Progress on an Ecosystem Status Report for the U.S. Caribbean

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GCFI
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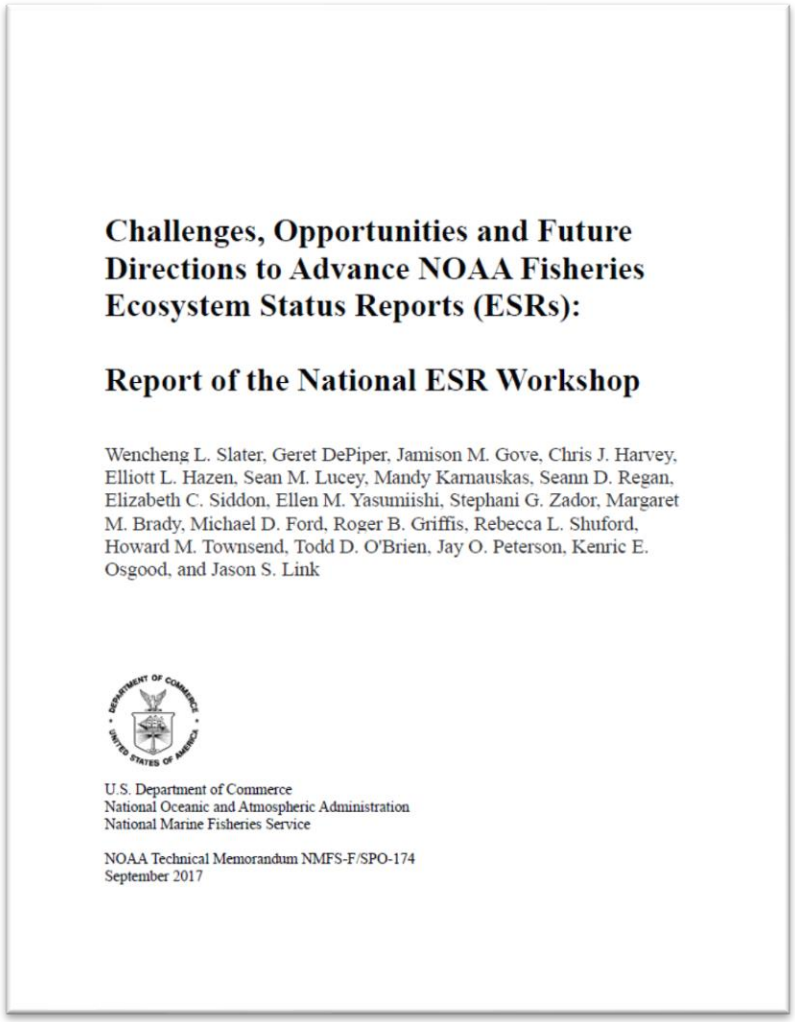
What is an Ecosystem Status Report?



Challenges, Opportunities and Future Directions to Advance NOAA Fisheries Ecosystem Status Reports (ESRs):

Report of the National ESR Workshop

Wencheng L. Slater, Geret DePiper, Jamison M. Gove, Chris J. Harvey, Elliott L. Hazen, Sean M. Lucey, Mandy Karnauskas, Seann D. Regan, Elizabeth C. Siddon, Ellen M. Yasumiishi, Stephani G. Zador, Margaret M. Brady, Michael D. Ford, Roger B. Griffis, Rebecca L. Shuford, Howard M. Townsend, Todd D. O'Brien, Jay O. Peterson, Kenric E. Osgood, and Jason S. Link

U.S. Department of Commerce
National Oceanic and Atmospheric Administration
National Marine Fisheries Service

NOAA Technical Memorandum NMFS-F/SPO-174
September 2017

"Ecosystem Status Reports (ESRs) are synthesized scientific products that provide information on the past and possible future conditions of marine ecosystems based on suites of indicators.

This information provides vital context for a range of decisions affecting marine ecosystems and supports an ecosystem approach to marine resource management" (Slater et al. 2017).

Two types of indicators

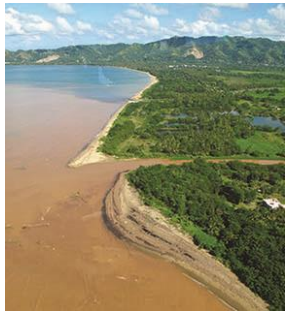
1) Tracking progress on fishery management objectives

Food production and stock sustainability

Protection of ecosystems and trophic integrity

Equity and fairness

2) Risks to meeting fishery management objectives



Two types of indicators

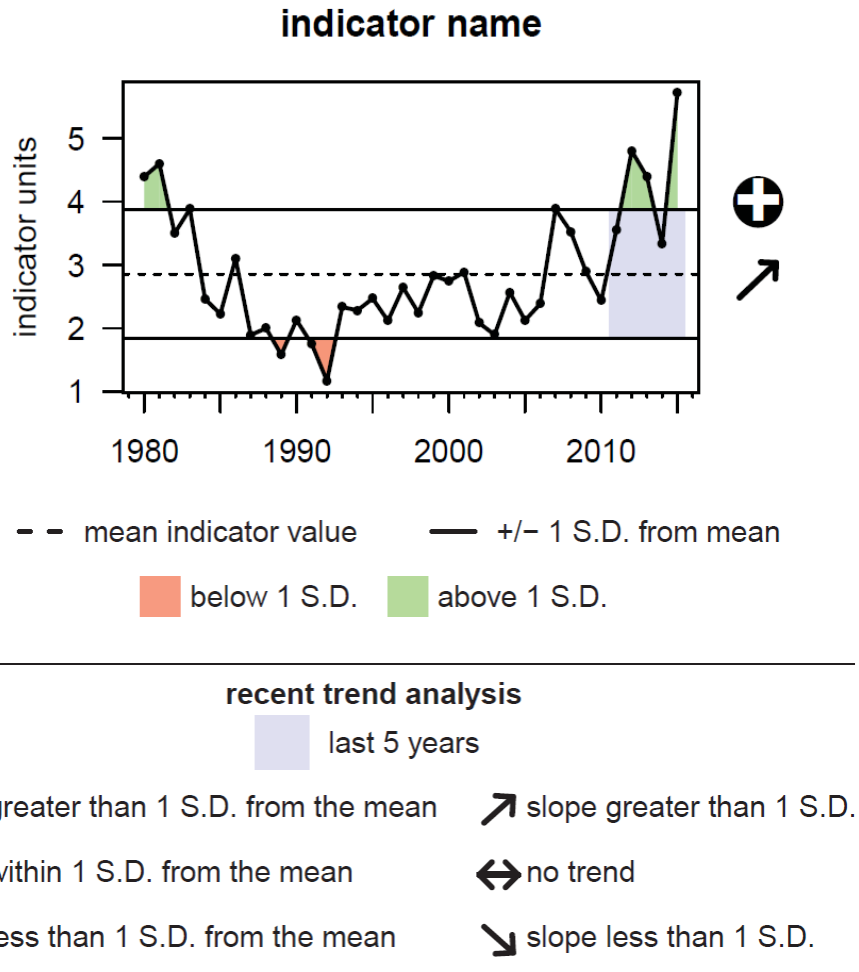
1) Tracking progress on fishery management objectives
   - Broad categories of objectives derived from Island-based Fishery Management Plans

2) Risks to meeting fishery management objectives
   - Derived from conceptual models created by Caribbean Fishery Management Council, indicator scoring process, expert working groups

Risks to meeting fishery management objectives

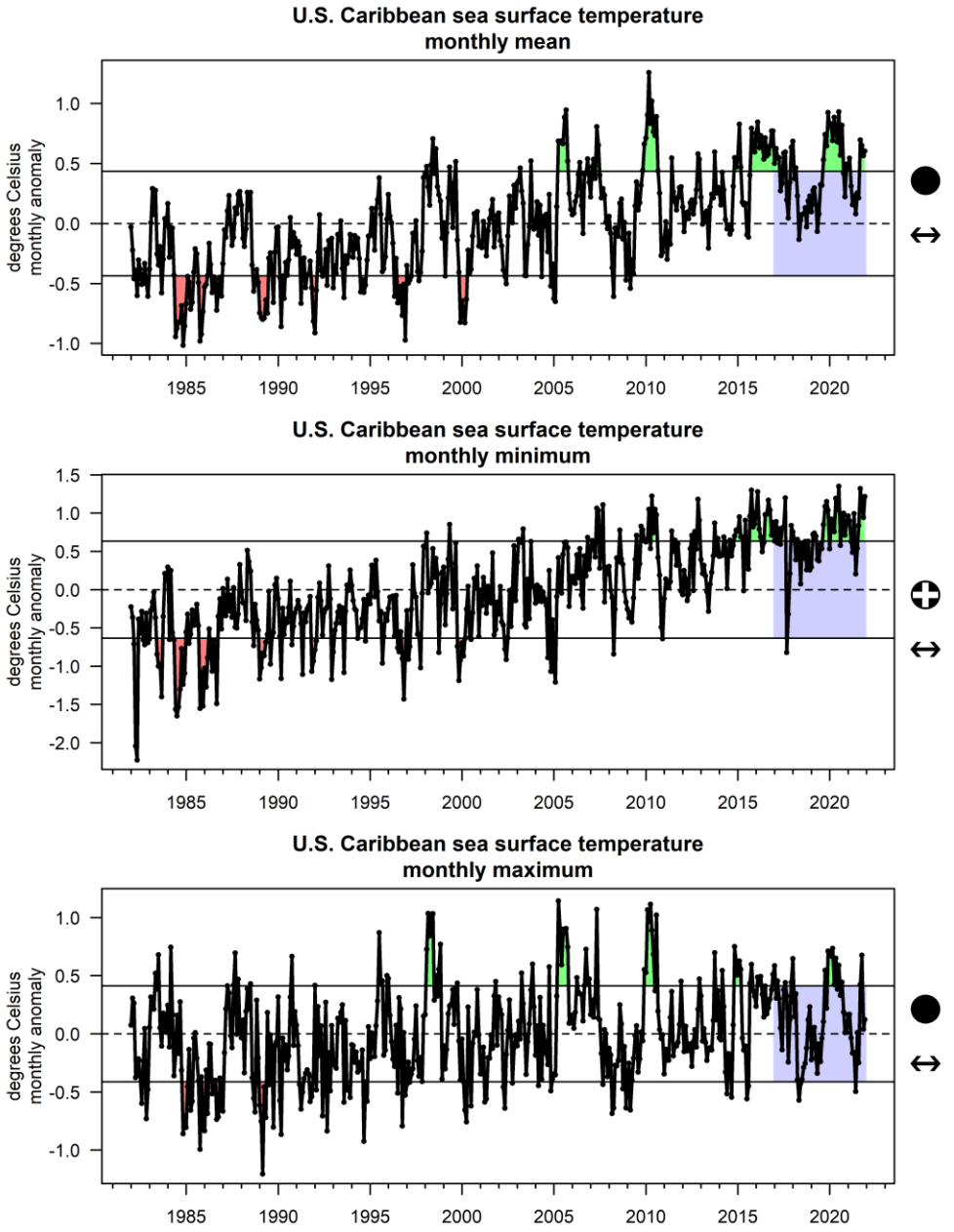
Selected indicators:

- Sea surface temperature
- Coral bleaching stress
- Primary productivity
- Hurricane activity
- Land-based pollution
- Coastal development
- Habitat condition
- *Sargassum* inundation
- Tourism activity
- GDP and employment in ocean economy
- Market disturbances



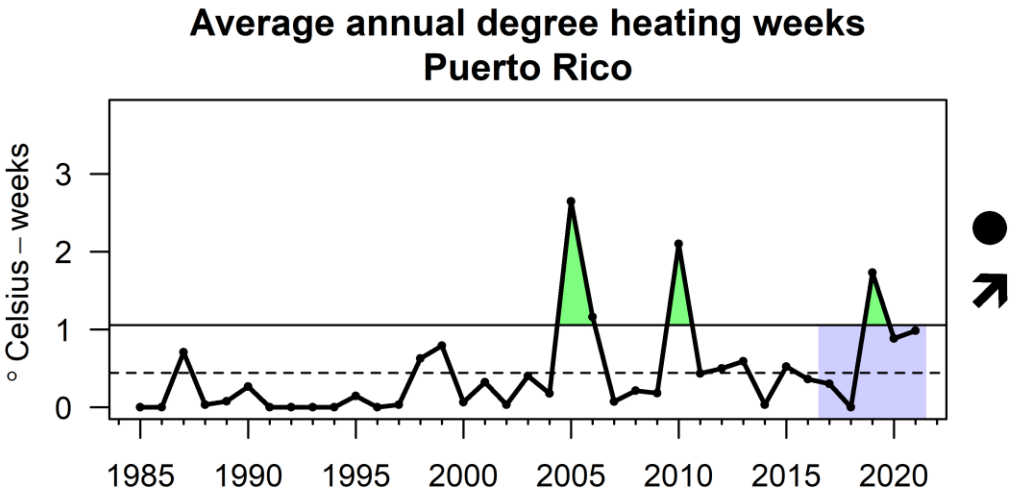
Sea surface temperature

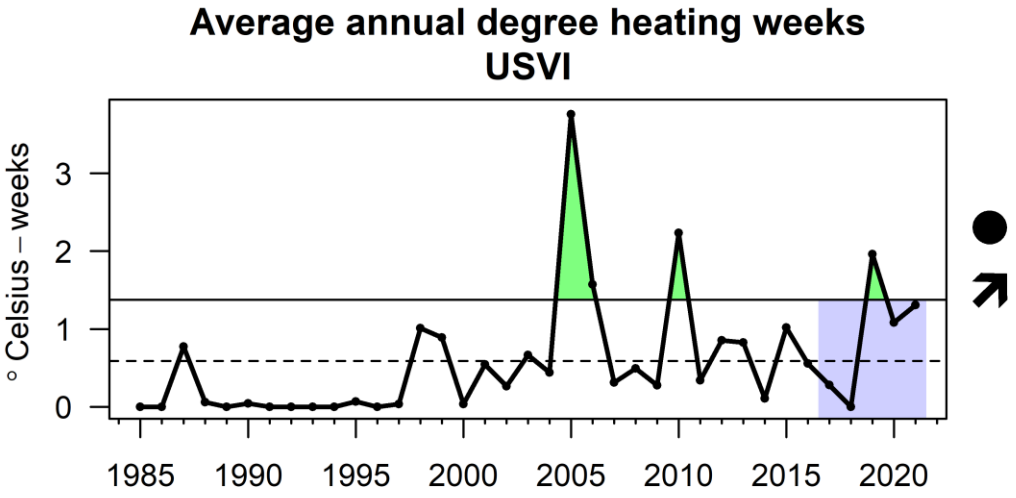
- Generally increasing over time (average rate = 0.25 ºC per decade)
- Last 5 years, mean is above average, monthly minima are > 1 S.D. above average
- No trend last two decades in monthly maxima, but ↑ anomalies in 2005 and 2010



Coral bleaching stress

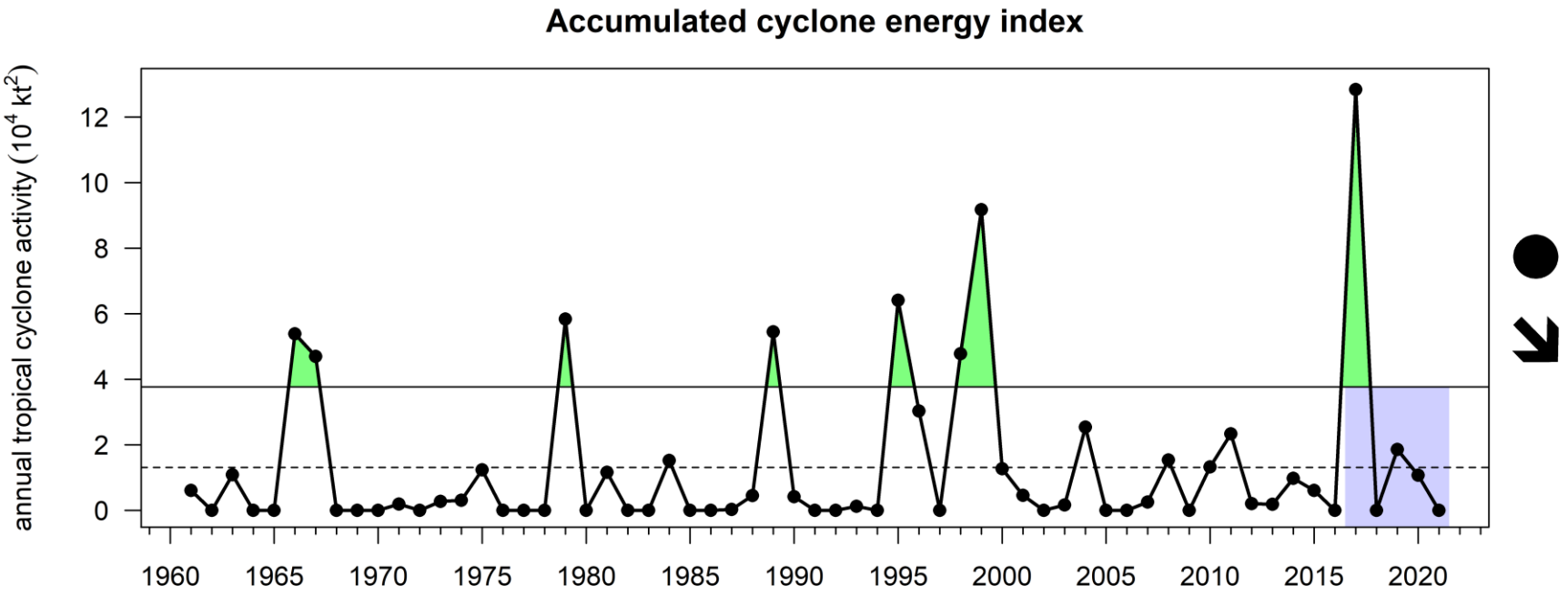
- Generally below average until 2004 (peak in 1998), then sudden record peak in 2005
- Last 5 years average, but increasing trend





Hurricane activity

- Generally below average last two decades, but year 2017 was an all-time high across 6 decades of data



Annual accumulated cyclone energy index, calculated as the sum of squared 6-hourly reported wind speeds for storms tracking through the U.S. Caribbean region (16.7 - 19.6N, 63.5 - 68.9W)

Sargassum inundation

- Largely absent until 2011
- Seasonal pattern as of 2014
- Generally increasing over time series

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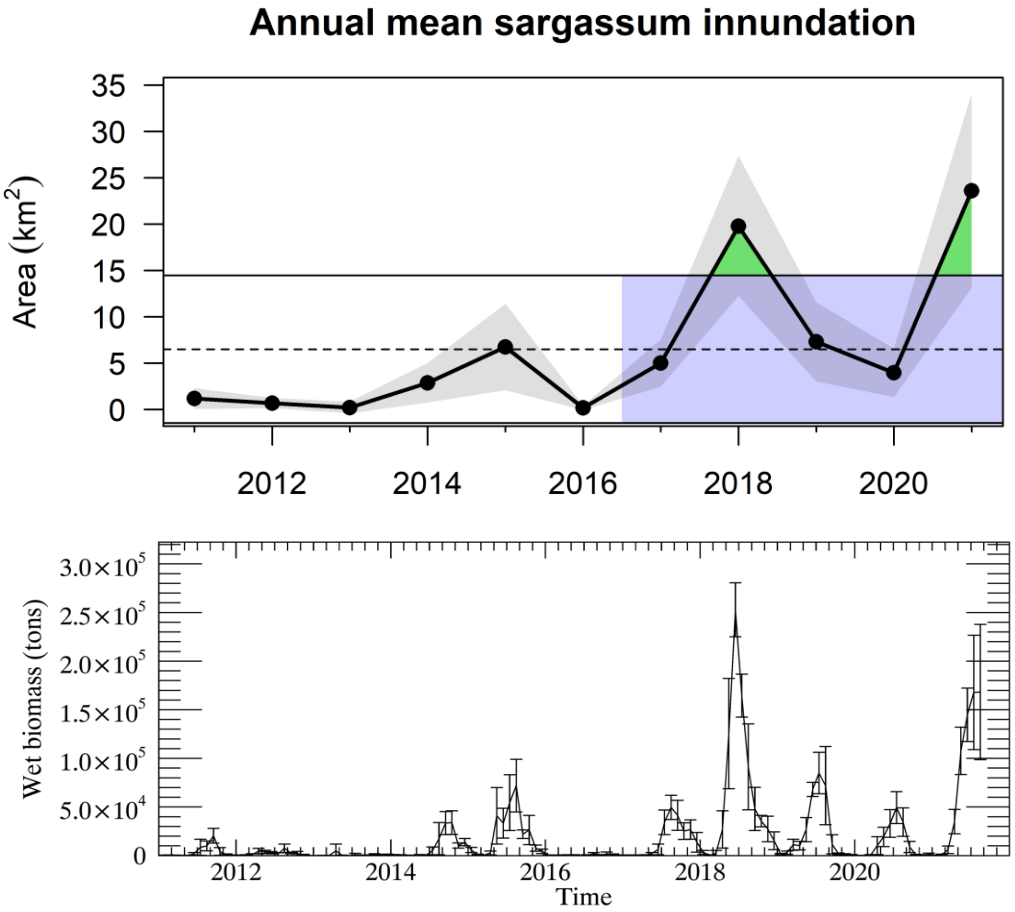


Mean monthly *Sargassum* wet biomass (2011 – 2021), estimated from MODIS satellite measurements using algorithms of Wang and Hu (2016) and Wang et al., (2018). Vertical bars are +/- 1 S.D.

Coastal development

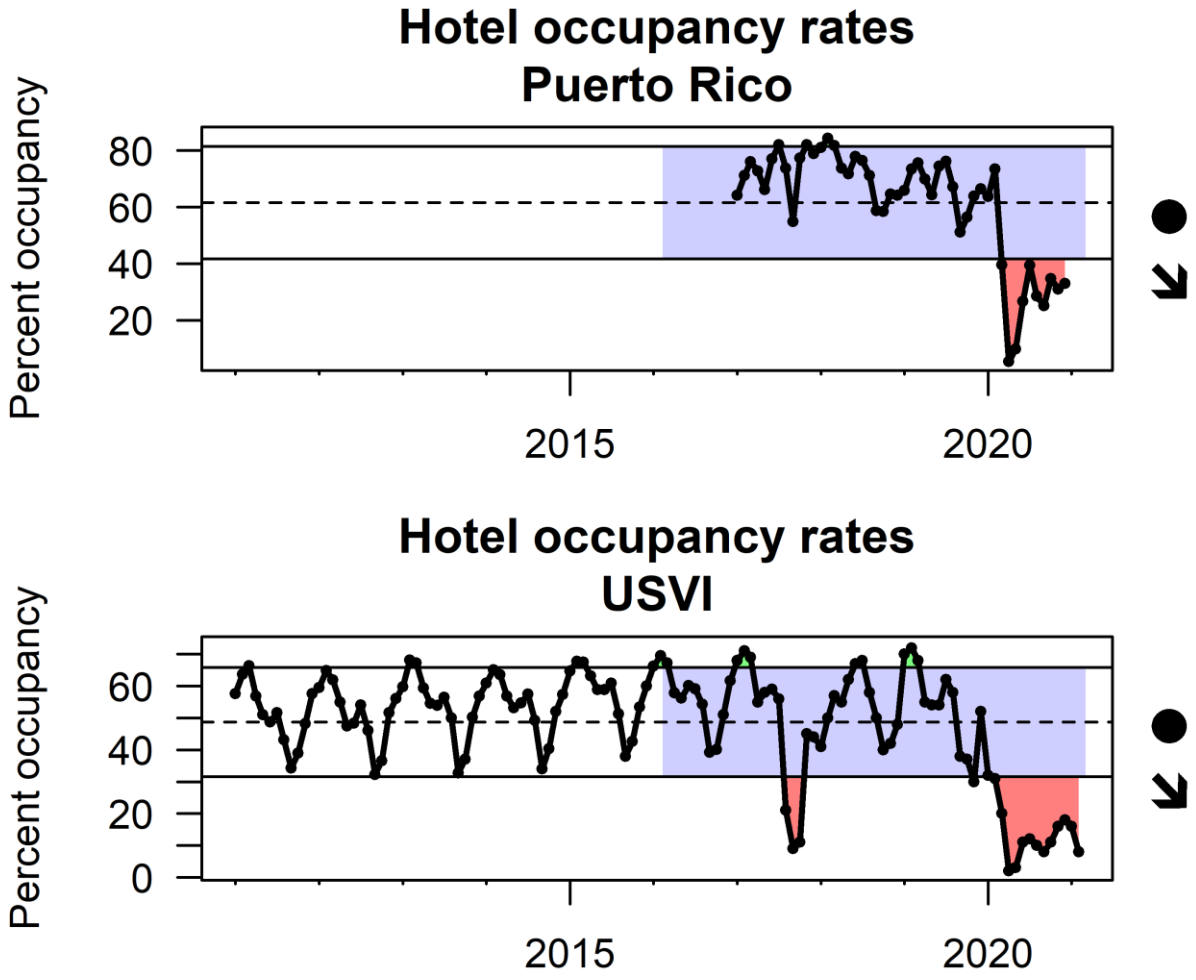
- Increase in developed land and impervious surfaces lead to impacts and modifications to shoreline habitat and water quality

Island	Percent change in developed land	Percent change in impervious surfaces
St. Croix	+4.48%	+5.73%
St. John	+5.91%	+5.94
St. Thomas	-1.91%	+9.01%
Puerto Rico	Not available	Not available

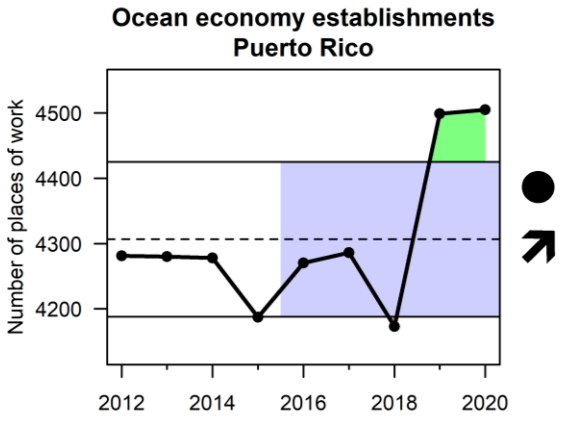
Percent change in developed land from 2003 to 2012. Source: NOAA CCAP, satellite data.

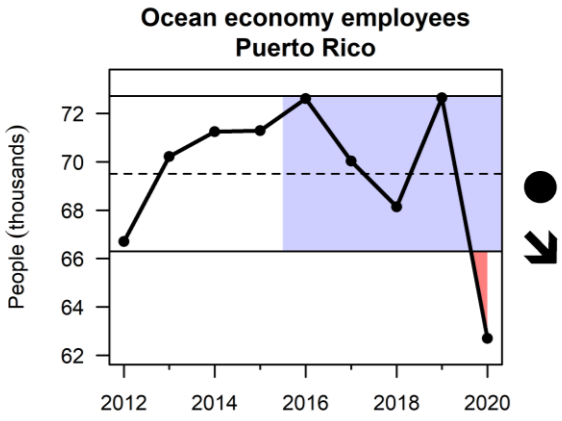
Risk: Tourism activity

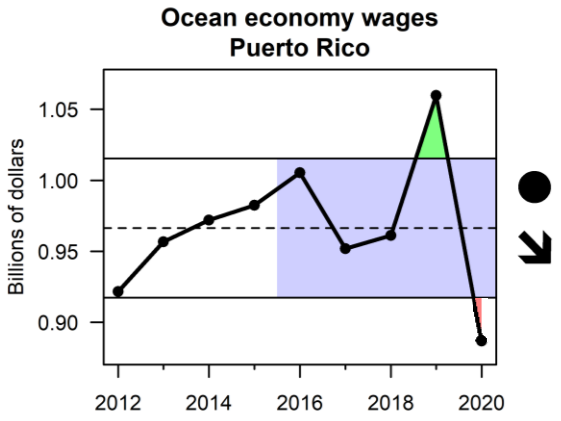
- Clear impacts from hurricanes Maria and Irma and pandemic

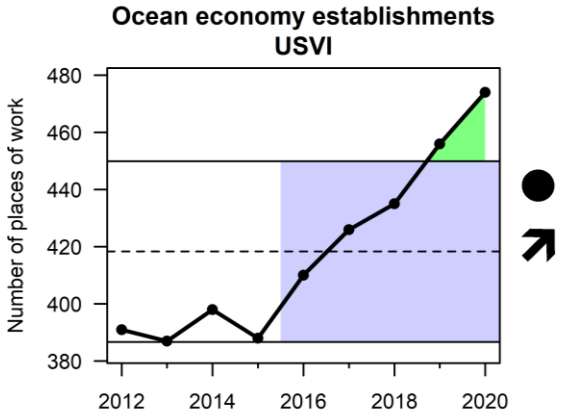


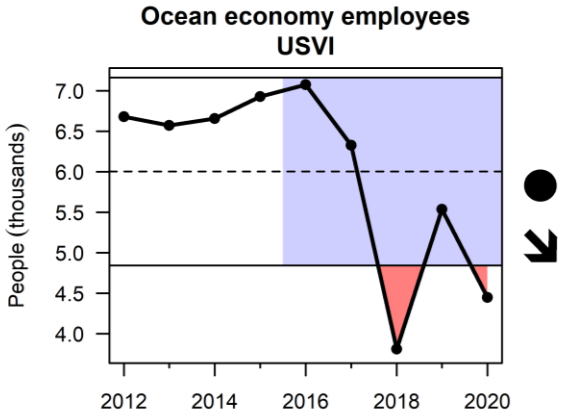
Wages and employee levels

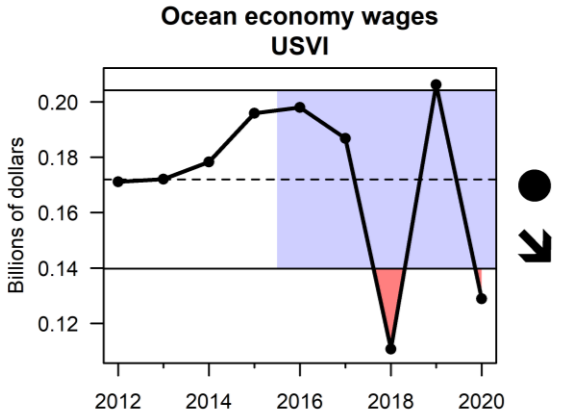










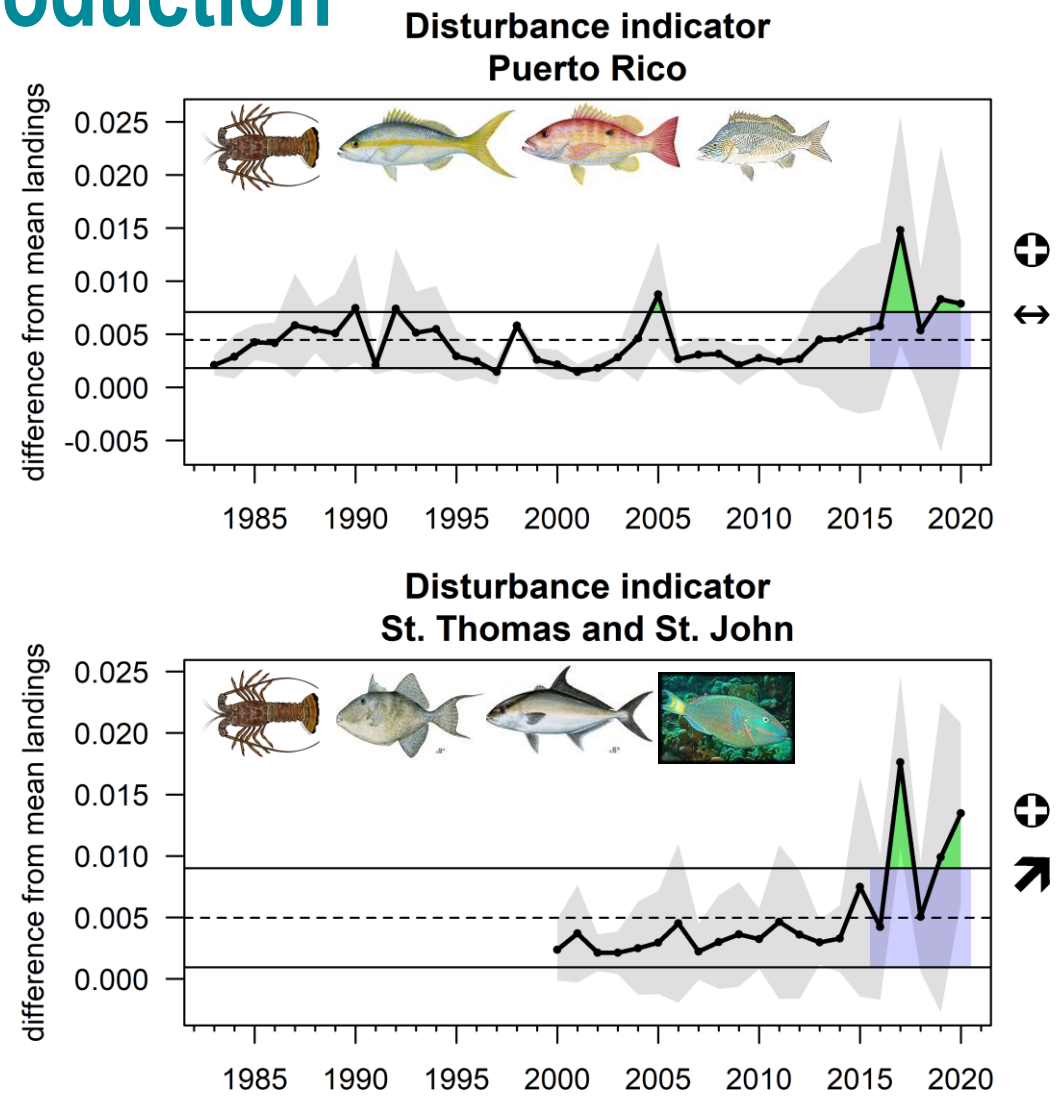


- Impacts from hurricanes Maria and Irma, and pandemic

Objective: Food production

- Disturbance level* generally below average from 2000 - 2014
- Significant increase in last 5 years, highest value in 2017

*For primary target species, calculate proportion of landings in each month, by year, then sum the square of deviations from the mean for each year $D_y = \sum_{m=1}^{12} \left(P_{m,y} - \bar{P}_m\right)^2$



Risks to meeting fishery management objectives

Chronic stressors:

- Mean sea surface temperatures
- *Sargassum* inundation
- Coastal development
- Habitat condition

Acute stressors:

- High temperature anomalies, bleaching stress
- Hurricane activity
- COVID pandemic
- Economic instability

Impacts on fishery management objectives

Next steps – focus on FMP objective indicators:

- Food production and stock sustainability
- Socioeconomic health
- Equity and fairness
- Engagement and participation
- Bycatch reduction
- Governance, outreach and enforcement
- Protection of ecosystems and trophic integrity

NOAA FISHERIES

SEFSC

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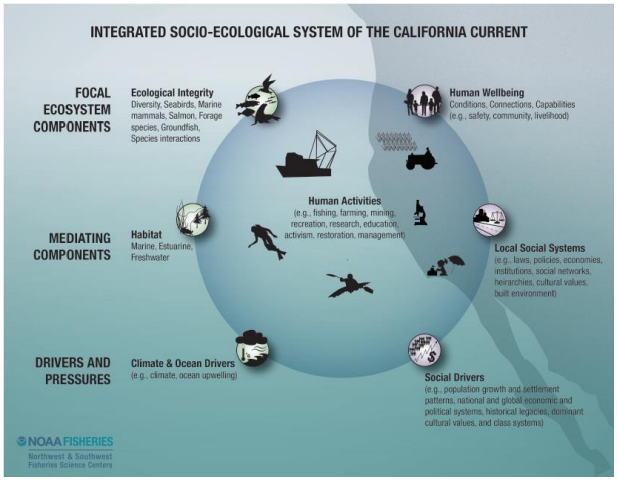
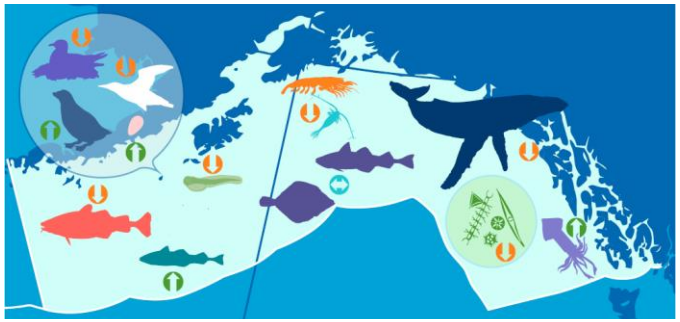
Extras

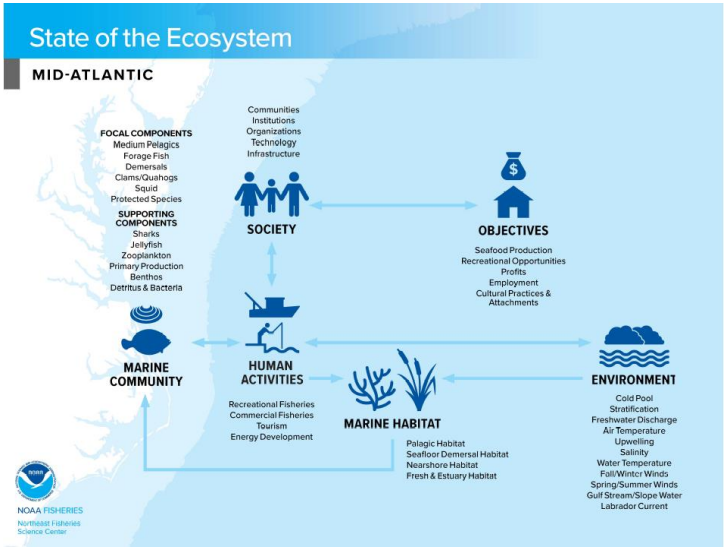
How are they used in management?



NPFMC: single-species quotas set in context of ecosystem information



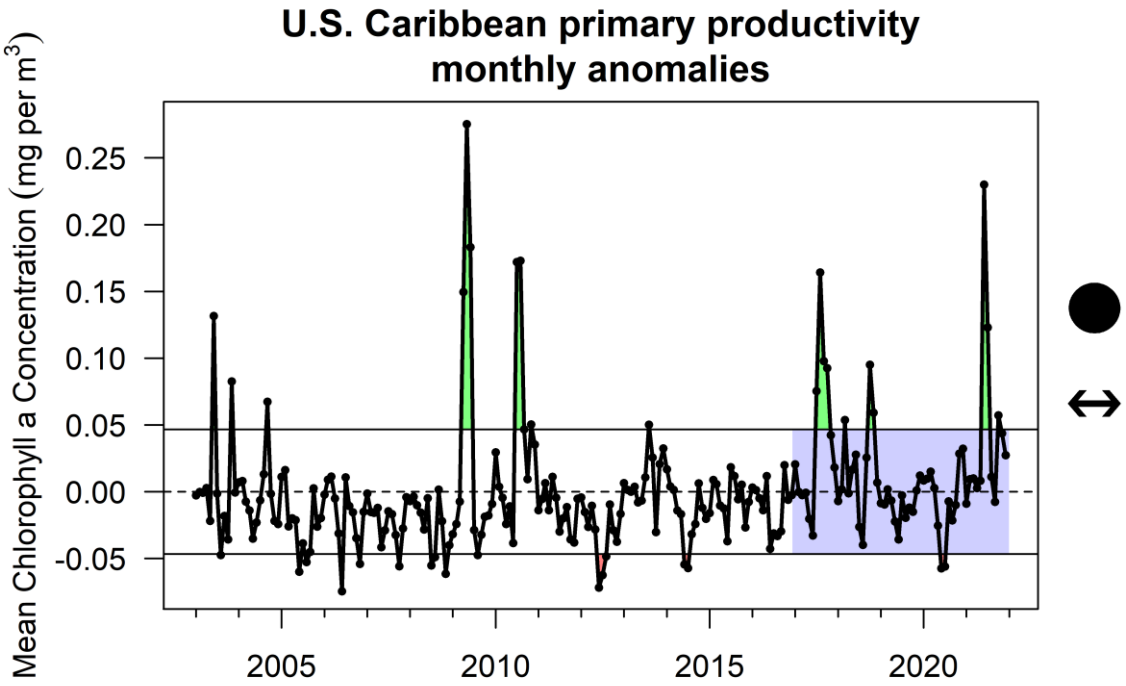
PFMC: Fishery Ecosystem Plan requires an ESR describing status and trends, as context for decision-making

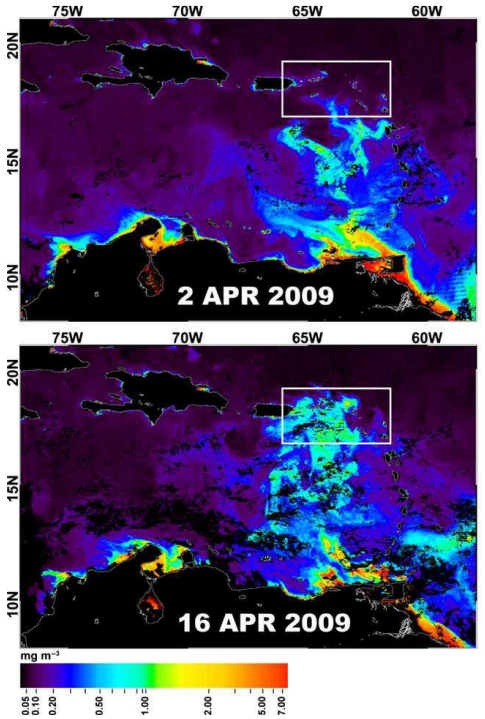


MAFMC: Indicators linked to specific management objectives

Primary productivity

- No long-term trend
- Peaks related to anomalous events (Orinoco River plume, hurricanes)





Johns et al., 2014
doi:10.1111/fog.12082

Fishery disturbances

- For primary target species*, calculate proportion of landings in each month, by year, then sum the square of deviations from the mean for each year
- Anomalies represent level of “disturbance” from typical patterns

*excluded species with seasonal closures implemented during time series