

OVERVIEW OF EFFORTS TO FILL CRITICAL LIFE HISTORY INFORMATION GAPS FOR DATA-POOR REEF FISHES: UPCOMING SEDAR SPECIES

Jesús Rivera Hernández and Virginia Shervette

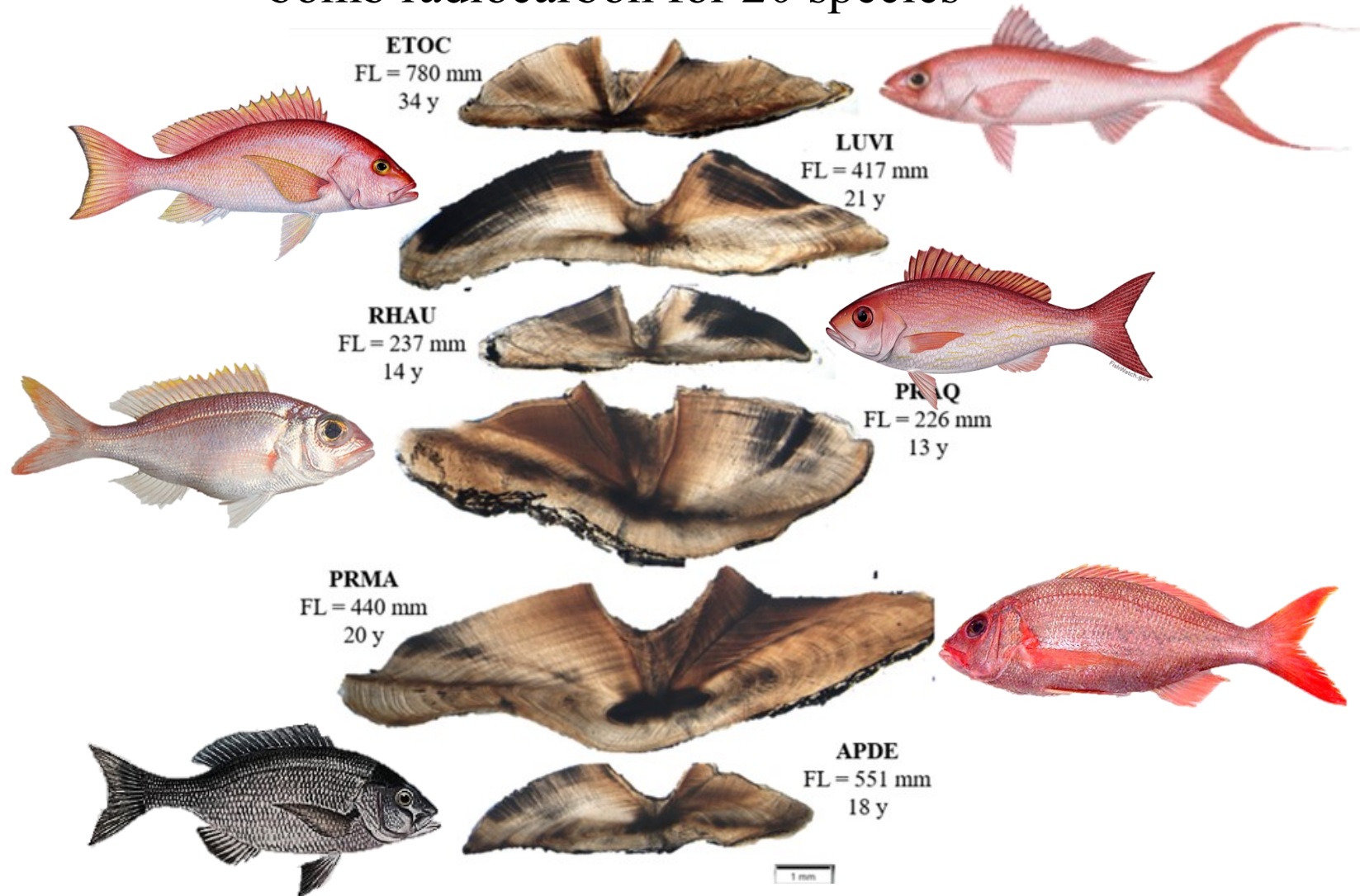
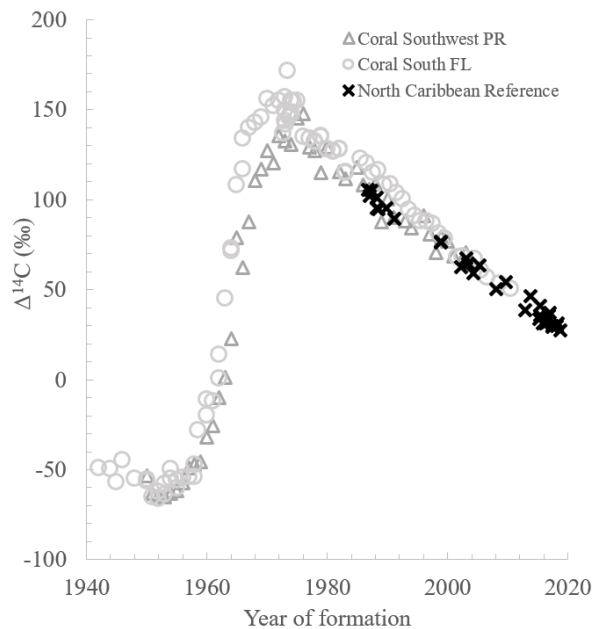
Collaborating researchers and fishers: Noemí Peña Alvarado and Wilson Santiago Soler, Puerto Rico DNER; Kate Overly, NMFS Panama City; Julien Magras, St. Thomas/St. John Fishermen's Association; Nicky Martinez, Omar Hughes, Bobby Thomas; Carlos Velazquez, Marcos Henke



Novel Approaches to Age Validation in Data-Poor U.S. Caribbean Reef Fishes

- Age is fundamental in estimating life history parameters
- Accurate age data are required to estimate growth, longevity, and mortality

- Established age estimation protocols validated via bomb radiocarbon for 20 species



Top landed reef fishes (ranked by total lbs landed) we are currently investigating for reproductive biology, population demographics, growth, and population connectivity/stock structure

STT/J

- 1. Queen triggerfish
- 2. Red hind
- 3. Yellowtail snapper
- 4. Blue runner
- 6. White grunt
- 10. Scrawled cowfish
- 11. Redtail parrotfish
- 12. Stoplight parrotfish
- 13. Mutton snapper
- 14. Coney
- 15 Bar jack
- 17. Hogfish
- 20. Blackfin snapper
- 23. Lane snapper



STX

- 1. Stoplight parrotfish
- 2. Yellowtail parrotfish
- 3. Redtail parrotfish
- 4. Queen triggerfish
- 5. Red hind
- 7. Princess parrotfish
- 8. Coney
- 9. Queen parrotfish
- 10. Redband parrotfish
- 11. Blackfin snapper
- 12. Yellowtail snapper
- 14. White grunt
- 18. Mutton snapper
- 23. Lane snapper



PR

- 1. Silk snapper
- 2. Yellowtail snapper
- 3. Queen snapper
- 4. Lane snapper
- 5. Queen t
- 6. Hogfish
- 7. Red hind
- 8. Boxfish
- 9. Mutton snapper
- 10. Stoplight parrotfish
- 11. Bar jack
- 12. Cardinal
- 13. Vermilion
- 14. Blackfin snapper
- 20. Coney

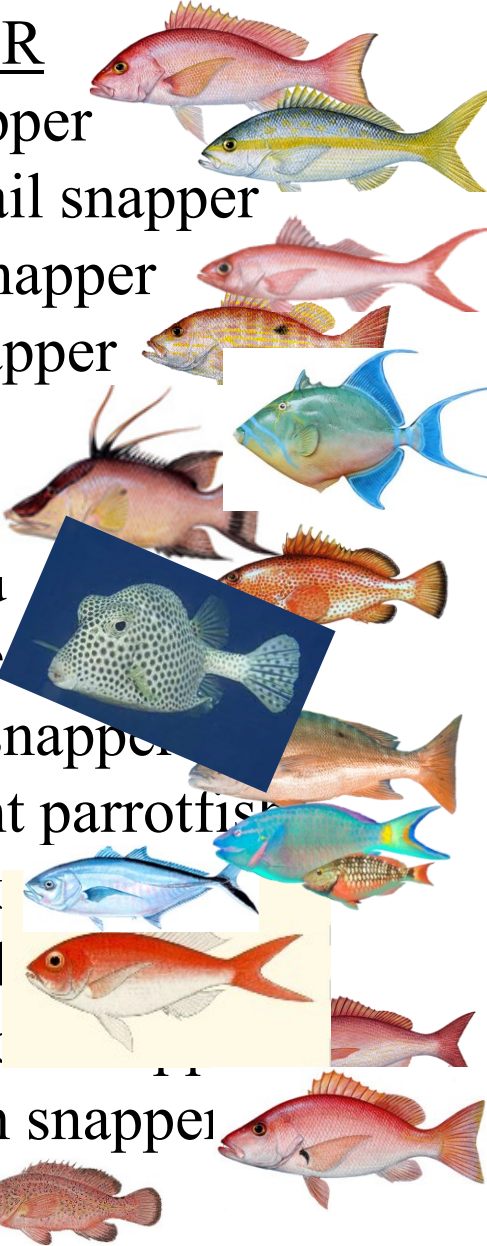


Table 1: SEDAR Project Planning Grid – October 2021 SEDAR Steering Committee Meeting Outcome

Table Color Legend:

Steering Committee Approved and SEFSC Scheduled Projects	FUTURE Requests
Steering Committee Approved, PENDING SEFSC SCHEDULING	2024 Preliminary Projects – To Be Finalized at the Spring 2022 Meeting
SEDAR SCHEDULE OVERVIEW – October 2021 SEDAR Steering Committee Discussion	

YEAR	SA Team				Gulf Team					Caribbean Team	HMS Team		FL FWCC	ASMFC GSMFC	CMP/ Shrimp
	1	2	3	4	1	2	3	4	5		1	2			
2021	Scamp RT	Red Snapper OA	Gag Grouper OA	Tilefish OA	Scamp RT	Gag Grouper OA	Red Snapper RT	Red Snapper RT		Queen Trigger PR-STX-STT OA	Hammerheads RT	Mutton Snapper Bench		Gulf Menhaden OA	
2022	Scamp OA		Spanish Mackerel OA		Scamp OA	Gray Snapper OA									
2023	Vermillion OA	Gray Triggerfish RT	Black Sea Bass OA						Gulf Spanish Mackerel OA	Yellowtail (PR & STT); Stoplight Parrotfish (STX)	HH OA	HH OA			ASFMC Red Drum (RW)
2024	Red Snapper RT	Gray Triggerfish OA	Tilefish OA	Blueline Tilefish OA	Red Grouper OA		Cobia OA	Vermillion OA	Gulf Shrimp RT	Spiny Lobster OA (all islands)	Bull, Spinner, Tiger, Finetooth Sharks RT		Hogfish Bench	Gulf Menhaden OA	
2025			Gag Grouper OA	Snowy Grouper OA	Red Porgy OA			Lane Snapper OA			Caribbean Hogfish			Black Grouper Bench?	
2026	Red Snapper OA	GAJ RT	White Grunt RT		GAJ RT	Gray Triggerfish OA	Tilefish or Blueline OA	Gag RT			Bull, Spinner, Tiger, Finetooth Sharks OA				
2027	Atlantic migratory Cobia OA									Gag OA					

Timing of projects shown in this table is approximate and is intended for SEDAR Steering Committee workload planning purposes only. Please consult individual project schedules for specific start and end dates.

Table 1: SEDAR Steering Committee Meeting Schedule Overview – October 2021 to 2027

YEAR	SA T1	SA T2
2021	Scamp RT	Red Snapper OA
2022	Scamp OA	Gray Triggerfish RT
2023	Vermillion OA	Gray Triggerfish OA
2024	Red Snapper RT	Gag Grouper OA
2025	Red Snapper OA	GAJ RT
2026	Atlantic migratory Cobia OA	
2027		

Timing of project planning purposes

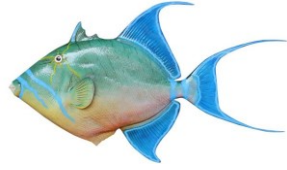
YEAR	Caribbean Team			Comments
	PR	STT/J	STX	
2021	Queen Triggerfish OA			Data gaps for life history: *Stratified random sampling for length of general population *Small, immature samples *Large fish from all three islands
2022				
2023	Yellowtail Snapper		Stoplight Parrotfish	Data gaps for life history: Yellowtail – need BIG FISH; more fish from STT/J Stoplight – need small and large fish
2024	Spiny Lobster			
2025	Hogfish ???	???	???	Data gaps for life history: FI samples Small and large fish STT/J – need more samples STX – not common in landings

Committee		
FL FWCC	ASMFC GSMFC	CMP/ Shrimp
	Gulf Menhaden OA	
Mutton Snapper Bench	ASFMC Menhaden OA	
	ASFMC Red Drum (RW)	
Hogfish Bench	Gulf Menhaden OA	
Black Grouper Bench?		King Mackerel OA (SA & Gulf)

Committee workload dates.

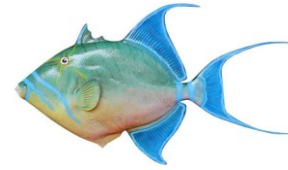
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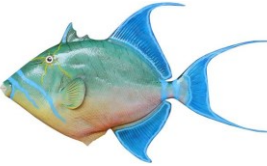
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STX

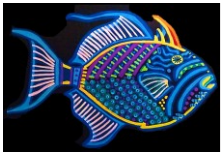


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PR



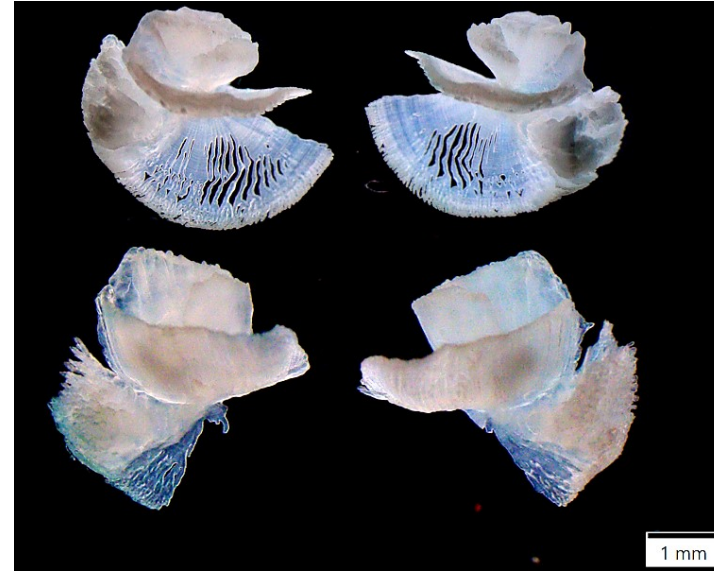
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12. Cardinal
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20. Coney



QUEEN TRIGGERFISH



- **Currently undergoing assessment for entire U.S. Caribbean**
- **Validation of otolith age estimates via $\Delta^{14}\text{C}$ analysis: longevity nearly tripled from 14 to 40 y (23 y Caribbean waters)**
- **Investigating population connectivity between NC/SC, FL, and U.S. Caribbean waters**

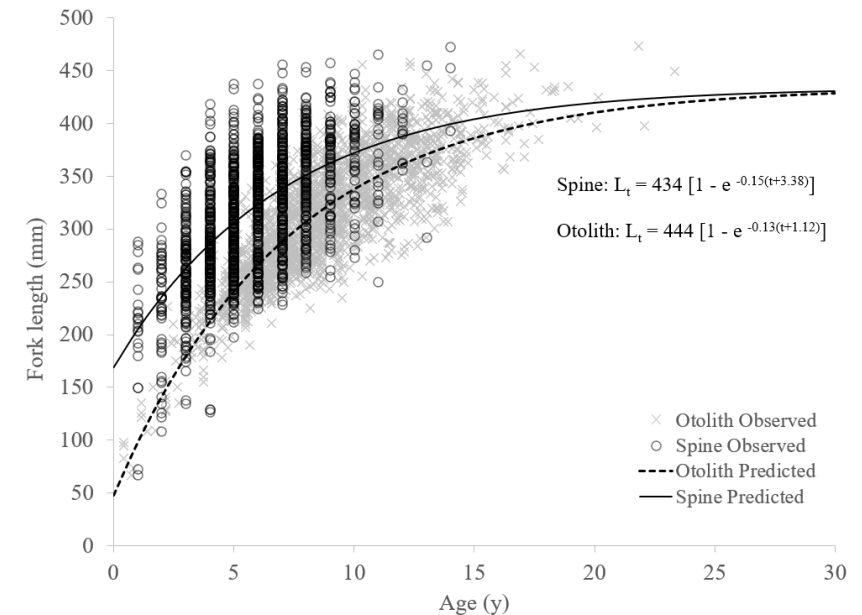


Left and right sagittal otoliths from two queen triggerfish samples. Note the unusual shape/morphology and the small and fragile nature of these otolith types.

Rivera Hernandez JM, Pena Alvarado N, Correa Velez K, Nemeth R, Appeldoorn R, Shervette V. 2019. Queen Triggerfish *Balistes vetula* reproductive biology in U.S. Caribbean waters. *Transactions of the American Fisheries Society* 148: 134-147.

Shervette VR, Rivera Hernandez (In Press). Queen triggerfish: radiocarbon validation of otolith-based age estimates, growth, and updated longevity PLOS ONE.

Rivera Hernandez JM, Shervette VR (In Prep). Queen triggerfish *Balistes vetula* population demographics in the northern Caribbean.



Species		Length-Age					Maturity	
		Max age	Size max age	L_{∞} mm	K	t_0	L_m mm	A_m years
Queen triggerfish	New	40 y 23 y Carib	427 FL 416 FL	430 FL M: 441 FL F: 412 FL	0.15 M: 0.15 F: 0.15	-0.59 M: -0.59 F: -0.59	M: 190 F: 233	M: 2.7 F: 4.6
	Stevens et al. 2019	14	393 FL	441 FL	0.14	-1.8	215 FL	2.97 y
Stoplight parrotfish	New	17 y	354 FL	351 FL	0.23	-0.67	163 FL	1.8 y
Queen snapper	New	63 y GOM	GOM ₆₃ : 914	GOM: 930 FL	GOM: 0.06	GOM: -0.08		
	Stevens et al. 2019	-	-	1020 FL	0.40	-0.29	-	-

Stevens et al. 2019. Life history demographic parameter synthesis for exploited Florida and Caribbean coral reef fishes.

Synthesized life history information for 84 commercially exploited tropical reef fish species from Florida and the U.S. Caribbean and attempted to identify a useable set of life history parameters for each species that included life span, length at age, and maturity.

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Stoplight Parrotfish STX

Ageing method validated via bomb radiocarbon; maximum age 17 y

Preliminary parrotfish genomics work indicates no major population structure for U.S. Caribbean

STX Fishery: Majority of stoplight caught via spearfishing at depths < 25 m

Sampling:

- STX F-D = 790; need F-I collections including juveniles and fish from deeper sites than where typically speared
- STT/J + PR + STX = 1939 total from a combination of depths
- Questions for SSC; sample collections



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Yellowtail snapper	New	26 y Carib	383 FL	No Juv: 537 TL W/Juv: 481 TL W/Juv: 390 FL	No Juv: 0.11 W/Juv: 0.17 W/Juv: 0.17	No Juv: -3.32 W/Juv: -1.79 W/Juv: -1.99	<i>In progress</i>	<i>In progress</i>
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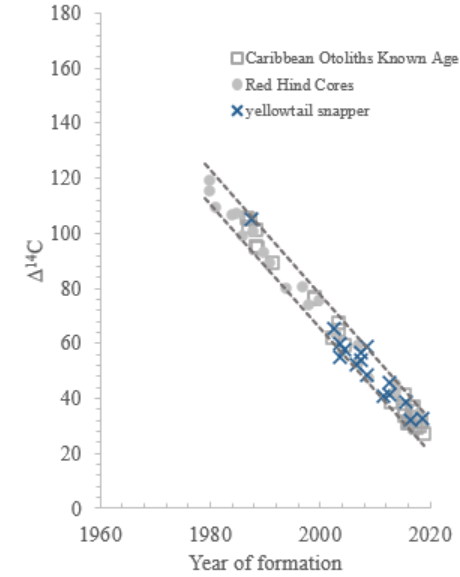
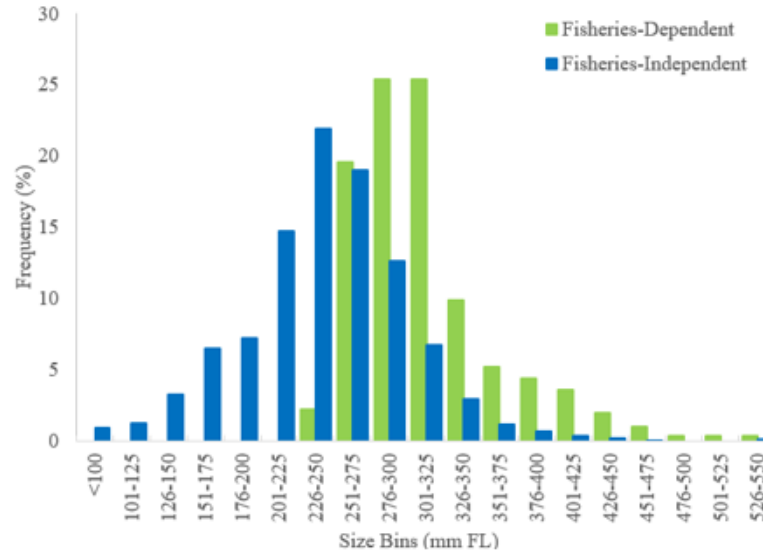
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Yellowtail snapper 2022/2023 RP and STT/J



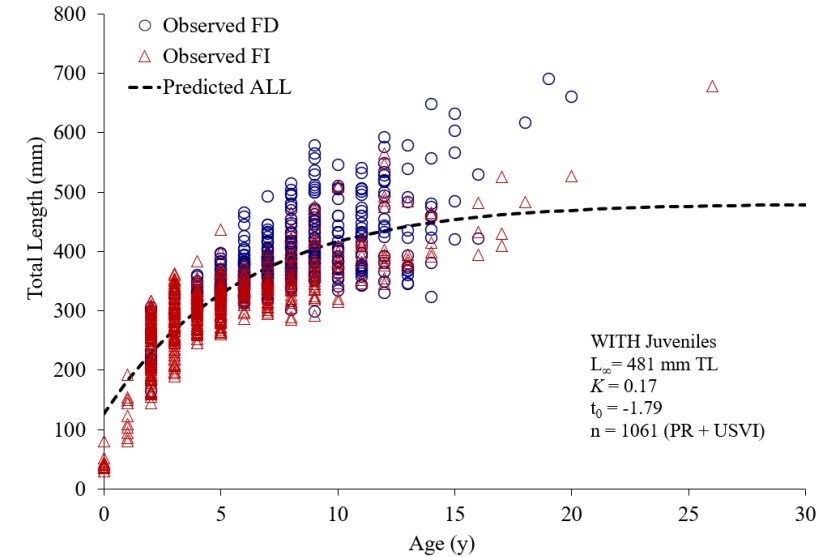
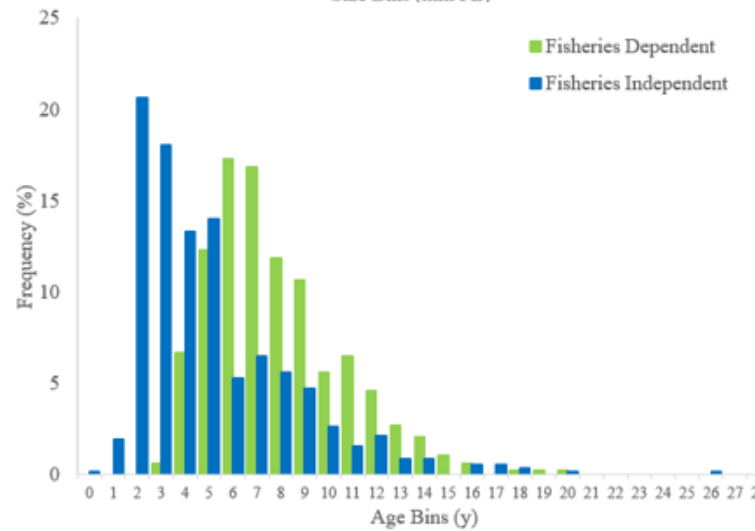
In preparation for stock assessment current data/sample gaps:

PR F-D: 129 *NEED MORE!!!!*

PR F-I: 832


STT/J F-D: 304 *NEED MORE!!!!*

STT/J F-I: 11 *NEED MORE!!!!*



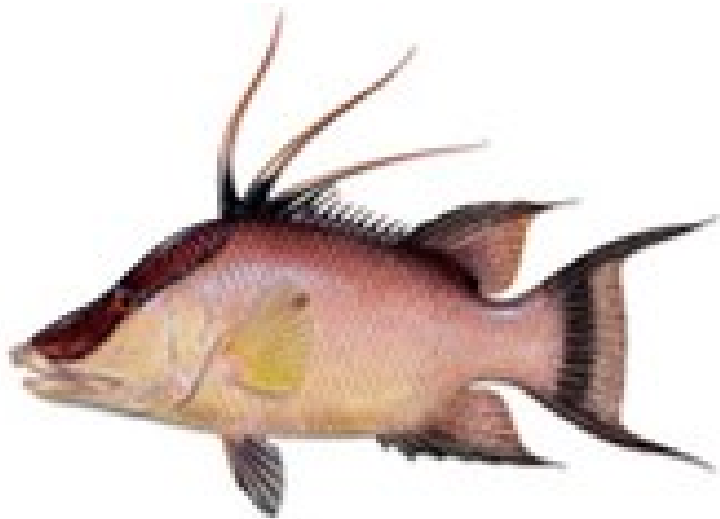
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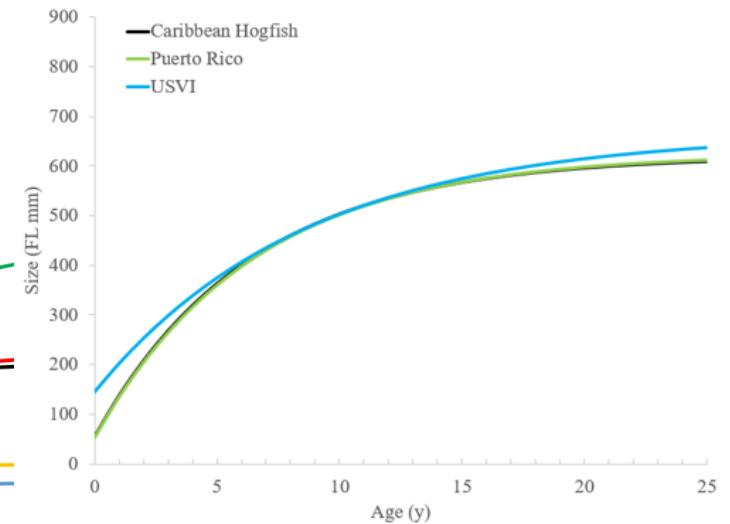
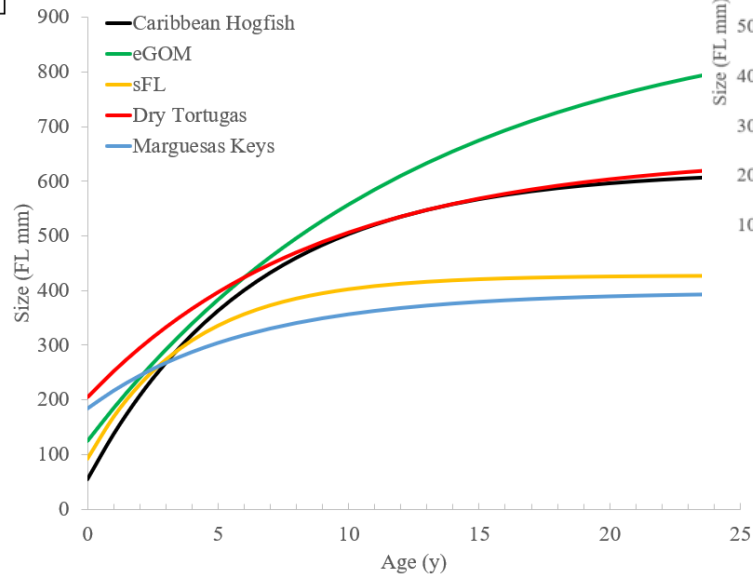
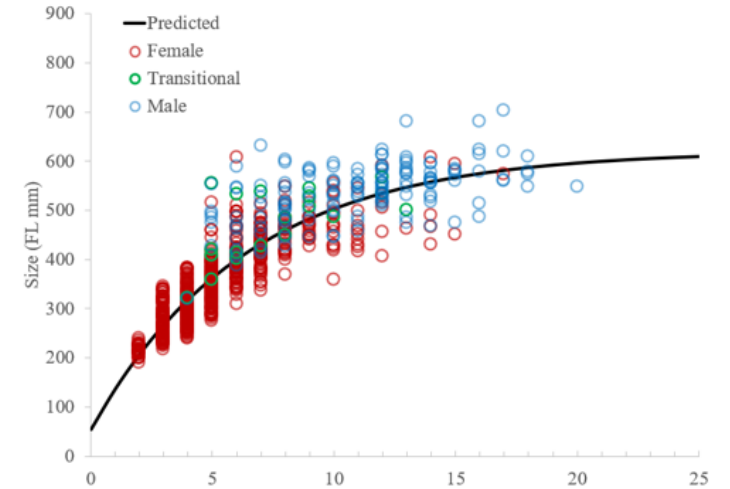
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2. Red hind	2. Yellowtail parrotfish	2. Yellowtail snapper
3. Yellowtail snapper	3. Redtail parrotfish	3. Queen snapper
4. Blue runner	4. Queen triggerfish	4. Lane snapper
6. White grunt	5. Red hind	5. Queen t
10. Scrawled cowfish	7. Princess parrotfish	6. Hogfish 
11. Redtail parrotfish	8. Coney	7. Red hind
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Hogfish PR and STT/J

	PR			USVI			Overall		
	Female	Trans	Male	Female	Trans	Male	Female	Trans	Male
January	16	-	7	5	-	-	21	0	7
February	15	-	6	6	-	1	21	0	7
March	42	-	12	2	-	-	44	0	12
April	44	-	18	-	-	-	44	0	18
May	41	1	9	19	-	1	60	1	10
June	88	-	39	-	-	-	88	0	39
July	37	2	9	23	-	1	60	2	10
August	87	6	16	13	1	-	100	7	16
September	45	2	6	23	2	-	68	4	6
October	60	2	14	22	2	1	82	4	15
November	44	1	16	7	1	-	51	2	16
December	18	1	6	15	-	-	33	1	6
Total	537	15	158	134	6	4	672	21	162



Important considerations for sampling design and interpretation of results:
 For STT/J: more samples needed from both fisheries-dependent and – independent collections
 For PR: big and small fish; opportunistic F-I



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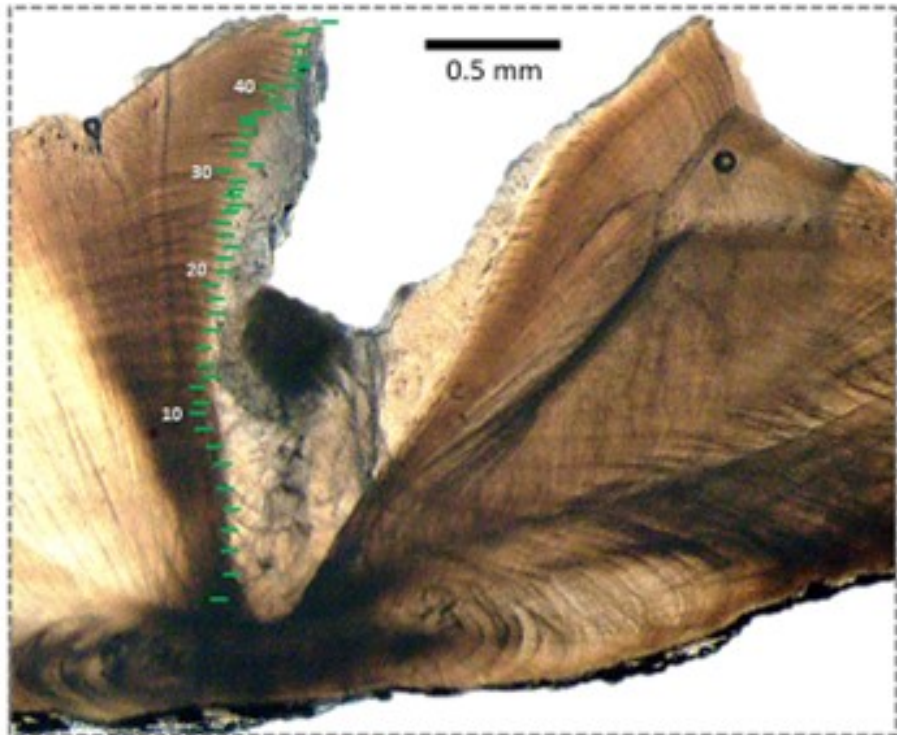
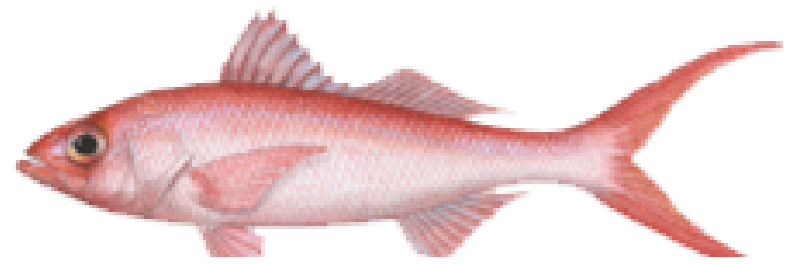


PR

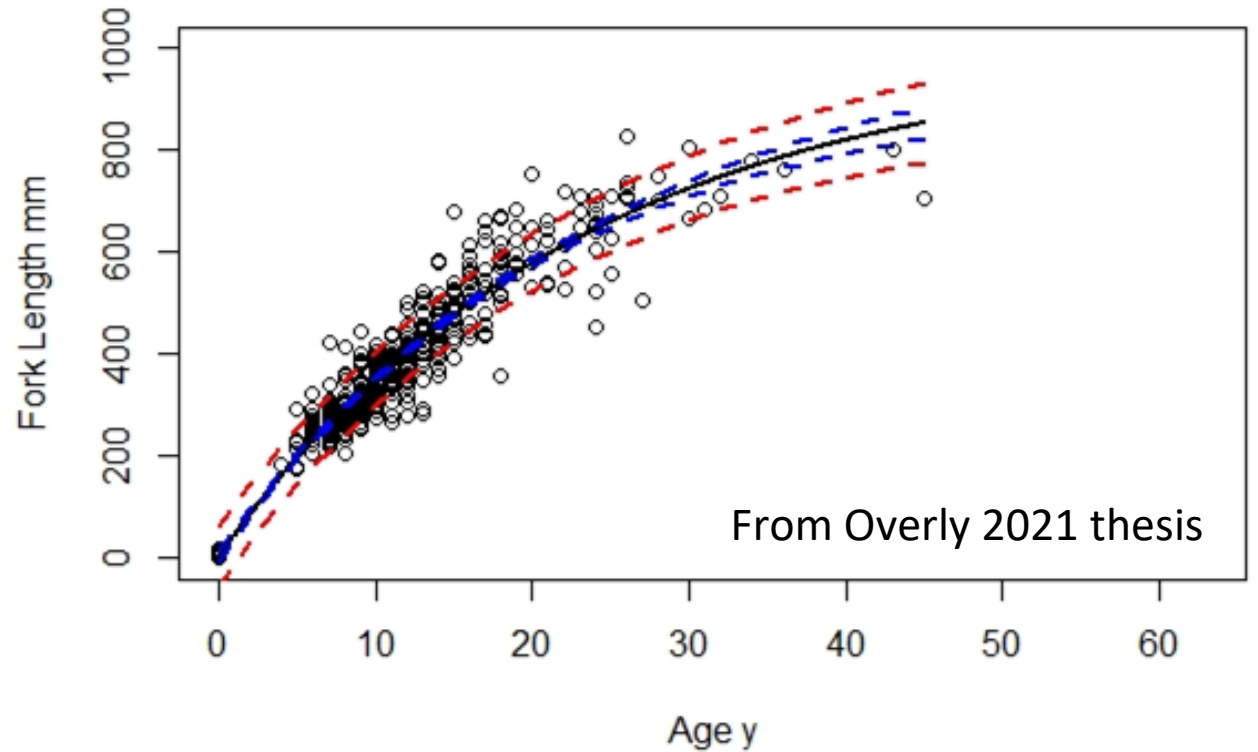
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Queen snapper PR



Fisheries-Dependent (Shervette/Rivera Hernandez/Santiago Soler): 491
Fisheries-Independent (David/Overly): 110
Fisheries-Independent (Smith/Ault): 45



Species		Length-Age					Maturity	
		Max age	Size max age	L_{∞} mm	K	t_0	L_m mm	A_m years
Queen triggerfish	New	40 y 23 y Carib	427 FL 416 FL	430 FL M: 441 FL F: 412 FL	0.15 M: 0.15 F: 0.15	-0.59 M: -0.59 F: -0.59	M: 190 F: 233	M: 2.7 F: 4.6
	Stevens et al. 2019	14	393 FL	441 FL	0.14	-1.8	215 FL	2.97 y
Stoplight parrotfish	New	17 y	354 FL	351 FL	0.23	-0.67	163 FL	1.8 y
	Stevens et al. 2019	9 y	408 FL	415 FL	0.45	-0.06	205 FL	-
Yellowtail snapper	New	26 y Carib	383 FL	No Juv: 537 TL W/Juv: 481 TL W/Juv: 390 FL	No Juv: 0.11 W/Juv: 0.17 W/Juv: 0.17	No Juv: -3.32 W/Juv: -1.79 W/Juv: -1.99	<i>In progress</i>	<i>In progress</i>
	Stevens et al. 2019	28 y	474 FL	618 TL	0.13	-3.13	232 FL	1.7 y
Hogfish	New	20 y Carib	602 FL	624 FL	0.16	-0.61	186 FL	1.13 y
	Stevens et al. 2019	23 y	784 FL	849 FL	0.11	-1.33	177 FL	0.88 y
Queen snapper	New	45 y Carib 63 y GOM	PR ₄₅ : 831 FL GOM ₆₃ : 914	PR: 994 FL GOM: 930 FL	PR: 0.04 GOM: 0.06	PR: -0.13 GOM: -0.08		
	Stevens et al. 2019	-	-	1020 FL	0.40	-0.29	-	-

Table 1: SEDAR Steering Committee Meeting Schedule
 Table Color Legend

Steering Committee Meeting
 Steering Committee Meeting
 SEDAR SCHEDULE OVERVIEW – October 2024

YEAR	SA T	
	1	2
2021	Scamp RT	Red Snapper OA
2022	Scamp OA	
2023	Vermillion OA	Gray Triggerfish RT
2024	Red Snapper RT	Gray Triggerfish OA
2025		Gag Grouper OA
2026	Red Snapper OA	GAJ RT
2027	Atlantic migratory Cobia OA	

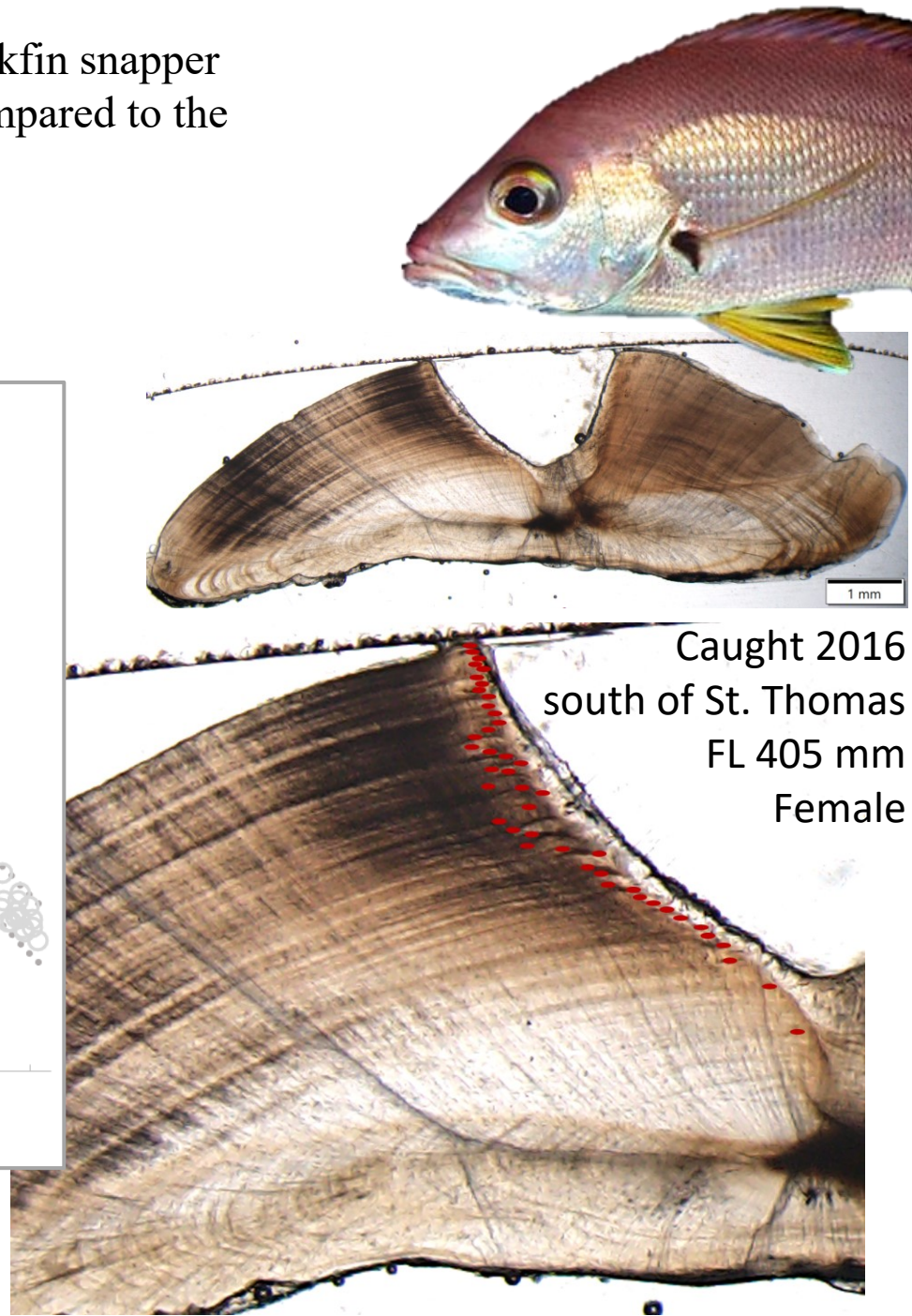
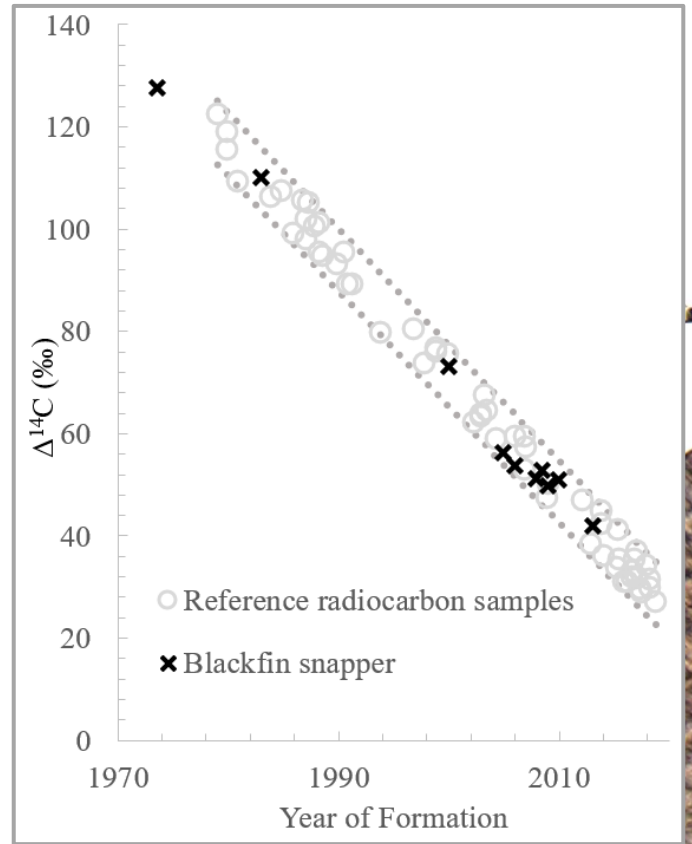
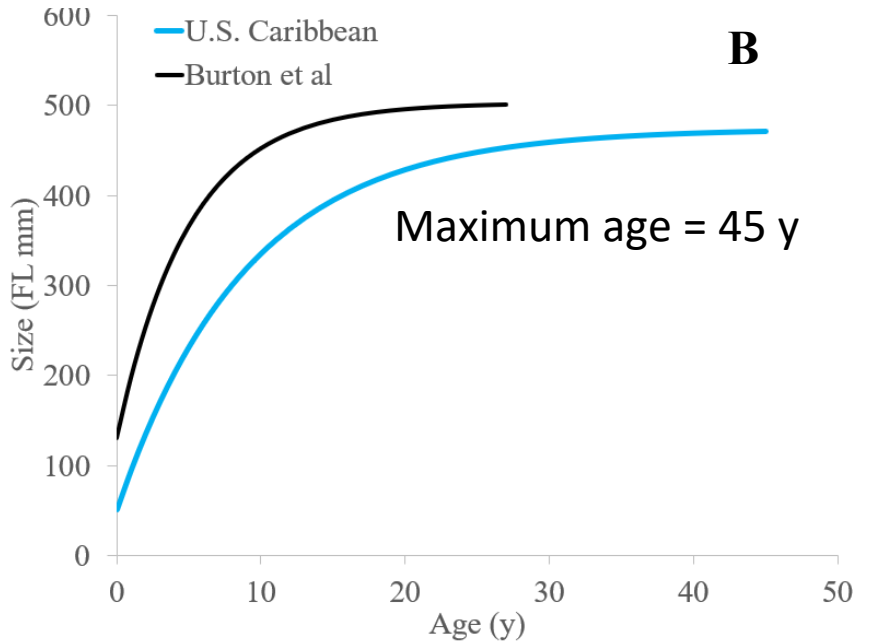
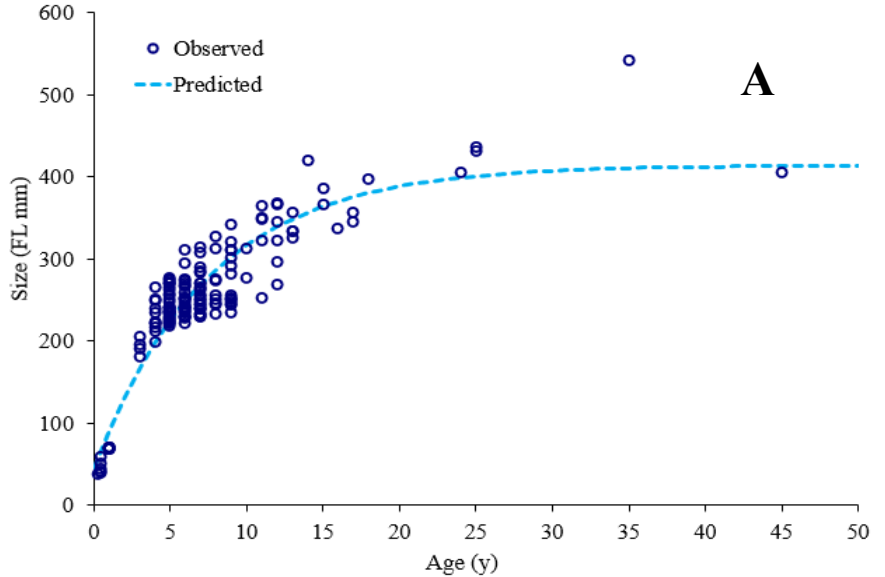
Timing of project planning purposes

YEAR	Caribbean Team			Comments
	PR	STT/J	STX	
2021	Queen Triggerfish OA			Data gaps for life history: *Stratified random sampling for length of general population *Small, immature samples *Large fish from all three islands
2022				
2023	Yellowtail Snapper		Stoplight Parrotfish	Data gaps for life history: Yellowtail – need BIG FISH; more fish from STT/J Stoplight – need small and large fish
2024	Spiny Lobster			
2025	Hogfish ???	???	???	Data gaps for life history: FI samples Small and large fish STT/J – need more samples STX – not common in landings

Committee		
the Spring 2022 Meeting		
FL FWCC	ASMFC GSMFC	CMP/ Shrimp
	Gulf Menhaden OA	
Mutton Snapper Bench	ASFMC Menhaden OA	
	ASFMC Red Drum (RW)	
Hogfish Bench	Gulf Menhaden OA	
Black Grouper Bench?		King Mackerel OA (SA & Gulf)

Committee workload dates.

(A) Growth function fit to observed size at age data for our U.S. Caribbean blackfin snapper samples. (B) von Bertalanffy growth curves for our U.S. Caribbean samples compared to the growth curve from Burton et al. (2016) for FL-Caribbean blackfin samples.



PR Fishers: Carlos Velasquez, Marcos Henke, Macho Rodriguez, Junior Lugo, Javier Vadilla

STT/J Fishers: Julien Magras, Tony Blanchard, Danny Berry, Ledee Brothers, Bobby Vente

STX Fishers: Gerson Martinez, Nick Jr., Bobby Thomas, Tom Daley, Omar Hughes

PRDNER Fisheries Laboratory: Noemi Peña, Veronica Seda, Wilfredo Torres, Wilson Santiago Soler, Luis Rivera

The Nature Conservancy in St. Croix

Fish/Fisheries Conservation Lab:
Kayley Kirkland and Jordan Henderson

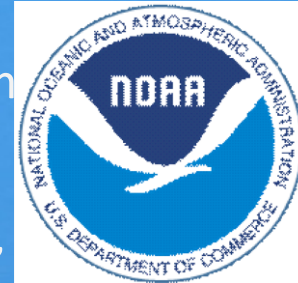
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