my feeling was that artificial reefs are a type of a marine development, and so they're not very big, usually, but, nonetheless, you have to have a boat to carry all the material out there, and it stays in the water, and there is waste associated with that too.

RICHARD APPELDOORN: I agree with everything you said, but wouldn't that be artificial reef driving marine development, rather than the other way around?

JOE KIMMEL: Yes, it probably is, Rich. I'm sorry, but I really had a problem, in my mind, keeping the positives and negatives and the columns and the rows in the right place, and so I will agree with you there, and what would you like me to put in that box?

RICHARD APPELDOORN: I would say you're putting a zero there, but then, under artificial reefs, wherever that connects to -- In artificial reefs, you have it connecting to marine development as a one, and so I think that's what you want, and so just put a zero in the current box we're talking about, and you already have that connection made, the way I would think it would be made anyway.

JUAN CRUZ-MOTTA: One question, Rich. Whenever you do say a jetty or a marina, you're actually -- That's a marine development, and it's artificial structures, and so I would see a relationship between marine development and artificial reefs.

RICHARD APPELDOORN: I was thinking of artificial reefs as something that was actually planned as an artificial reef and not just say pilings in the water attracting fish.

JUAN CRUZ-MOTTA: So I agree with your position then.

JOE KIMMEL: So we need to change that to a zero there in artificial reefs then?

RICHARD APPELDOORN: Yes.

JOE KIMMEL: Okay. Let's go to marine development to the energy sector, and I didn't have any relationship there. Any problems

with that? Hearing none, I will go marine development to light contamination. I put a two there, because, as you're developing something in the marine there, you're stirring up sediments, or you're discharging stuff, and the stuff comes off of your boat and everything, and maybe that's a little bit strong, and maybe it should be a one, but that was why I put a two there.

RICHARD APPELDOORN: I think the light contamination is referring to lights above -- Light contamination above the water like affecting turtles and stuff.

VANCE VICENTE: Yes, I agree, Richard. That's what we talked about.

JOE KIMMEL: Okay. I didn't realize that, and so maybe that should be a zero.

RICHARD APPELDOORN: I would agree with that, because we sort of captured that in a lot of the other ones.

JOE KIMMEL: Okay. Moving from marine development down to mariculture, I looked at mariculture as another type of marine development, and I remember the cobia farms and the other kinds of mariculture events, and there are other developments that are happening in marine waters, and I see that as a type of development, and so I put a one there. Problems or suggestions?

RICHARD APPELDOORN: I think what you just talked about was mariculture driving marine development. If you already had a mariculture operation going, and then you started marine development, would that impact the mariculture? That's what this box is.

JOE KIMMEL: Okay. Maybe that should be a zero as well.

KEVIN MCCARTHY: Is there ever a case where there is an existing mariculture facility and they get pushed out by some other kind of marine development, or even, down below, coastal development? In that case, it would be a negative something. I don't know that that happens, but it happens in other places, for sure.

JUAN CRUZ-MOTTA: I have another question, perhaps for Vance or Reni or Rich, but how widespread is mariculture in Puerto Rico and the U.S. Virgin Islands?

RICHARD APPELDOORN: It's not widespread.

JUAN CRUZ-MOTTA: So should we consider that box at all?

JORGE GARCIA-SAIS: I think that we should, because, for example, there is now ongoing projects of mariculture. For example, Stacy is cultivating sea urchins, and we have talked about the need for us to start some scale of mariculture of corals, because of the ensuing diseases and big losses of certain species, and so I would not take it out from there, because it's a prospective option for the declining stocks of corals and other organisms that we are experiencing in the marine environment.

JUAN CRUZ-MOTTA: Thank you, Reni. Then I agree. Let's leave that box.

JOE KIMMEL: Okay. Moving from marine development down to research, then --

RICHARD APPELDOORN: I think what he means is that we need to have a value in that box. I think that would be like a negative-one.

JORGE GARCIA-SAIS: Well, I believe that mariculture is the one driving marine development, and not the other way around, but I am not sure if they are interacting both ways.

RICHARD APPELDOORN: That was the question here. Would marine development displace ongoing mariculture or the ability to put mariculture into place?

JORGE GARCIA-SAIS: I believe it's the other way around. I believe that mariculture influences marine development.

GRACIELA GARCIA-MOLINER: There is a presidential document that just came out promoting American seafood competitiveness and economic growth, and that specifically speaks to facilitating aquaculture projects, through regulatory transparency and long-term strategic planning. The council will be commenting on that fairly soon, and so, right now, it's limited to what Reni said, and the cobia project and the snapper farm, et cetera, have disappeared, but probably there will be -- There is a queen conch hatchery being developed in Naguabo, and so that might take -- It will probably bring more projects to the area.

CHURCHILL GRIMES: I was just thinking about exactly the same thing, and I saw that notice, and there is a controversy in the Gulf of Mexico here about making it easier for mariculture operations to operate in the territorial sea beyond state waters, and so, if things don't change, you're going to see more of it.

JORGE GARCIA-SAIS: By the way, there is also a proposal for a big

lobster mariculture project in Puerto Rico, and I don't know if you've heard about it, but I was contacted a few months ago for some questions and stuff, and there is a company that will start mariculture of spiny lobster, and so be aware of that.

RICHARD APPELDOORN: I think we're all agreed that mariculture is an up and coming thing. What we are asking right now is whether marine development will affect mariculture operations. I think we're all in agreement that mariculture operations will affect marine development, but we haven't gotten to that one yet.

JORGE GARCIA-SAIS: I think it's a zero.

RICHARD APPELDOORN: Okay.

JOE KIMMEL: Okay. I do, too. Moving from marine development down to research, I put a one there, because any sorts of developments, inshore or offshore, usually require impact statements and that stuff, and whether you call that research or policy and process, I don't know, but that's why I put a one there. What do you guys think?

JORGE GARCIA-SAIS: I give it a two.

RICHARD APPELDOORN: This is something that I wouldn't have even thought about, and so I think it's a really good point, and Reni probably knows this better than anybody else, and Vance as well, and he's going with a two, and that's fine with me.

VANCE VICENTE: I am fine with that.

JOE KIMMEL: Okay. Well, let's go on down to --

RICHARD APPELDOORN: We were going to make research a two. Boating, Joe.

JOE KIMMEL: With boating, I figured, if you were going to have marine development, you're going to need to get there somehow, and so I don't know whether this should be a row or a column thing, but I put a one with that relationship.

RICHARD APPELDOORN: That same argument is driving marina activity as well?

JOE KIMMEL: Exactly. Any comments about those two columns?

JORGE GARCIA-SAIS: I think I agree with that, Joe.

RICHARD APPELDOORN: I am just wondering whether they should be higher than ones, but we can leave it at one and keep moving.

JOE KIMMEL: Okay. Recreational diving, I don't think there's a lot of relationship between marine development and recreational diving, and the occasional curiosity, I guess, but, for the most part, I don't see a relationship there.

RICHARD APPELDOORN: Well, I will disagree with that. If you look the piers in Vieques or the pier in Frederiksted, they support a lot of recreational diving.

JOE KIMMEL: I forgot about those, Rich. Thanks for that. I appreciate it.

RICHARD APPELDOORN: Also another example is Sugar Pier up in Aguadilla.

JOE KIMMEL: Right, and so that should be a one, I guess, in that box. What do you think?

RICHARD APPELDOORN: That works for me.

JOE KIMMEL: Okay. I've got a negative-one. Any development, as far as I'm concerned, doesn't help conservation or restoration. I'm sorry, and that's my bias, and that's my score there, minus-one.

RICHARD APPELDOORN: I would agree with that. I think we're talking here about actual site-specific conservation and restoration activities, and, quite often, the demand for marine development trumps that, so that protected mangroves are still protected, except that we need to put something here, and so the mangroves lose, and so, yes, minus-one seems to be good, the way I think about it.

WALTER KEITHLY: I disagree entirely, and not necessarily -- I don't know how you define it, but, oftentimes, development requires mitigation, and mitigation may be conservation or restoration-type activities. Thank you.

JOE KIMMEL: So, Walter, how would you score that?

WALTER KEITHLY: Again, I have been refusing to score throughout this whole process, but I'm just saying that it could well be positive, in my opinion.

JOE KIMMEL: Does the rest of the group have any problems with the

negative-one there? Okay. Moving on, we'll move down to coastal development.

KEVIN MCCARTHY: Joe, before you move on, there was a question in the chat box from Michelle about the energy sector, including windmills, and does it include windmills? If so, does that change that zero to something?

JOE KIMMEL: I frankly didn't think about that, but that's a possibility. What do you guys think?

JORGE GARCIA-SAIS: Joe, do you mean windmills established on the marine shelf or -- I know it's a big issue on the east coast of the U.S., where they are -- I mean, they are installing huge areas of the marine environment of the continental shelf with windmills, but, in Puerto Rico, I don't know if it's a projected impact or what. It's really big on the east coast of the U.S. right now.

KEVIN MCCARTHY: Right now in Puerto Rico, it's limited to land-based windmills?

JORGE GARCIA-SAIS: Right, and I think that they are mostly land-based, but I am not aware of any proposed projections on moving them into the marine environment. I frankly don't know.

VANCE VICENTE: There was, Reni, for Guayanilla Bay, but the permitting didn't go very far, because they were going to have serious impacts on seagrass beds, principally, and so the proponent lost interest, but there was a proposal to install windmills on the shelf, off the shelf, but not anymore.

JORGE GARCIA-SAIS: Okay. Vance, thanks.

JOE KIMMEL: So it sounds like, to me, we probably need to leave that as a zero, unless something is imminent, in terms of moving windmills into the marine environment.

RICHARD APPELDOORN: Well, I was trying to find the glossary definitions for that, but, in the document that was sent out, your component seemed to be missing in that, and so I don't have it readily available, and so, if one of those people who have been tracking this, Orian maybe, or Graciela, have quick access to what we were discussing as the energy sector.

I know a lot of what we were discussing was thermal impacts of that, but there is offshore development, not just of windmills, but Marcos brought up the fact that there is still interest in other development as well, and so, at this point, I would say, if

our energy sector doesn't include those things, we would need another box, but, right now, for our purposes here, marine development, I guess, would not include the energy sector. That is taken up by its own box.

GRACIELA GARCIA-MOLINER: I didn't find anything quickly on the energy sector, but --

RICHARD APPELDOORN: Sarah just posted it was light, noise, and thermal pollution issues. If we're talking about windmills and things like that, we also have infrastructure that goes out to them and displacement around them, et cetera.

JOE KIMMEL: Okay, and so what are we going to do with the number for the energy sector up there in marine development, leave it as a zero or put a number in there?

RICHARD APPELDOORN: My preference is to leave it as a zero, and we are going to bring in those other components that we've just talked about throughout the energy sector into our discussion and definition of energy sector.

JOE KIMMEL: Okay, and so I will move down to the second row, coastal development, and I have marine development as a one there, and my rationale was parking lots and boat ramps and maybe those things that are needed to support the marine development, and that's why I put a one. Any argument or suggestions?

VANCE VICENTE: It goes beyond parking lots. I mean, the coastal zone of Puerto Rico extends from the shoreline one kilometer, I believe, to upland, and so that would include condominiums and homes and roads and airports and the like.

JOE KIMMEL: So maybe that number should be higher than a one?

VANCE VICENTE: Well, yes, I think so. Hotels. Vanessa Ramirez just said hotels, too.

JOE KIMMEL: Any input from anybody else? Vance, what do you think about putting a two there?

VANCE VICENTE: Yes, I would.

JOE KIMMEL: Okay. Moving along, coastal development to military uses, I didn't see any connection there, and so I left it as a zero. Not hearing any comment, I will move down to noise generation, and, just like marine development, my feeling is that there is always noise generation when you develop anything, and it

may affect resources in the marine environment. Any discussion or changes?

VANCE VICENTE: I agree.

RICHARD APPELDOORN: I agree.

JOE KIMMEL: Okay. Let's move on down to coastal development to large-vessel shipping activity. I put a one there, because I am thinking that one of the types of coastal developments is the digging channels and dredging and that sort of stuff, and you need the large vessels for doing that sort of thing, barges and so on, and so I put a one in that box, and maybe it should be higher or lower, and I don't know.

VANCE VICENTE: If any, it could be a bit higher, because we also have to take into consideration the utility lines, and so maybe you want to give it a two, maybe.

JOE KIMMEL: I'm good with that, Vance. Good suggestion. Any more comment on the large-vessel shipping and coastal development there? Okay. Then I move on down to the next block of waste, and, again, I see development as creating waste, and, in this case, maybe there is more waste than their marine development, and so I put a two in that box. What do you think?

RICHARD APPELDOORN: Maybe even a three.

JOE KIMMEL: I can go for a three.

VANCE VICENTE: Richard, can you explain why a three?

RICHARD APPELDOORN: Because, as you're developing the coast, you're going to be increasing the population density in those areas, and that's going to be resulting in a lot more waste being produced, and the immediate choice about where to put that is going to be the marine environment.

VANCE VICENTE: Okay. Got you.

JOE KIMMEL: Okay. Let's move from coastal development down to artificial reefs, and I had a one for marine development and artificial reefs, and it got changed to a zero, and so maybe I was wrong here too, and maybe it should be a zero as well. What do you think, Rich?

VANCE VICENTE: No, I would -- We have to have a number there. Some of the coastal development involves the construction of

artificial structures, piers and the like, and so, I mean, instead of artificial reefs, I would put artificial structures, maybe, and that should cover much more. I mean, it's an opinion, because you can also have artificial reefs as a unit when you look at mitigation projections to compensate for impacts on the submerged lands of Puerto Rico, like reef balls and the like, which is a separate category, but, if you look at artificial structures, yes, there is definitely construction of seawalls and piers and things like that, and I would not put a zero there.

RICHARD APPELDOORN: Well, we have this under the previous one, and I had argued that that's artificial reef and that these other structures, which do attract things were -- Artificial reefs was here specifically talking about structures put in and designed to function as reefs and not things that were designed to do other things, but also happen to attract fish.

VANCE VICENTE: Like reef balls, and that's the kind of thing that you're thinking about.

RICHARD APPELDOORN: Reef balls or sinking ships or all kinds of things that people have done with the intention of actually creating something, and so, in this one, under that scenario, as coastal development expands, and I would say probably your offshore environment degrades, there probably would be a demand to put in artificial reefs, and so I could see where you might get a one here.

JOE KIMMEL: Okay. Any more -- I am in agreement with that too, Rich. Any more discussion here on this particular box? Okay. Hearing none, I will move on down to the energy sector and coastal development, and I have a zero there, just like I had on marine development. What do you guys think about that? It's closer to shore, and I don't know. Maybe it's got a different -- It should have a different --

RICHARD APPELDOORN: I think all development might drive the energy sector, but that it might be placed nearshore, because of heating or whatever requirements, or cooling or whatever requirements, but I don't think it's the development on the coast that drives that so much as all development, and so I think a zero is good for me.

VANCE VICENTE: But, on the other hand, Richard, the higher the coastal development, the higher is the energy demand, and so I see a direct relationship there.

RICHARD APPELDOORN: That's just development. That's not because it's in the coastal zone, but that's just because there is more

development and more -- Our electrical facilities, electrical-producing facilities, are very centralized, and so they are meeting -- When demand goes up, something gets built, but it's not because we necessarily built in a coastal zone. It's just that, globally, on an island or whatever, the demand for electricity has gone up, and I don't think it's necessarily driven by coastal zone versus just --

VANCE VICENTE: Okay. Got it. Thank you.

JOE KIMMEL: Okay. Coastal development, and we'll move on down to light contamination, and I had a higher number in the marine development than we have now, and I used the same philosophy for putting a two here. I saw it as light contamination, and the coastal development that I was thinking of, dredging and that kind of stuff, would suspend a lot of sediment particles, and there would be discharges from the vessels as well, probably, and I saw that as light contamination, but Rich defined light contamination in a different way, and so I'm ready for any suggestions here.

RICHARD APPELDOORN: This is one case where your arguments were wrong, but the number is there because coastal development does light up the coast, and that gives us light contamination. I am going to ask about the scale of this, because this is, obviously, a near-coast phenomenon, in terms of how we suspect it affects things, and so I'm not sure of the magnitude. I am not unhappy with a two, but I don't know whether this is something more limited or not, spatially speaking. Like I said, I'm not unhappy with a two.

JOE KIMMEL: Vance or Reni or anybody, what do you think?

VANCE VICENTE: There have been ways in which the light pollution problem has been controlled significantly, by changing the type of bulbs and by creating interference on the illumination towards the beach, putting lamps that point vertically down, rather than horizontally, and it has been pretty much taken care of. It's not as huge of a problem as it used to be, but it is a problem.

JORGE GARCIA-SAIS: I was mostly concerned about the turtle hatching and going in the wrong directions and that kind of thing, and the problem with the bioluminescence of the bays, and that was my concern, and that concern -- Well, it's important. I would go ahead and put a three there, but I'm okay with two.

RICHARD APPELDOORN: So let's go with a two. I think Vance makes a good point, but that situation exists because measures were enacted to get people to change how they were lighting things, and

so the relationship is strong, but it's just that there isn't already a management intervention to try and reduce that.

VANCE VICENTE: I'm okay with a two.

JOE KIMMEL: Okay, but Vanessa had a note here that says she agrees with Vance, but we still have some big problems with residential areas near the coast. Does that affect the number we're going to put in light contamination?

RICHARD APPELDOORN: No.

JOE KIMMEL: I'm okay with a two as well.

RICHARD APPELDOORN: I'm agreeing with Vanessa too on that, but I think our two captures that.

JOE KIMMEL: Okay. Moving down to mariculture, I see that as a type of coastal development, and so I put a one there.

RICHARD APPELDOORN: Which one is driving which?

JOE KIMMEL: That's where I have problems, in figuring that out.

JUAN CRUZ-MOTTA: Actually, the coastal development can interfere with mariculture, as explained by Reni before.

RICHARD APPELDOORN: So a negative-one might be actually a way to go with that.

JOE KIMMEL: I also remember, when they were doing the cobia, and there was an effort, years ago, about mariculture of -- They called it king crabs, but that's not what it was, but nonetheless, it was done as close to the shore as they could, so that they could get there and get back, doing whatever they needed to do for mariculture, and so does that affect the number that we want to put in mariculture? Should it be higher or lower?

JUAN CRUZ-MOTTA: Minus-one.

JOE KIMMEL: Okay. Down to the next one, research again, development usually requires impact statements and that kind of thing, and so, if they are considered scientific research, then it deserves a score, and I think one is probably appropriate, myself.

VANCE VICENTE: I agree.

RICHARD APPELDOORN: Next box.

JOE KIMMEL: Okay. Boating, well, if you're going to have coastal development, you're going to need a boat to get out and get back, and so that's why I put a one there. Comments?

JORGE GARCIA-SAIS: I would increase it to a two.

RICHARD APPELDOORN: I think, as the coastal development proceeds, you have a much stronger population that's going to put demand on boating activities. The same thing with marinas.

JOE KIMMEL: All right, and so we've got a two there. Now let's go over to marina activities. I mean, I don't know if the boating and the marina activities go up strictly together, but I would think there is enough need for marina activity with the more boating you have, and so at least a one for marina activities, and maybe a two, and I don't know. What do you guys think?

JORGE GARCIA-SAIS: I would give it a two.

VANCE VICENTE: I would give it a two.

JOE KIMMEL: Okay. Let's go with a two.

RICHARD APPELDOORN: Please.

JOE KIMMEL: Okay. Recreational activities. Maybe there is some recreational activities, or recreational diving, with coastal development, but I didn't recognize any when I was scoring this spreadsheet, and does anybody have any comments?

JORGE GARCIA-SAIS: At least one, if not two.

RICHARD APPELDOORN: Explain that.

JORGE GARCIA-SAIS: With the increase in the coastal population, recreational diving is going to develop as well, you know, because people that live on the coast usually like water activities, and, on those, recreational diving is one of them.

JOE KIMMEL: So would you say, Reni, a two or a one?

RICHARD APPELDOORN: Let's put in a two.

JOE KIMMEL: Okay. Let's continue on down to the conservation and restoration, and I put a negative-one. I don't see how development really helps in either one of those conservation or restoration categories.

JUAN CRUZ-MOTTA: I totally agree with you, Joe. Actually, I would increase that to minus-two.

VANCE VICENTE: Walter had a point regarding -- Walter made a point before regarding mitigation, but what is important to remember is that practically all type of mitigations are compensatory mitigation, and so it doesn't really enhance conservation, but you just compensate for wetland, or submerged wetlands, and reefs and the like, but it's mostly a compensatory thing, and so there is no enhancement of conservation or restoration by mitigation projects.

WALTER KEITHLY: Vance you probably know better than I do, but isn't it often a negotiation between the representatives for say the federal or state government and the builder? If the negotiations are -- If the power lays with the representative for the government, then I can see where it would be a net positive, in terms of mitigation, but you know better than I do, and so I will leave it up to you.

VANCE VICENTE: The preferred type of mitigation is onsite and in-kind, and so, normally, what should happen, as least theoretically, and many mitigation programs fail, and, actually, there is an actual loss of the resource, but, hypothetically, you compensate for the extent of damage to the resource, and it's supposed to be at least one-to-one, but they always require a three-to-one, because of the ecological function losses until that system that you are transplanting, or that you are creating, grows ecologically mature.

JUAN CRUZ-MOTTA: I have a question. Do you think that this organized coastal development, at least here in Puerto Rico, is way, way more than the few mitigation programs?

VANCE VICENTE: Well, since 1973, when the Clean Water Act became implemented, together with the regulations, the U.S. Army Corps of Engineers and Fish and Wildlife mitigation programs, hypothetically, it's supposed to compensate for whatever cover or function or loss of a system, but that really doesn't happen. There are very, very few successful mitigation projects, and, there, I have to say that, in that aspect, I have been successful in life, but not in many others. Thanks.

In general, I think that there is a loss, that there has been a loss historically. If you look at it historically, there has definitely been a loss of resource, which still has not been compensated for.

JOE KIMMEL: Okay. I think the minus-two captures that relationship between coastal development and conservation and restoration.

CHURCHILL GRIMES: Perhaps, based upon what Vance is saying, it ought to be a minus-three.

JOE KIMMEL: Are there other comments? I will go with a minus-three, and I don't have any problem with that. Okay. Thank you, Liajay. Okay. Let's move down to the next row, and that's military uses. When I get to marine development, I've got a zip. Coastal development, I also have a zero. Noise generation is also a zero, although I had to think about that for a while.

VANCE VICENTE: I just got back. I don't know if anything was said in the last forty seconds.

RICHARD APPELDOORN: Yes, and you were made the chair of the committee. Congratulations.

JOE KIMMEL: We went with a three on the coastal development and conservation and restoration, mostly because of your comments there.

VANCE VICENTE: I saw it. Thank you.

JOE KIMMEL: Now we're onto military uses, and we've been over marine development and military uses, and I don't see a relationship. Coastal development and military uses, I don't see one. Noise generation and military uses, or military uses and noise generation, maybe there is one there. Maybe that should be a one.

RICHARD APPELDOORN: If you look at torpedoes and things like that, sonar, there's a pretty solid connection there.

VANCE VICENTE: Not to mention the ship shock testing off the Vieques Channel. I mean, that's serious noise contamination.

JOE KIMMEL: So it sounds like, at least in Vieques, it's fairly localized, and maybe it should be a two. I don't know, and what do you guys think?

VANCE VICENTE: I would raise it to a two, at least, with all these sonars and all these tracking instruments that the Navy has installed underwater.

JOE KIMMEL: Okay. They are not bombing Vieques anymore, are they?

VANCE VICENTE: No, they're not, but still there is -- In Culebra Island, too.

JOE KIMMEL: Okay. Well, let's go with a two.

TARSILA SEARA: I just wanted to make a comment, or maybe a question. For the military uses, in relationship to coastal development, I was thinking, as you were talking about Vieques, the military uses that are hindering coastal development, shouldn't we capture that in a way?

JOE KIMMEL: Good point.

VANCE VICENTE: Can you repeat that? I didn't understand the question.

TARSILA SEARA: I was just pointing out that there might be a relationship there between military uses and coastal development, as we're using Vieques as an example, and half of the island cannot be developed, because they are using it.

JOE KIMMEL: Are there like unexploded ordnance and stuff like that? Is that what you mean?

TARSILA SEARA: Right.

JOE KIMMEL: Yes, that definitely would impede development.

TARSILA SEARA: Right.

JOE KIMMEL: I simply had not -- That had not entered my mind, and so maybe that should be a one in that box.

TARSILA SEARA: Yes, I would say that.

RICHARD APPELDOORN: Negative.

VANCE VICENTE: But also there is short-term impairment of use of the resources while they clean their act up, and so that's another thing, but there is a positive thing regarding conservation. For example, right now in California, the only wetlands left are because they are within military grounds.

CHURCHILL GRIMES: Then again, there's like Monterrey Bay, where the base is gone, and the rest of it was supposed to go to various good uses in the long run, but about 50 percent of the land can't be used, because of unexploded ordnance and that sort of thing.

VANCE VICENTE: There are different angles of looking at it and analyzing it, but --

RICHARD APPELDOORN: We're all saying the same thing, but the question is what's the magnitude here?

JOE KIMMEL: Minus-one or minus-two, I guess.

VANCE VICENTE: I would say minus-two. I was thinking minus-two. We also have to think beyond Vieques. I mean, there is the Punta Salinas military base. In St. Croix, you have a naval office right there on the shore, on the northwest coast of the island of St. Croix, and so I would put a minus-two.

JOE KIMMEL: Okay. It sounds like most people are in agreement with that, and Liajay will put a two there. Then I think we already did the noise generation, and so large-vessel shipping activity.

RICHARD APPELDOORN: Why don't we make that a little higher? The Navy uses --

JOE KIMMEL: So large vessel and military uses should be a two, right?

RICHARD APPELDOORN: Yes, that works for me.

JOE KIMMEL: Okay. Moving on, we'll get to waste, military uses and waste, and I put a zero, but maybe there should be a higher number there.

RICHARD APPELDOORN: This is talking about the interaction between military uses and the competing uses for waste disposal, essentially is what the waste is, and so, if the military has its own demands for waste disposal, and, of course, offshore Vieques is a really good example of that, then military uses are increasing the demand for using the marine environment for waste disposal, and that's specific to Vieques, and I don't know if we want to expand this to other kinds of stuff. Otherwise, it's kind of handled in coastal development.

JOE KIMMEL: Okay, and so maybe we should put a -- What do you think, a one in that box?

RICHARD APPELDOORN: I think at least something, because Vieques is not a particularly small area that's being impacted in that regard.

JOE KIMMEL: Any problems with this, everybody, a one for military use and waste? Hearing no more comments, I will move down to military use and artificial reefs, and I don't see a big connection there. What do you think?

RICHARD APPELDOORN: I don't see any connection. I mean, one can say, and it has been the case, that military vessels have been used to -- They're sunk as artificial reefs, but that's not a direct connection to military uses. It's just the military has a vessel to get rid of.

JOE KIMMEL: Okay. Let's -- Vance, did you have something?

VANCE VICENTE: They're not doing that anymore, because of liability, but, in the past, it has been proposed.

RICHARD APPELDOORN: I would agree with a zero on energy sector.

JOE KIMMEL: Okay. Let's go ahead and with military uses and move over to light contamination. I had a zero.

RICHARD APPELDOORN: I would give it a one.

JOE KIMMEL: Give it a one there, Liajay. Thank you. Anybody have any problems with a one in that box?

VANCE VICENTE: Nope.

JOE KIMMEL: Three, two, one. All right. Military uses and mariculture. I didn't see any big connection there as well. I left it a zero, or I put a zero there. No problems? Military use and research. I don't see any connection there either?

VANCE VICENTE: Well, for a long time, there was the Navy, and the Department of Defense in general, were not required to conduct any type of environmental assessment or impact study, but that is not the case since 1973, a case in which we won, and now the Navy is required, as was the Department of Defense, and they have to conduct environmental studies, as well as implement mitigation programs.

JOE KIMMEL: So what do you recommend that we put there, Vance?

VANCE VICENTE: At least a one. Is there further discussion on that particular point? Okay. Let's go to military uses and boating. I have a zero in the box. What do you think, guys?

VANCE VICENTE: There is definitely boating activity, especially on the U.S. Navy bases, and so there is -- I would not put a zero there. I would put at least a one.

RICHARD APPELDOORN: Remember this is distinct from large-vessel shipping. As I could see where, as was in the past in Vieques, the Navy was inhibiting boating activity, and so maybe this could go both ways.

VANCE VICENTE: Well, temporarily, they do bring small boats in, especially off the Punta Salinas area, the Punta Salinas station, naval station, and especially during installation of utility lines, marine fiberoptic cables, and sewage disposal, sewage pipes, et cetera, and I would put a one, because zero means nothing, and a one means something, but not something big.

JOE KIMMEL: Good point, Vance. I certainly agree with a one there. Any further discussion on this particular point? Okay. Then let's move over to marina activity, and I don't know. If you have more boating, you have more marina activity as well, and so maybe that deserves a one as well. What do you think, guys?

VANCE VICENTE: Yes, a one. Remember in the naval station in Saba that they constructed a marina directly associated with the military activities, or the recreational aspects of the military activities, and so, I mean, that's just example.

JOE KIMMEL: Any further discussion on a one in that box? Okay. Hearing none, let's go on over to the military uses and recreational diving. I left a zero there, but, you know, I can remember diving on the dock out there in St. Croix one time, and a submarine came in while I was underwater, and that was quite an event, but I left this as a zero, because I don't think that happens a whole lot, but, anyway, what do you think, guys?

VANCE VICENTE: Well, a zero here, but, if you think of Guantanamo Bay, it's something else. I mean, there's a lot of recreational diving by the military and by the relatives that live there, but, locally, I don't see any association between military uses and recreational diving.

JORGE GARCIA-SAIS: I am good with zero.

KEVIN MCCARTHY: The only thing that I can think of is, if you've got a base down there where there are residents, just like there would be an increase in recreational boating, there potentially is an increase in recreational diving.

Now, I don't know how many -- You know, what the population is of military personnel and their dependents in Puerto Rico or the Virgin Islands, but I know, back when Roosevelt Roads was in operation, I had a friend who was a Navy ROTC in college, and she specifically tried to get stationed there so that she could go diving, and so there are people who have that interest, and I know that a bunch of friends who were Navy or Marine Corps would go -- They would try to go to places.

Like the Marines are in Okinawa, and they would go there specifically so that they could dive, if they could get stationed there, and so, again, I don't know how many people are down there on bases, but there will be -- If there are, they want to go boating and diving, and so, again, it depends on magnitude and how many people are there living on bases, and I have no idea what that answer is.

JOE KIMMEL: Okay. Currently, there's a zero there, and so many somebody wants to make a comment.

VANCE VICENTE: There is some association. Like, say, when the military bases are very active, they are normally associated with recreational diving, and so at least in the past.

KEVIN MCCARTHY: Again, I don't know how many people are living on military bases down there, and I can't imagine it's -- It's not a huge -- I wouldn't think it's a huge increase in recreational divers, but I could live with a -- If we're going to make boating, and a part of that is recreational boating from these bases, a one, I could live with a one in diving, and I just don't know how many people this involves. If it's a small amount, then let's call it a zero, because I don't know what the base populations are down there.

RICHARD APPELDOORN: Remember the issue here is are we generating -- Is the military use generating recreational diving to the point where there is a competing demand for space from recreational divers versus fishers, and so recreational divers that actually engage in spearfishing isn't recreational diving in this category. That's recreational fishing.

KEVIN MCCARTHY: Agreed. They could be doing both. Again, it's a matter of is there enough of it happening, because of military personnel and their dependents, that it's more than just an occasional thing, and I have no idea what that answer is, and it depends on the number of people down there.

GRACIELA GARCIA-MOLINER: Michelle is commenting on that, because,

I mean, now, the bases are practically -- The military personnel here is practically gone, and so probably there has been a very high use of recreational diving and fishing in that area, and we don't know exactly what's happening right now.

KEVIN MCCARTHY: If there aren't very many people, then I'm content with it being a zero.

JOE KIMMEL: You know, Kevin, it has changed, like Graciela said. Years ago, I mean, Ramey Air Force Base and Roosevelt Roads were running high and strong, but that's no more, and so I think a lot of the activities that were happening when the bases were filled with people are not happening anymore, and so I am good with a zero there. Any more discussion on this one?

KEVIN MCCARTHY: Not from me.

JOE KIMMEL: Okay. Then we'll go on over to military uses and conservation and restoration. I had a zero there, and I didn't see a connection. Anybody else?

RICHARD APPELDOORN: I think the comments have already been made that, quite often, military uses result in ad hoc conservation and restoration uses, because they preclude the general public from areas, either because of like unexploded ordnance, or they're just doing something secret or whatever, and there actually might be a positive --

JORGE GARCIA-SAIS: I would put a minus-one, because of the unexploded ordnance in Vieques and other places.

RICHARD APPELDOORN: It's not a minus if the military use went up and, because of that, the area is being conserved also went up.

JORGE GARCIA-SAIS: I have a lot of reservations regarding that. I am not even sure that it can be restored. I mean, I've seen the bumps. The only way you are taking the bombs out of there is if you explode them, and, if you explode them, you're going to break up the reef, and so that is a major problem, which is being dealt with right now as we speak. There is no easy way out. Either you leave the bombs there, and many of them will be left there, or you have to make them explode, and, thereby, you're going to break out big chunks of reefs. These are not small bombs. This is not your typical Coca-Cola-sized bomb.

KEVIN MCCARTHY: If they are left there, that effectively excludes anyone from going in, right? Thereby, you have a conservation zone brought about by the necessity of staying away from the bombs.

RICHARD APPELDOORN: We have comments from Churchill and then Marcos.

CHURCHILL GRIMES: I was just going to agree with you, Rich. If there is something dangerous there and you are precluded from going there, that has a conservation benefit, and, also, there are usually areas where they are conducting operations near bases that they don't allow the public to come there, period, and so they reduce the impacts on it, and that has a conservation benefit.

RICHARD APPELDOORN: Marcos.

MARCOS HANKE: I am sorry to be a little late, but the recreational diving in Roosevelt Roads -- There is a company called Pure Adventure, and the majority of the trainings and the operation that they do is on the naval base that before they couldn't use, and there is a lot of recreational divers that used to dive from the shoreline on that facility. It's not a minor activity going on in relation to diving in Roosevelt Roads right now.

JOE KIMMEL: Marcos, you're saying that the military base and recreational diving connection should be a one or something like that?

MARCOS HANKE: At least one, yes. I think one, because one of the biggest naval bases that we have, the footprint there and the old activity is there, and this is what is going on now, and it's not just -- There is a business related to it, but the recreational independent divers are using that as a resource for the activity, and, actually, Humacao University, the training for the students is done from, part of it, is done from the shoreline of Roosevelt Roads.

JOE KIMMEL: Okay. Everybody else had agreed to a zero there, and so what does everybody else think about Marcos's comments?

KEVIN MCCARTHY: Is it still an active military base, or has it shifted to completely civilian use, in which case it's part of recreational diving in general, right?

MARCOS HANKE: Yes, partially, but there is still some areas that are federally-managed, and it's not all the structure, but there is a little blend of both, I believe. The areas that I am talking about, yes, are public access right now.

JOE KIMMEL: Okay. We've got to make a decision here, guys. What do you want to put in that box? We had a zero in there before,

and now we're sort of debating whether to put a one or a two or something in there.

JUAN CRUZ-MOTTA: How many Navy bases are active in Puerto Rico and the USVI?

GRACIELA GARCIA-MOLINER: Active, none. There might be some federal oversight of some of them, but, as for the military, the way they used to be, really none. I mean, you do have the training sectors, the Coast Guard and things like that, that use the bases for their training in-house, like school type of training, but, other than that --

RICHARD APPELDOORN: Well, the Coast Guard themselves would be considered a military use, under the context of how we're talking about this.

GRACIELA GARCIA-MOLINER: SO it would be one in San Juan and Charlotte Amalie, and I don't know if they have a special place in the port of St. Croix, but not the presence that we had before in any of the islands.

JORGE GARCIA-SAIS: It's like some recreational divers are military, but so are accountants and so many other professionals, and it's fortuitous. It's nothing like there is concentrated recreational diving based on the military guys. It's not happening. They're just like one more, just like anybody else.

RICHARD APPELDOORN: Yes, and so a zero. Let's see if we can get this last box done.

JOE KIMMEL: Okay, and so we're staying with a zero for the recreational diving block?

RICHARD APPELDOORN: Yes.

JOE KIMMEL: I think we were headed towards a one on the military uses and the conservation and restoration, because of restrictions that the military might put in some areas.

JORGE GARCIA-SAIS: That is something that I would give -- But you can go ahead with my opposition, and you can go ahead, because I believe that I'm probably the only one against this classification, but whatever, and I would have put at least a minus-one, because the bombs are there, and they were not there before, and so, for me, that's not conservation.

I mean, the consequences of that bring about the conservation or

whatever, and good, but, now, look at the case of Vieques. There is a legitimate intent of recuperating those areas for recreational activities, and, right now, they are full of bombs, and so is that good for conservation?

Well, maybe yes, but it detracts from the overall value, recreational value, of the place that could be used for recreation with conservation at the same time, with adequate measures, and now it's -- The value of those marine seascapes have been lost because of the bombs being there. Then the alternative for exploding them would destroy the reefs, and so, from my standpoint, it's a negative all the way around, but I know that -- Maybe I am not the only one that thinks this way, and so I will go with whatever you want.

VANCE VICENTE: Reni, you have a good point. Back ten years ago, there was a coral specialist that came from the University of Georgia, and we conducted a scientific study regarding incidents of coral diseases on reefs that were heavily impacted by shells from bombs, and also throughout the whole different range of conditions, and we found a significant higher incidence of coral diseases in those reefs that were receiving direct and indirect impacts of the bombing, and so I agree with you that those reefs will never be the same, and they have lost a lot of their ecological value and aesthetical value, and so that's a good point, Reni.

TARSILA SEARA: I think this goes back to a previous comment by Walter as well, and I think all these relationships with conservation and restoration are going to be very difficult to characterize as positive and negative, and the same for development and military uses, because there will be impacts that will cause a need for conservation and restoration, but there are also mechanisms that will, through development and military uses, that will fund or support these conservation and restoration strategies, and so I think these are some of those very difficult to characterize relationships, in my opinion.

RICHARD APPELDOORN: I agree with that, and we were handling that by giving it a color of blue, when we were talking about the boxes in your presentation, and maybe we should just do that here.

JOE KIMMEL: So, Rich, the blue color means you have a one and you're not sure of it, and is that what the blue --

RICHARD APPELDOORN: No. It means the direction could go either way.

JOE KIMMEL: Okay. Well, a blue one sounds good to me. Any more

comments on that particular row, anything in that row?

WALTER KEITHLY: Based on the comments we just heard, would that be the situation with many of these conservation/restoration boxes, components? Again, I argued, on the last one, that it's very uncertain, because of restoration or mitigation issues, and, because of that argument and Vance's response, it went from a minus-two to a minus-three, which I didn't respond to at the time, but it's at least acknowledged that there are restoration and mitigation issues, and sometimes they're successful, and sometimes they're not successful, but sometimes it's a three-to-one mitigation even, and so, at the time, it didn't make sense to me to change those from a minus-two to a minus-three, and I think all of these should be put in blue, if that's where we're going.

TARSILA SEARA: That was my argument, was for all of those boxes to be blue, all the development and military uses, and so I would agree with that.

JOE KIMMEL: Comments from anybody else?

RICHARD APPELDOORN: This is with respect to conservation and restoration?

TARSILA SEARA: Yes, and so coming from marine development and coastal development, and so just I think, in my opinion, all of those, and so going from marine development and coastal development and military uses to conservation and restoration, and so, right now, we have minus-one, minus-three, and then one. I think all of those should be undefined, in terms of positive and negative, because of everything that was discussed, and I totally agree with everybody's comments.

RICHARD APPELDOORN: Well, I am going to disagree, because the issue here is these are competing resources, and so this is a spatial thing, and does marine development promote the closing of areas, or the restoration of existing things, or does it discourage that?

I could think of -- Maybe it can go both ways, but so it's not whether it degrades or makes better the resource, but it's whether you are actually implementing some kind of conservation and restoration closure, and that's the competition for fishing, right, is you're setting aside something, and so those are the activities that we're talking about. Are these things promoting those kinds of activities or not?

WALTER KEITHLY: I'm not sure what you just said, Rich. Depending

on the success of a restoration project, or a mitigation project, you could enhance fishing activities, vis-à-vis the status quo.

RICHARD APPELDOORN: Yes, but it's not that. It's whether -- It's like a three-to-one, like you're talking about, and it's successful, and then you have created something new, and hopefully in perpetuity, and then you have that effect. Vance was just saying, if it's a one-to-one, you haven't changed anything, and the reality is that most of the conservation or restoration efforts and these permits don't work well.

They work to some degree, and so even a one-to-one is not getting you back to where you were. Artificial mangroves and artificial seagrass beds just aren't real seagrass beds, and they quite frequently don't survive natural disturbances, because they're just in the wrong spot. We really need to close this discussion, and so I am fine with just putting all of those in blue.

JUAN CRUZ-MOTTA: I would strongly disagree with putting a blue for the coastal development. What you are discussing, I totally agree with you, and that might be happening in other parts of the states, but, here in Puerto Rico, there is a strong conflict between coastal development and conservation and restoration initiatives. That I got a permit to build and then I did the restoration, it's not happening.

Here, there is a strong conflict between coastal development, which is, by the way, very disorganized, and a lot of that coastal development is done unlawfully, and a very good example of that is the west coast of Puerto Rico, and so, if the majority says, okay, let's put it through, then fine. That is my personal and strong opinion, that the coastal development has a high negative impact on conservation and restoration. Thank you.

WALTER KEITHLY: You all know the situation down there better than I do, and so I'm willing to go with what everybody else thinks. I am the one that brought up the issue of mitigation to begin with, because I think everybody had forgotten that when we had started this exercise. Thank you.

RICHARD APPELDOORN: So I'm going to agree with J.J., and that one should stay a minus-three.

JOE KIMMEL: I'm good with that as well, Rich. Okay. I think everybody has heard all the discussion, and we're going to stick with a three in that particular box, a black three, a minus-three, and I will move on to the noise generation.

RICHARD APPELDOORN: No, you're not. I'm sorry, but we have to terminate discussion now. It's after 12:30, and we have two presentations that need to be given, and so this is really as far as we're going in the sub-model, and we're going to have to pick that up at another time, which I'm sure that Graciela would be glad to schedule for us.

GRACIELA GARCIA-MOLINER: Definitely.

RICHARD APPELDOORN: At this point, we would like to hear the presentation on the marine ecosystem something, and I don't have the agenda in front of me.

GRACIELA GARCIA-MOLINER: Kelly, do you want to be the presenter?

CARIBBEAN ECOSYSTEM STATUS REPORT UPDATE (156:23)

KELLY MONTENERO: Sure. Everyone on the call, I believe, received a copy of the presentation, just in case you want to peruse it later. Thank you so much for giving me a chance to present, everyone. It's been really interesting listening in on the meeting and hearing about the conceptual model.

We're going to shake things up a little bit right now, and I'm going to give you guys an overview of a different project, and it's related, but it's different, and so we're switching gears right now.

I wanted to introduce myself. My name is Kelly Montenero, and I'm also presenting on behalf of my co-worker and proposal author, Dr. Mandy Karnauskas, who you guys are I think all familiar with. I work for the University of Miami Cooperative Institute of Marine and Atmospheric Studies. I am based in Miami, Florida, and this project is funded by NOAA's Southeast Fisheries Science, and so we're affiliated through that, and Mandy is, obviously, at the Science Center in Miami.

All right, and so what is an ecosystem status report? What are we switching gears to? There's a lot of text there for you, but here's our definition of what an ecosystem status report is. It's a product that provides information on past and possible future conditions of marine ecosystems, based on suites of indicators. This information is intended to provide context for a range of decisions affecting marine ecosystems and supporting an ecosystem approach to resource management, and so an EBM idea.

Why this is relevant to our conversation right now is they are routinely used in the U.S. among fishery management regions, and

they're also used for other purposes, such as the National Marine Sanctuary system and also similar efforts internationally on large-scale to small-scale regions, and so it's a good way to get that information on conditions of resources, specifically ecosystem-based management based on a suite of indicators.

All right, and so this is giving you a little bit more of an example, and so ecosystem status reports, or ESRs, because you know that we love to use acronyms at NOAA, summarize status and trends over time, which is key to remember here, in a suite of vetted indicators, and these reports can provide a broad overview of the current state of integrated components, and we're focusing on social, economic, ecological, and physical components here of a marine ecosystem.

What I am showing you here in these different figures are examples from the Gulf of Mexico ecosystem status report, authored by Dr. Mandy Karnauskas, and an example from the California Current ecosystem status report. On the left, you will see a time series graph showing status and trends of dissolved oxygen in the Gulf of Mexico, and, on the right, you will see a cluster analysis of forage fish abundance in the California Current, just to give you a different example of what this report -- What talking about specific indicators might look like.

All right, and so how are they used in management? We've got a couple of examples here, and I know that we're tight on time, and so, as long as everyone is okay with looking at the materials that Graciela distributed, and these are all hyperlinks in the presentation that you have, and feel free to explore them more at your leisure, so I don't take up everyone's whole afternoon here, but we've got an example from the Pacific and how their FEP requires a yearly ecosystem report, describing status and trends and the context for decision making. Again, you can click on that figure and read more about it.

Up in Alaska, there is single-species quotas set in the context of ecosystem information provided by the ESR, and, in the Mid-Atlantic, and the Northeast as well, indicators are linked to specific management objectives, and so here's a couple of different ways that this ESR can be directly used in fisheries management, so that it's a useful product, always our goal.

Zooming in on our proposed process for our Caribbean ecosystem status report project, we've got this nice flow chart here for you showing that we're not just making these up out of thin air, and so this is our proposed process for selecting indicators and then calculating status and trends of these indicators to produce an

ecosystem status report, and so that's the end goal of this process, but I wanted to lay it out for you guys, so you can see how we're going through this process and see if it makes sense to everyone.

We are working from the individual fishery management plans of each island group in the Caribbean to compile a list of fishery objectives, and so thank you to everyone that worked on those, because it's kind of like the standing on the shoulders of giants idea. I am able to build on previous efforts, versus reinventing the wheel right now, and so that's been super useful.

From a fishery management plan list of objectives, if the objective maps directly to a single indicator, from these conceptual models that you guys have been working tirelessly on, both during this week and previous meetings, that's our indicator selection, which is great. We just calculate the indicators from that and use that to create our ecosystem status report.

If the objectives don't match, particularly to a single indicator from the conceptual model, we go by categories and by topic/component, and then we plan to work with expert working groups remotely/virtually, as COVID requires right now, as well as using those conceptual models that you guys have been working on.

From these two boxes, it will lead to a candidate or a proposed list of potential indicators. If that's a pretty clear one-to-one, that goes directly into calculating indicators and then writing and producing an ecosystem status report product. If not, or if we're not comfortable with directly matching things up, we will go into an indicator vetting/scoring process, and so that will be revised, I guess, by indicator criteria, which I will go into in a minute, and asking experts to score indicators based on their best fit to these different criteria.

The scoring process, which is individually done, will lead to indicator selection, and that suite of vetted, best-fit indicators will be calculated to show status and trends over time, leading to that ecosystem status report product, and so a couple of different choose-your-own-adventure routes, kind of, based on whether there is a one-to-one match between an indicator and an objective, building off of the conceptual models.

That criteria for selecting best-fit indicators is laid out here for you, and this is what we're thinking of so far, but I would love to hear input, feedback, and thoughts on this, either today or when you get a chance, when we're not taking up your whole afternoon, but you can see that our indicators need to have long-

term data available for them. Otherwise, unfortunately, it's pretty hard to draw concrete status and trends figures and graphs from that.

These indicators need to be measurable, and so not just like a yes or no or a black and white, but something that we can measure. They need to be sensitive to changes in the environment. If we're showing the condition, it needs to be sensitive to changes in the condition.

They need to be specific, and these indicators need to have scalability, both through time and through space, and, obviously, they need to be relevant to the fishery management plan objectives, and, finally, they need to be responsive to management actions, and so that's something that management bodies, resource managers individually, can think, if I change my management actions, will this show a change in condition with these indicators.

Here's a timeline of our plan for the work, and there's a lot of small text on there, and I began as a contractor on this project in February of this year, and there is funding for two years, as I have noted on there, for this project, and so that's great, because we can get feedback and make sure that this is a useful product for the region.

There's a couple of things that you guys just need to note on here and that will probably come up for you. As a follow-up after presenting this, both to the SSC and the TAP, I'm hoping to get feedback on potential indicators to be included, as you saw in that process flow chart, and so you will probably be getting a request to potentially complete what we're calling a decision matrix that is scoring the process for selecting top indicators per component and objectives for our vetted indicator suite.

I will be working on data collection, which will be a nice outcome from this product, and then creating that status and trends analysis. I hope to get feedback from the work from management bodies in, obviously, depending on travel restrictions, in late fall of this year, or maybe early next year, and then we're hoping to adopt products following feedback from the council and management bodes and advisory bodies, products that are useful, and make a plan for how to update this report, potentially just with key indicators, potentially with tools that allow stakeholders to explore the indicators, and that remains to be seen, but, again, this is an overall two-year process, but I just wanted to show you guys our timeline for specific action items.

Like I said, and I know that I'm standing on the shoulders of

giants with other ongoing efforts, and we explained how the indicator selection process is going to start by drawing from the conceptual models that you guys have been working on all week, and we've been matching our components of the system with the conceptual models to guide indicator selection, and that's our starting block, but we'll add to that, based on our indicator criteria with indicators that have data availability and are sensitive and are relevant to management actions with fishery management plan objectives and so on.

The ESR will be a synthesis and visualization of data that has already been compiled through various efforts as well, and we'll be adding to that, by making sure that we have the data collection for selected indicators, but, as you're aware, the EBFM working group has done a lot of work on data compilation, and so that's going to be discussing with them what they've done so far or where we can build off of that, what we can use.

The SEDAR data compilation from NOAA's Science Center and other data from the SEFSC and other academic groups, and, obviously, the data compilation from Lenfest, and we're hoping to be able to dovetail those efforts, so that we're not being repetitive and taking up too much of any expert's time.

I tried to kind of explain how these projects are different, but complementary, and we heard from J.J. yesterday in talking about his model technique, in a snapshot sense, and our ESR project will identify indicators matched specifically with management objectives and analyze status and trends in a timeline sense, more of a linear timeline overall, showing changes in condition, and it can result in spinoff projects for continued evaluation and management applications, and both of these projects are planning to build on previous efforts for ecosystem-based management.

Finally, how we envision this ecosystem status report to be used, it will allow managers to understand whether management objectives are being met. It will give a broader ecosystem context, including those specific components of physical, biological, social, and economic decision-making. Right now, with COVID-19 being on all of our minds, it will help us understand the impacts of acute major stressors, whether that's hurricanes, bleaching, disease events for coral, and COVID-19, obviously.

All right. Finally, here are some questions that I have for you guys, if time allows. If not, feel free to email me, and my email is on the following slide, and I would definitely welcome feedback from these questions.

First off, I wanted to make sure that using the fishery management plan objectives and conceptual models in this context makes sense to the SSC and everyone on this call. Does anyone have thoughts on that immediately, before I move on to my other questions?

Hearing silence, I understand that you've got a lot of information in a little bit of time, and so, if you want to think on it and brainstorm on it, since this is definitely switching gears, and get back to Mandy and I via email, we would definitely welcome that, but, if you have ideas right now that you would like to share, I would also welcome that.

BILL ARNOLD: Kelly, to give you one answer, I would say that, at least as a starting point, the FMP objectives and conceptual models -- Yes, those are good things to be using for your objectives.

KELLY MONTENERO: Okay. Great. Thank you so much.

BILL ARNOLD: I think we'll talk more about that at the TAP meeting.

KELLY MONTENERO: Exactly. Does anyone else have any thoughts about using the FMP objectives and the conceptual models in this report?

RICHARD APPELDOORN: I would just say that I hope that's why we're doing this.

KELLY MONTENERO: Well, that's a good use for it, right? That's good feedback as well. I am just making sure that I am accurately reading the purpose of the conceptual models and the fishery management plan objectives, and so thank you so much for all of your work on that.

BILL ARNOLD: Kelly, I have a question. You've got a timeline that's very nice, but it's just one through twenty-four months. We're going to need -- The council is going to need specific guidance on how these things tie together, and so if you could give us an idea of the latest date in your constrained project as to when you have to have those indicators, or at least some list of preliminary or tentative indicators, that would guide the need to get these conceptual models done, so that we can provide you with that information while you're still funded and active.

KELLY MONTENERO: I definitely appreciate that thought process, and you guys have made so much progress this week that it makes me feel very positive about that. Just so everyone knows, I also plan to give this overview of the project and seek feedback from the TAP meeting coming up in early June that Bill was referring

to, and so, after that, I'm hoping to dovetail the conceptual models and our proposed indicators that are matched to those fishery management plan objectives. My timeline right now has me doing that in early to mid-July, to have that vetted indicator suite, and does that sound reasonable, or do you think that's too ambitious?

BILL ARNOLD: For me, realistically, it's way too ambitious. I wish it wasn't, but I think it is.

KELLY MONTENERO: All right. What do you think about working off of the drafts that will be from the results of this week of meetings?

MANDY KARNAUSKAS: I think what we would envision, Bill, to answer your question, is we have everything we need from the conceptual models. I mean, we don't need a finalized model to be able to go forward, and taking information that you guys have put together so far gives us an indication for the different pieces that we need to be looking at, but I think we have everything that we need at this point to be able to move forward.

KELLY MONTENERO: Thank you so much for clarifying that, Mandy.

BILL ARNOLD: That's comforting news. Thank you, Mandy.

KELLY MONTENERO: It's been great to get those indicators and components of the conceptual model, and we don't really -- For this project, we don't need the scores specifically, and it's been good to see the connections, but we don't need the finalized scores of connections.

JUAN CRUZ-MOTTA: I have a question. Can you give us an example of an indicator that you have derived from the conceptual models that we have done, or two or three?

KELLY MONTENERO: Sure. I've done a little bit of like mental gymnastics to go from components to fishery management plan objectives and then matching that with the conceptual models to getting indicators that have data as proposed indicators, but some are obviously easier than others.

When we talk about salinity, for example, that can change to be changes in salinity in a specific region over time. It's just defining it a little bit more, rather than going from the larger idea to something that is scalable and relevant. From the socioeconomic standpoint, looking at population trends along the coast related to fishery management plan objectives, and, from the

conceptual models, again, as a way to down-scale it, something that is specific and defined, but, when it's not a specific one-to-one, we'll be reaching out for volunteers for expert working groups.

It would not be a huge demand on your time, and I didn't say this, but we've done this same what we're calling decision matrix process in the Florida Keys, to select best-fit indicators, and we were able to get it done in one day, just as long as people emailed me as soon as they had their scoring done, and so I'm not planning on taking up a ton more of your time, because I know that everyone is probably a little fatigued at the end of this week.

That's why I talk about potential indicators and then using a decision matrix to select specific options from that, based on input from expert working groups, both from this group and from academic groups and experts in the region. We're specifically looking at agencies as well, and so thank you for that.

Does anyone else have any other feedback on the process that we laid out in our flow chart? Does it make sense? Do you want more examples?

RICHARD APPELDOORN: I don't think we need more examples.

KELLY MONTENERO: All right. Thank you, Richard. If you have more thoughts later, please let me know.

JASON COPE: I was just going to thank Kelly for -- I mean, this overview was great, and there's certainly a lot to think about, but it's a good place for us to revisit, and thank you for this presentation.

KELLY MONTENERO: Excellent. Thank you so much, Jason, and thank you for your input. With that, I'm going to give you this warning right now that I might be reaching out to you with a request for input or maybe your time, and I guess that's for like a one-day process, as an expert in our working groups. Of course, don't feel the need to spend tons of time on it, but I would greatly, greatly value volunteers and feedback.

With that, I wanted to say thank you so much for letting me present during the very end of this weeklong meeting. It's been very educational to listen to this process, and here's my email address, and, just in case you don't have Mandy's email address, this is how you can reach out to us. I am hoping that you get a chance to look through these materials in the future and think about any feedback and answers to my questions and thoughts on the process,

et cetera, but I mostly wanted to make sure that this group was aware of the beginning of this project, and so, again, thank you so much for your time, and please reach out if you have any questions or feedback or thoughts, et cetera. Great. Thank you so much.

JOE KIMMEL: Kelly, thank you for your presentation. It was a good presentation.

KELLY MONTENERO: Thank you.

JUAN CRUZ-MOTTA: Yes, thank you. It was really good and very clear. Just, for the record, I just want to say that Lenfest is doing a lot more than what you state in your slide.

KELLY MONTENERO: I'm sorry. I apologize about that, J.J. I was trying to --

JUAN CRUZ-MOTTA: Yes, and it was just an example of one of the tools that we have used in the past and one of the tools that we think we will use in the future, and that was trying to move the discussion along, and that's not the final objective of Lenfest, but thank you for the presentation.

KELLY MONTENERO: All right. Yes, and thank you for clarifying that one, J.J. That's super helpful. All right. Thank you.

RICHARD APPELDOORN: All right. Thank you, Kelly. Then, very quickly, to the last presentation, which I think is on the reporting system. Graciela.

GRACIELA GARCIA-MOLINER: We are going to Alfredo. We're transferring -- You already have it. This is e-reporting, and so it's Alfredo and Ricardo, but I think Alfredo is presenting.

PR DNER E-REPORTING UPDATE (183:06)

ALFREDO SFEIR: Yes. When we started this project, I will never forget the first meeting with Puerto Rican fishermen, DRNA, and the Nature Conservancy. That meeting, what they added to it and what they would say, would pave the way for this work, for this fully-customized system to Puerto Rico. Thanks to the fishermen's beta testing, they helped us understand how to save them time. Thanks to the full engagement of Ricardo's Department of Statistics and all the team, we could really get away from paper and help them focus more on data recollection and collection.

TNC gave us all the leeway and the support, and so all these

factors really helped us raise the bar. We felt we had everything we needed to be successful, and so when is the system available? These are the questions that we've been asked, and it's actually been available since the 27th of February, with an administrative order.

Today, we have over 300 fishermen already using the system, with close to 900 data inputs, and so we have gone through a lot of work with DRNA to make this process flow, and with a lot of feedback from fishermen. This is also been on the news, and maybe most of you have seen it, and some of you in the room even have also helped us out, and so a special shoutout to some of those who are there who have helped us in the process.

This has been -- Since its launch, it's had a pretty calculated communication strategy, where even last Sunday, I think, DRNA published that it would start giving penalties to people who don't report, and so that actually even gave us a little jump in users.

Who did it? DNRA, TNC, and the Nature Conservancy and the NOAA Coral Reef Conservation Program and NFWF have been really critical to making this happen. Here, you can imagine Daniel Matos with his cup of coffee looking at the data, the visual map data, of where what species was fished when, and so all of this aggregated data, which is one of the features that we wanted to make sure was there, not only just collecting data, but also data for management.

What statistics does it collect? Well, here are the bases, which we did from scratch, to make sure -- The architecture was the species database, and also what are the results of having the fishermen, the species, the amount of fishing, and, really, I just wanted to make a special thanks to the chairman of the council, who brought up a case very recently that has been difficult over two times between the wenchman snapper and the cardinal snapper.

There has been clarification with Daniel Matos and NOAA that, basically, the difference -- In the case of the wenchman snapper, it wasn't even in the Erdmann catalog of species, and so this clarification, and, again, many thanks to the chairman, and it will help clarify doubts to the fishermen in Puerto Rico.

A special note was that statistical experiments were held, where apparently often reporting species -- 98 percent are cardinal snapper, and only 2 percent are wenchman, but these are the things that the system has complete flexibility to get input and to clarify and sophisticate and refine it.

What are the specific statistics? You have fishing statistics by

species, by fisherman, percentage in terms of the proportion of what is being caught, and you have a popularity ranking, what's most popular amongst the fishermen, in terms of catch, and we have the maps and all of the logging. We have a special prep area before DRNA can send the data to NOAA, and they have a workspace where they can see whether the data was actually correctly filled out by the fishermen.

All of this is combined with the dashboard, and, really, any additional statistics can be added in a growing manner, and there's also species management for agile changing and improvement of images, where we can't wait for the possibility to work on the API, to export directly to NOAA, and there is also communication with fishermen, where they get direct messages on closures on different things that DRNA and the Department of Statistics want to communicate to fishermen, and so, little by little, it's also turning into a management and communication platform. This is working offline and online, and so it does adapt itself for different fishermen environments.

One important point that people sometimes don't put enough emphasis on, and I need to really congratulate the Department of Statistics, and they go way beyond their work, but we implemented a call center with them, where they have a number, and please check it out. Call them.

If they're not there, you're going to get an answering machine, but they have been super amazing at responding as a team, and five of the team members, really on every ticket, every case, everything from usability to maybe even like something could scale up to -- Like Jeremy did, and, if it's a technological issue, we're also involved in the support center, and those issues, those tickets, get sent to us, but they have been really agile in dealing with so many calls.

They have even been getting calls from other issues related to DRNA and other systems, and so that's just a congratulations to the team, who took this, and really enthusiastically.

The progress reports are discussed at least once a month with DNER and TNC, and we were very fortunate also to work with a tremendous quality of industrial engineers at the University of Puerto Rico Mayaguez, really outstanding, and Fianeli was our hands on the ground, and he has been able to work very directly with DNER, and so we are very, very grateful to the university.

Thanks to Puerto Rico, we have been able to revamp and implement this in other countries and in a very sophisticated way, and we

are working with the same application, with, obviously, the Chilean variance and the Ecuadorian variance and the Mexican, which are different collection and different data, but this is scaling up, and Puerto Rico has a lot to do with this, because there was a lot of focus and a lot of exchanges and a lot of work.

Finally, just to say that Puerto Rico definitely can act as a tremendously scalable technological starting point for the future, and, obviously, as Peter Drucker says, what you can't measure, you can't manage, and now the first harvest supply chain, and the supply chain has issues, as we all know, and you know better than I, and so the first step in data collection efficiency has been made.

There's a lot of potential scaling up. For example, there could be scaling towards the fishermen, in terms of more strict data collection, and it's completely about integrating different data points, and you can very immediately run a traceability program with labels that the application can scale to that very, very quickly, and you can monitor different components along the supply chain.

We're working in different areas to make sure that we can offer sort of the most integral, or integrated, solution that can scale in any way to be able to continue getting data along the supply chain, be it as a, for example, COVID response to isolated fishermen in Latin American or just specific traceability program or basically targeting a specific species that have problems or specific fishing techniques. Anyway, I will stop there, and I'm sure that everybody wants to go to lunch, or is having lunch, and thank you for letting me present to you today.

JOE KIMMEL: Alfredo, I am really happy to see that they're turning to a cellphone data entry thing, and it's an instantaneous process here. I wish you the most success in the world in getting it going, wherever you try to make it go. I also want to let Rich know there is some chat in the chat box, and it may be that either you should read or that somebody should read to you there.

ALFREDO SFEIR: Thank you very much, Joe. I will go straight to the chat box as well.

KEVIN MCCARTHY: Before we do that, Alfredo, this was a really nice presentation. I work with these data a lot, and, rather than taking up a bunch of time, I would like to shoot you an email sometime, and maybe we can have a call and discuss this, because I have loads of questions. This is really nice work, and so I will catch up with you via email and arrange for a separate call,

if that's possible.

ALFREDO SFEIR: Thank you for your support, and I'm really looking forward to it. A lot of people put their hands on this and made it happen, and it's really such a joint effort. Thank you. I'm really looking forward to talking to you.

RICHARD APPELDOORN: Thank you, Alfredo. Vanessa, would you like to comment, relative to what you put in the chat?

VANESSA RAMIREZ: Thanks, Richard. I would just comment -- Because of the way that it was introduced to the fishermen, and practically the way that the news put this, it's very hard right now, and they are very afraid of the penalties that they are going to have, and many of our fishermen don't know how to use the app, which they have a small phone, or they don't even know how to read or write.

For people that have a disadvantage in technology, it has been really hard, and so I suggest that we should expand more training for them, and just remember that this is a new thing for everyone, and so, if on paper they never put their real numbers, just imagine what they are going to do in the electronic way, and so we need help with this, and we need to start again the conversation with the fishermen around.

DAMARIS DELGADO: May I speak, for clarification purposes? I would like to thank Alfredo and Vanessa for their comments. We are still receiving these statistics by mail, by regular mail, and we will still receive them, for the people that do not manage well the application, and so there is still that option for the fishers, and I just wanted to clarify that.

JOE KIMMEL: Vanessa had a good point. The fishermen, if they don't want to report the right number, they are not going to report the right number, and so, somehow, there needs to be a verification part of this, where somebody, either at the fish house or the market or whatever, also has input to this process, just to verify what the fishermen have said.

KEVIN MCCARTHY: We have that very program happening with dockside interviews, to have another source of collecting at least the landings data. There's a lot -- You know, we can't tell where they were fishing and things like that that may show up on this data collection effort, but we can at least get at landings and certainly number of trips and that kind of thing, and so we do have that ongoing in Puerto Rico, and we're getting it started up in the Virgin Islands, and so you're right on the money as far as that second round of verification goes, and we're trying to make

it happen.

JOE KIMMEL: Thank you, Kevin. I appreciate it.

RICHARD APPELDOORN: All right. I would like to see if Nelson would like to make a comment relative to what he put in the chat.

GRACIELA GARCIA-MOLINER: His microphone is not working, and so let me read what he said earlier. He is really happy with this project. For many years they have been waiting for it, but we can't ignore the high value of -- It's very important, the issues of the poachers and not reporting the data, because that is data that is never going to be recorded. Anything else, Nelson?

RICHARD APPELDOORN: Of course, that's a problem that exists regardless of the reporting method.

GRACIELA GARCIA-MOLINER: It's the same.

RICHARD APPELDOORN: Okay. I am not seeing any more comments.

GRACIELA GARCIA-MOLINER: Mr. Chair, if I may, I do have a question about making sure that there is no duplicity of records at the Southeast Fisheries Science Center in providing the data for analysis, et cetera, and so, Kevin, when you guys figure that out, can you report back to me, please?

KEVIN MCCARTHY: Could you repeat that question, please?

GRACIELA GARCIA-MOLINER: Can everyone hear me?

RICHARD APPELDOORN: I heard you, but could you just repeat it?

WALTER KEITHLY: May I ask one quick question, before we adjourn?

RICHARD APPELDOORN: Wait a minute, Walter. Graciela, would you repeat your statement for Kevin?

GRACIELA GARCIA-MOLINER: Kevin, we have this e-reporting, and then we have the regular forms that the fishermen still fill out, and so we have to make sure that there is no duplication of data as it goes to the Southeast Fisheries Science Center that officially supplies the information to the council. At some point, we have to have a conversation about that, to make sure that we are not counting double records, et cetera.

KEVIN MCCARTHY: Yes, I agree, and that is one of the many questions that Alfredo and I will be discussing, and that's why I wanted to

have that separate call, because I've got lots of questions, and that's among them, and so, yes, you're correct. Thanks.

GRACIELA GARCIA-MOLINER: Okay, because, officially, the data that we receive, we receive it from the Southeast Fisheries Science Center, and that makes it the best available information that goes to us, and so, that link, we need to make sure that it's appropriate. Thanks.

RICHARD APPELDOORN: Go ahead, Walter.

WALTER KEITHLY: Mr. Chairman, I just have a -- I may have missed it, but Graciela just answered part of my thoughts. When was this project initiated?

ALFREDO SFEIR: This project started two years ago.

WALTER KEITHLY: Okay. If that's the case, we saw a very large increase in lobster landings, and might that be because of either the duplication of the data between the hard copies and the cellphone records, or it may just be an increase in reporting in general, and, again, I think the Center really needs to go into those 2019 provisional landings and check that carefully. Thank you.

KEVIN MCCARTHY: Yes, we are going to be looking at that, and we do have some QA/QC procedures in place to look at things like duplicate records, although, if these data are somewhat different in some way, it may escape those sort of automatic procedures, and so, yes, you're correct, Walter, that we are already having a look at 2019.

RICHARD APPELDOORN: Yes, but Alfredo mentioned that this went operational this year, and so it may not be affected by that.

ALFREDO SFEIR: I thought when the project started, but I'm sorry, and I probably mis-answered that, and it's the 27th of February that the actually -- That this started, officially.

WALTER KEITHLY: Okay. I may have just missed that. Thank you for the clarification.

ALFREDO SFEIR: Sorry about that.

RICHARD APPELDOORN: Okay. At this point, I, for one, am very hungry, and I'm sure that everybody else is. It's been a really long week, and I want to thank everybody on the committee that was working hard to lead the discussions on these various sub-models

and the input that we received from other people who have been on this video conference.

I would also thank you all for your patience for making this format work as well as, I guess, it has, and, if there aren't any other comments, I would have the meeting adjourned. The committee will be hearing back from Graciela and myself about when to finish all of this.

GRACIELA GARCIA-MOLINER: Very soon.

RICHARD APPELDOORN: I think we're actually pretty close, given the guidance that J.J. had given us about how to proceed.

GRACIELA GARCIA-MOLINER: That's exactly what I told Miguel, and so you will be hearing from me very soon, Richard, and we'll send the email out as soon as possible.

RICHARD APPELDOORN: All right. Thank you, all.

(Whereupon, the meeting adjourned on May 22, 2020.)

- - -