Caribbean Ecosystem Status Report Update

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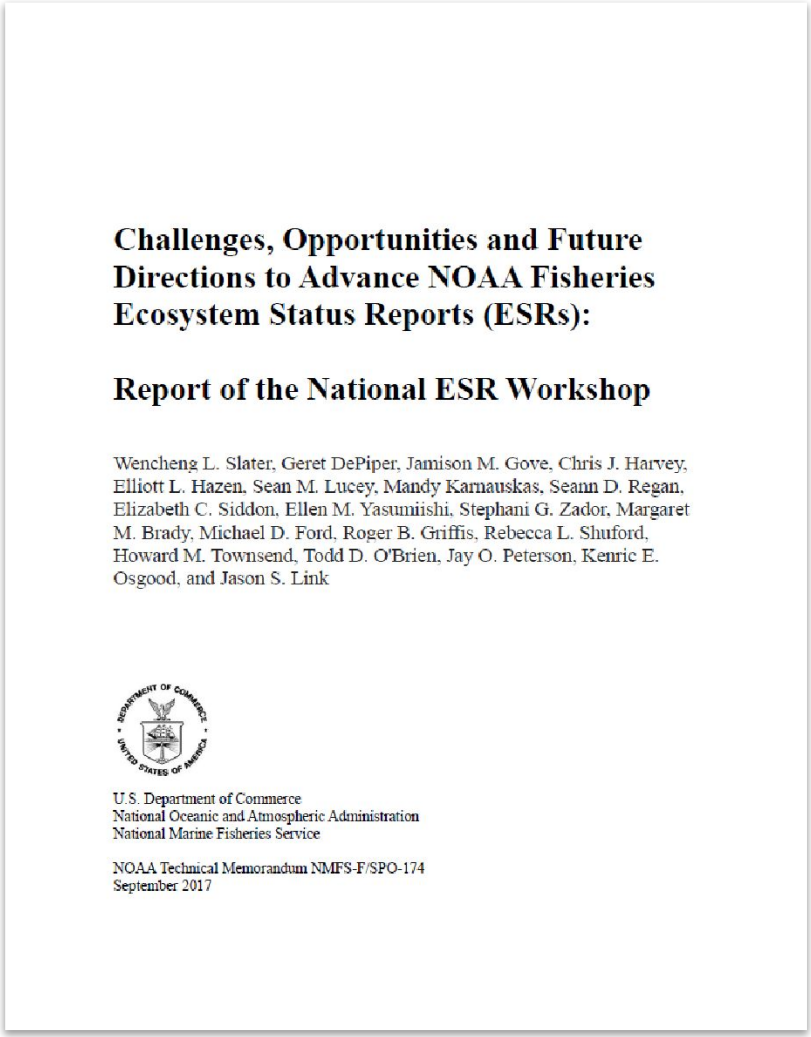
Caribbean Fishery Management Council

Ecosystem Based Fisheries Management Technical Advisory Panel

March 16-17, 2022

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

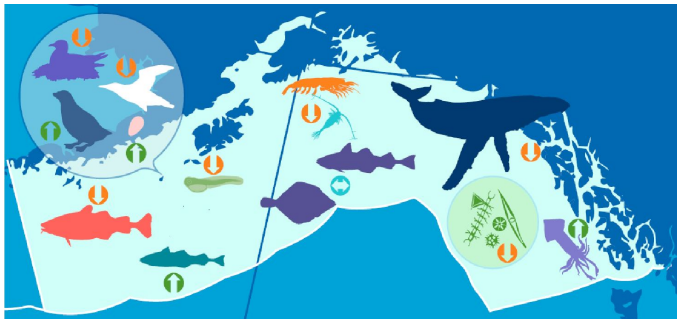
NOAA Technical Memorandum NMFS-F/SPO-174
September 2017

"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.

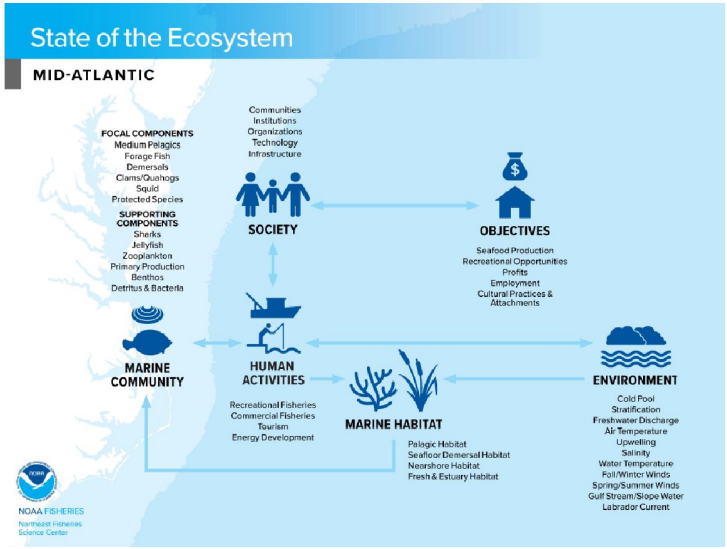
This information provides vital context for a range of decisions affecting marine ecosystems and supports an ecosystem approach to marine resource management" (Slater et al. 2017).

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



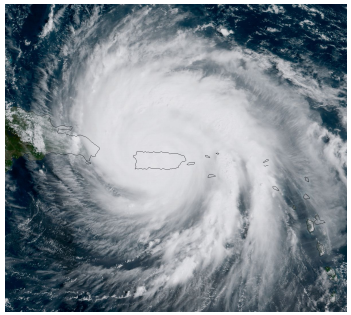
MAFMC: Indicators linked to specific management objectives

Two types of indicators

1) Tracking performance toward fishery management objectives

Example from New England
https://www.fisheries.noaa.gov/new-england-mid-atlantic/ecosystems/state-ecosystem-reports-northeast-us-shelf

2) Risks to meeting fishery management objectives

Two types of indicators

1) Tracking performance toward fishery management objectives

- Derived from Island-based Fishery Management Plans

2) Risks to meeting fishery management objectives

- Derived from conceptual models, indicator scoring process, expert working groups

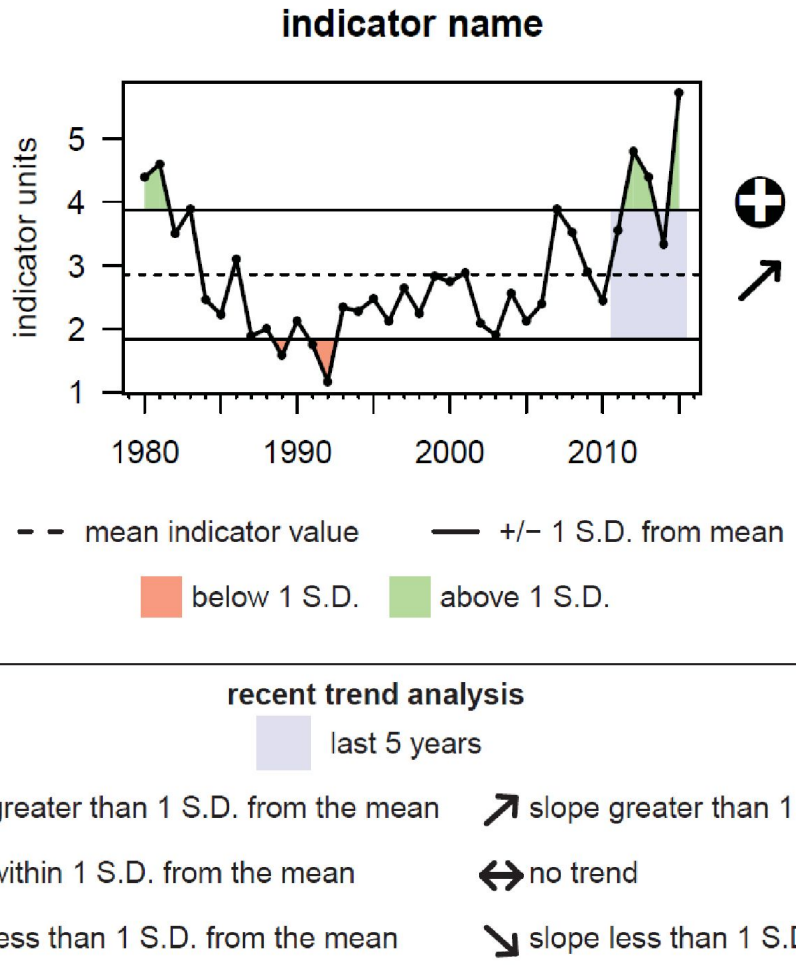
Conceptual model components that are represented in ESR:

Pollution, hurricanes, extreme weather, coastal development, *Sargassum* inundation, marine habitats, coral reef condition, climate change, tourism, population, GDP, wages

Risks to meeting fishery management objectives

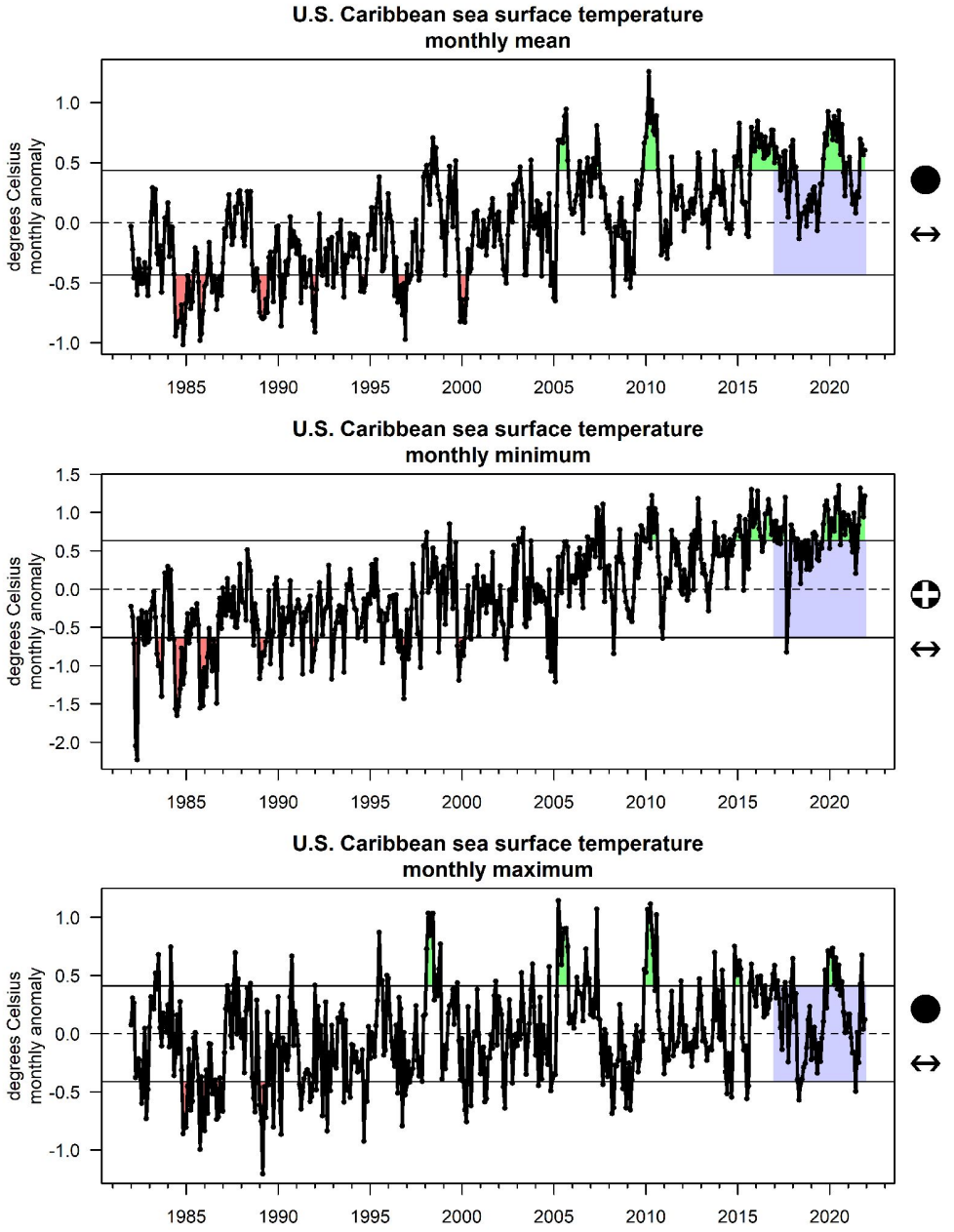
Select indicators:

- 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



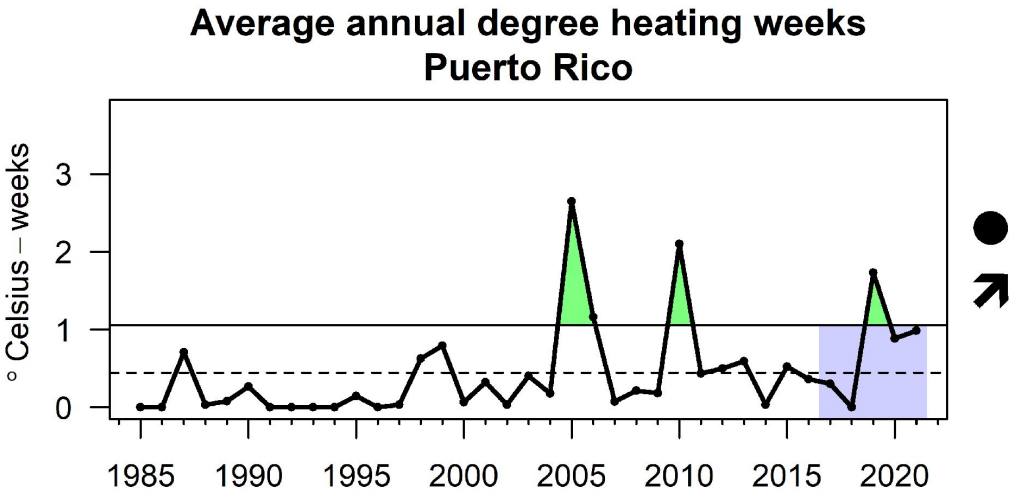
Sea surface temperature

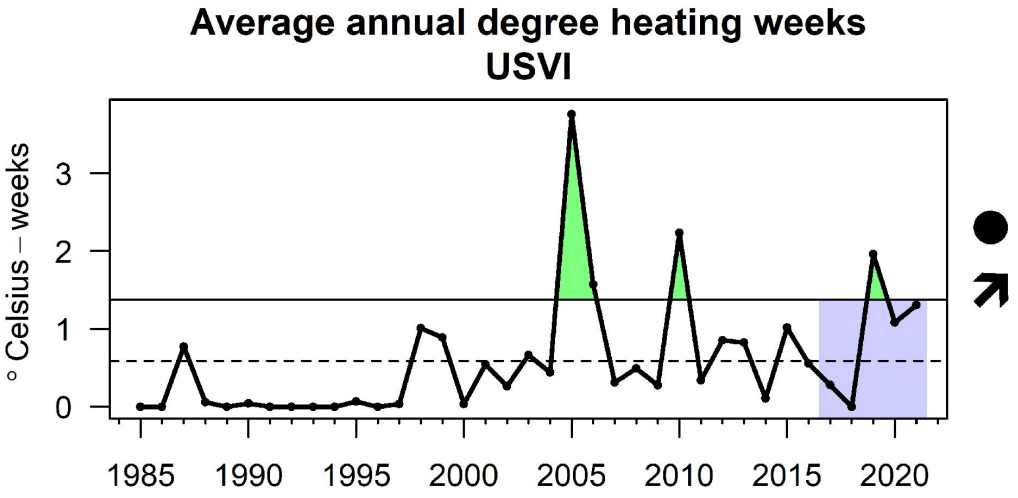
- Generally increasing over time (average rate = 0.25 ºC per decade)
- Last 5 years, mean is above average, monthly minima are > 1 S.D. above average
- No trend last two decades in monthly maxima, but ↑ anomalies in 2005 and 2010



Coral bleaching stress

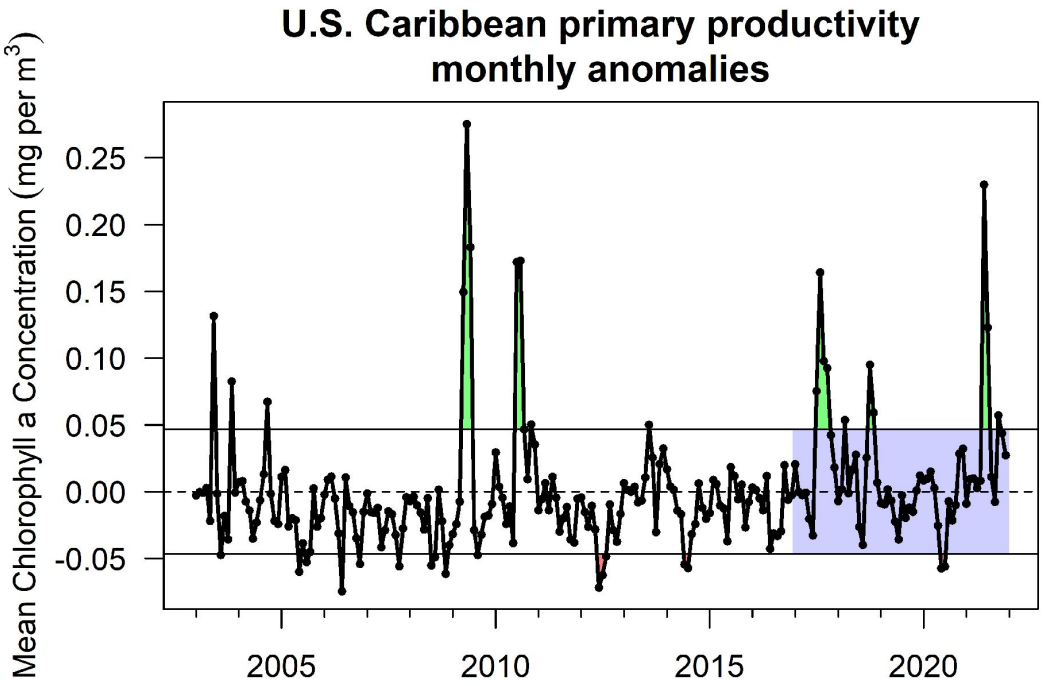
- Generally below average until 2004 (peak in 1998), then sudden record peak in 2005
- Last 5 years average, but increasing trend

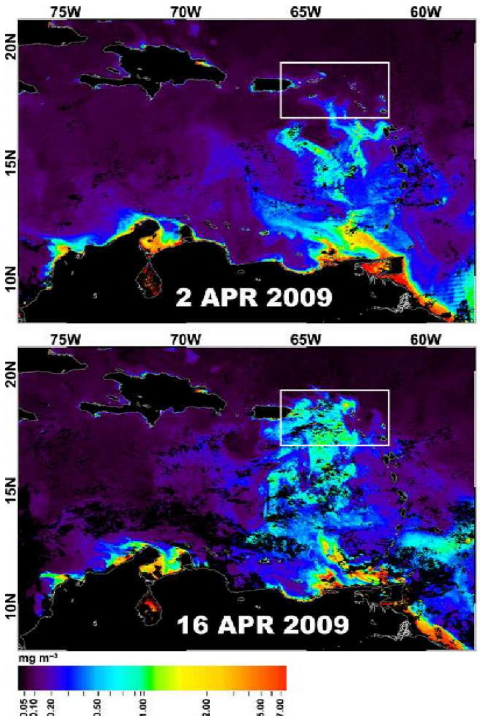




Primary productivity

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

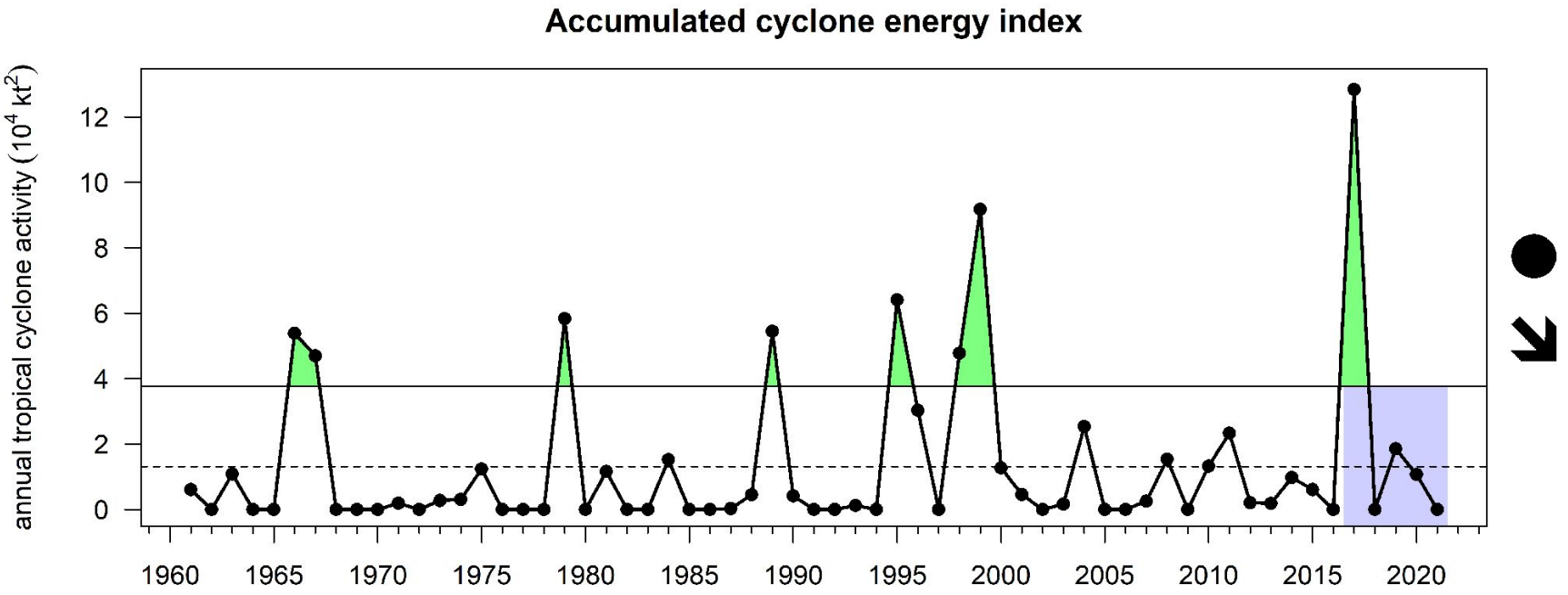




Johns et al., 2014
doi:10.1111/fog.12082

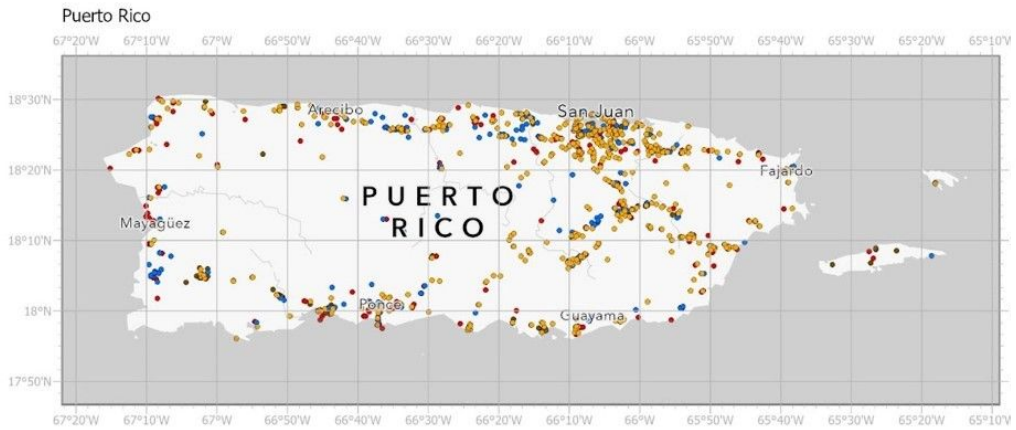
Hurricane activity

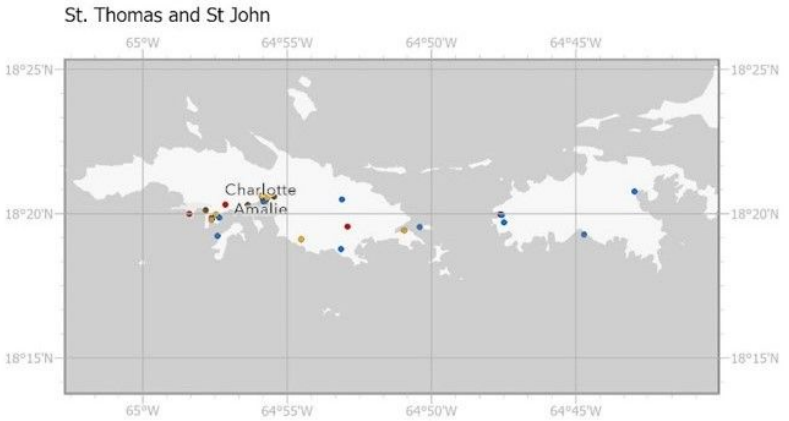
- Generally below average last two decades, but year 2017 was an all-time high across 6 decades of data

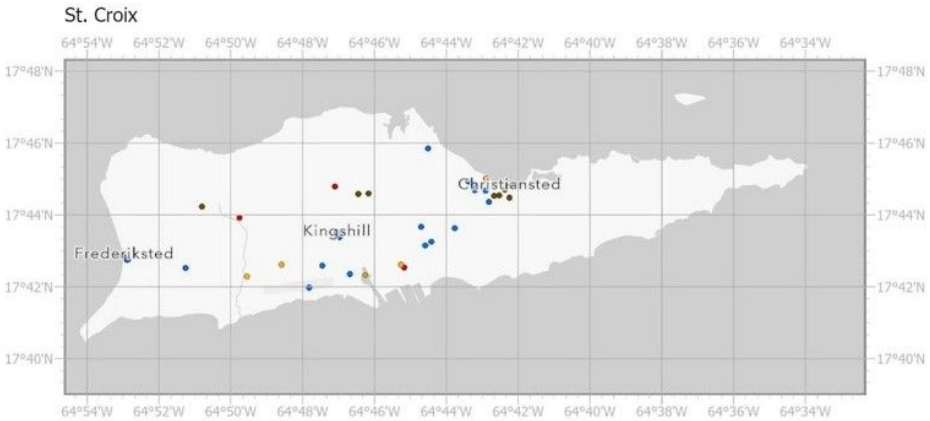


Annual accumulated cyclone energy index, calculated as the sum of squared 6-hourly reported wind speeds for storms tracking through the U.S. Caribbean region (16.7 - 19.6N, 63.5 - 68.9W)

Land-based pollution







- NCDB sites
- Superfund sites
- Brownfield sites
- Toxic Release Inventory Sites

Majority of sites in northeastern Puerto Rico

Toxic Release Inventory, Superfund sites (Superfund Enterprise Management System), National Compliance Database listed sites, and brownfield sites identified in the U.S. Caribbean.

Coastal development

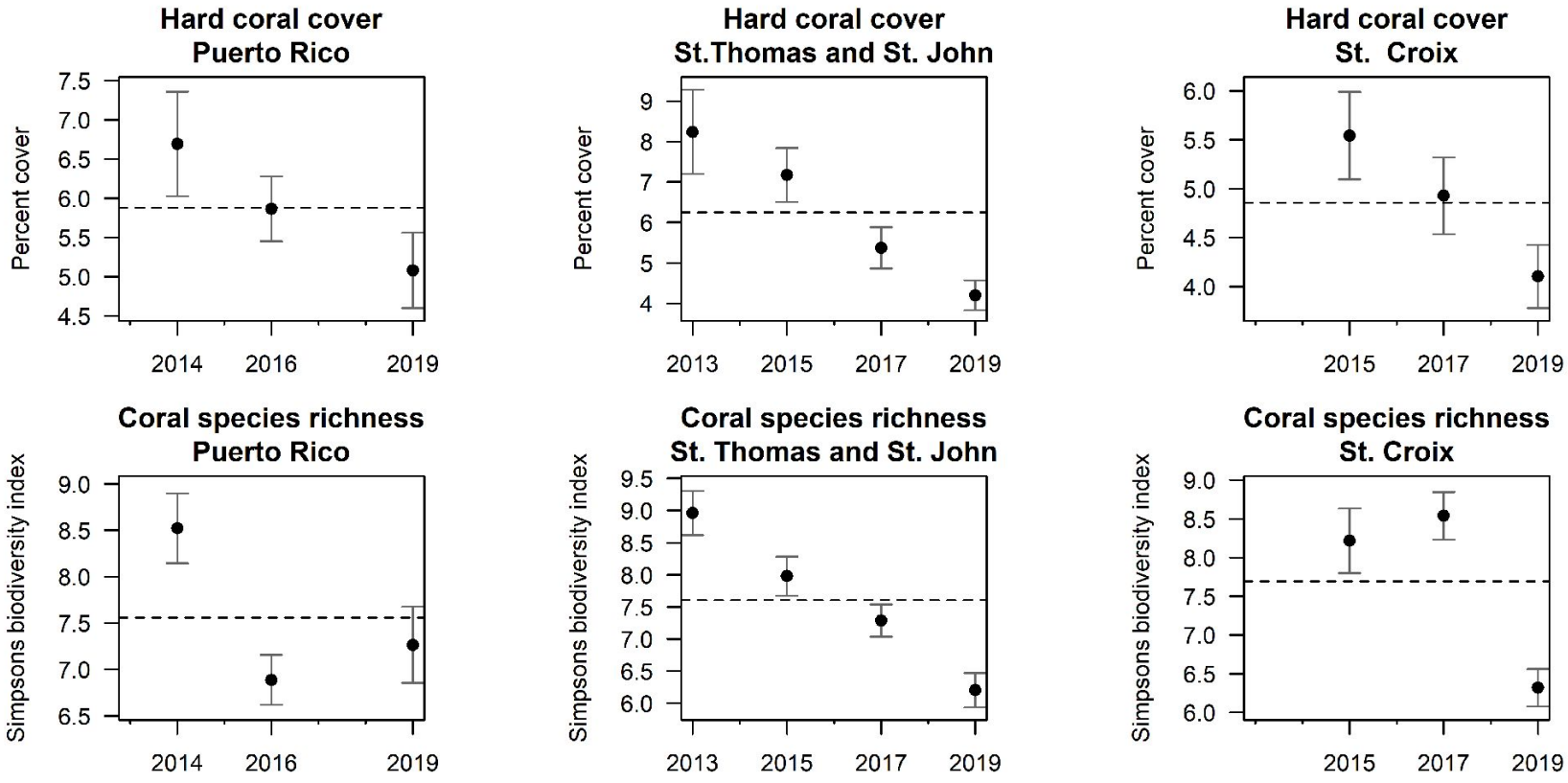
- Increase in developed land and impervious surfaces lead to impacts and modifications to shoreline habitat and water quality

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.

Coral reef habitat condition

- Limited time series, but generally declining



Percent hard coral cover and coral species richness estimated from NCRMP monitoring

Sargassum inundation

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

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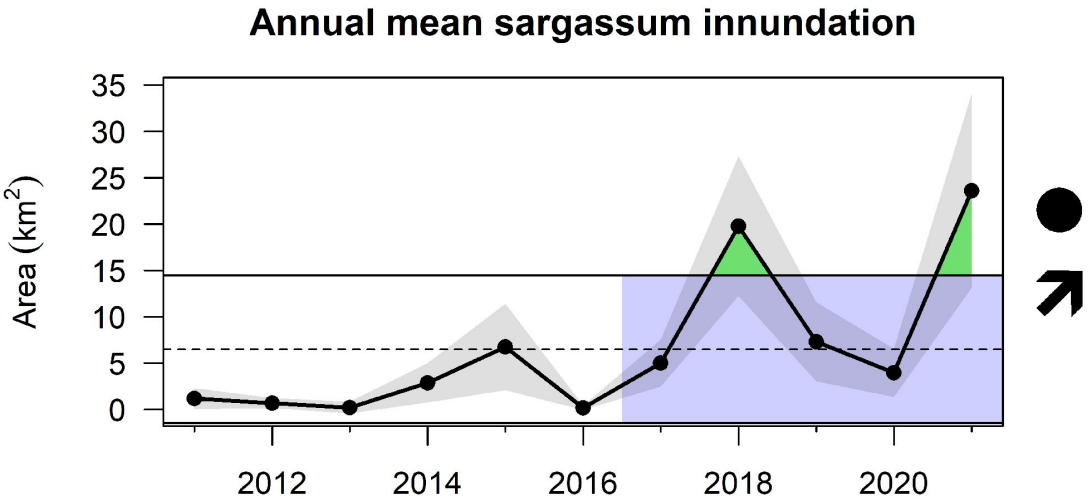
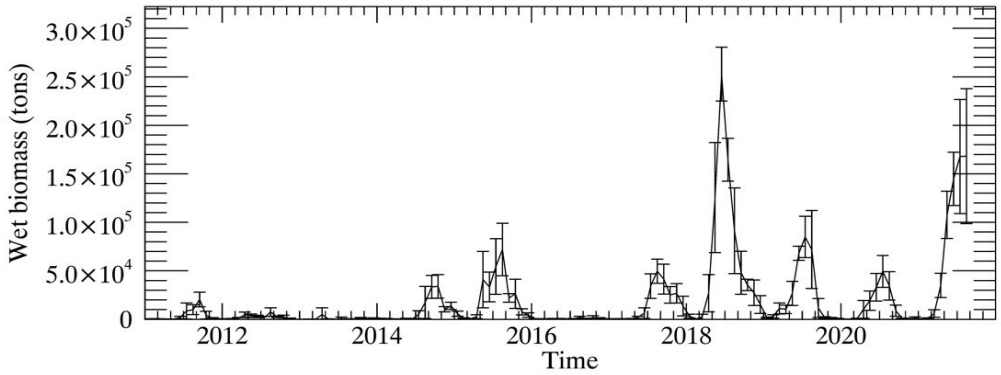
College of Marine Science,
University of South Florida

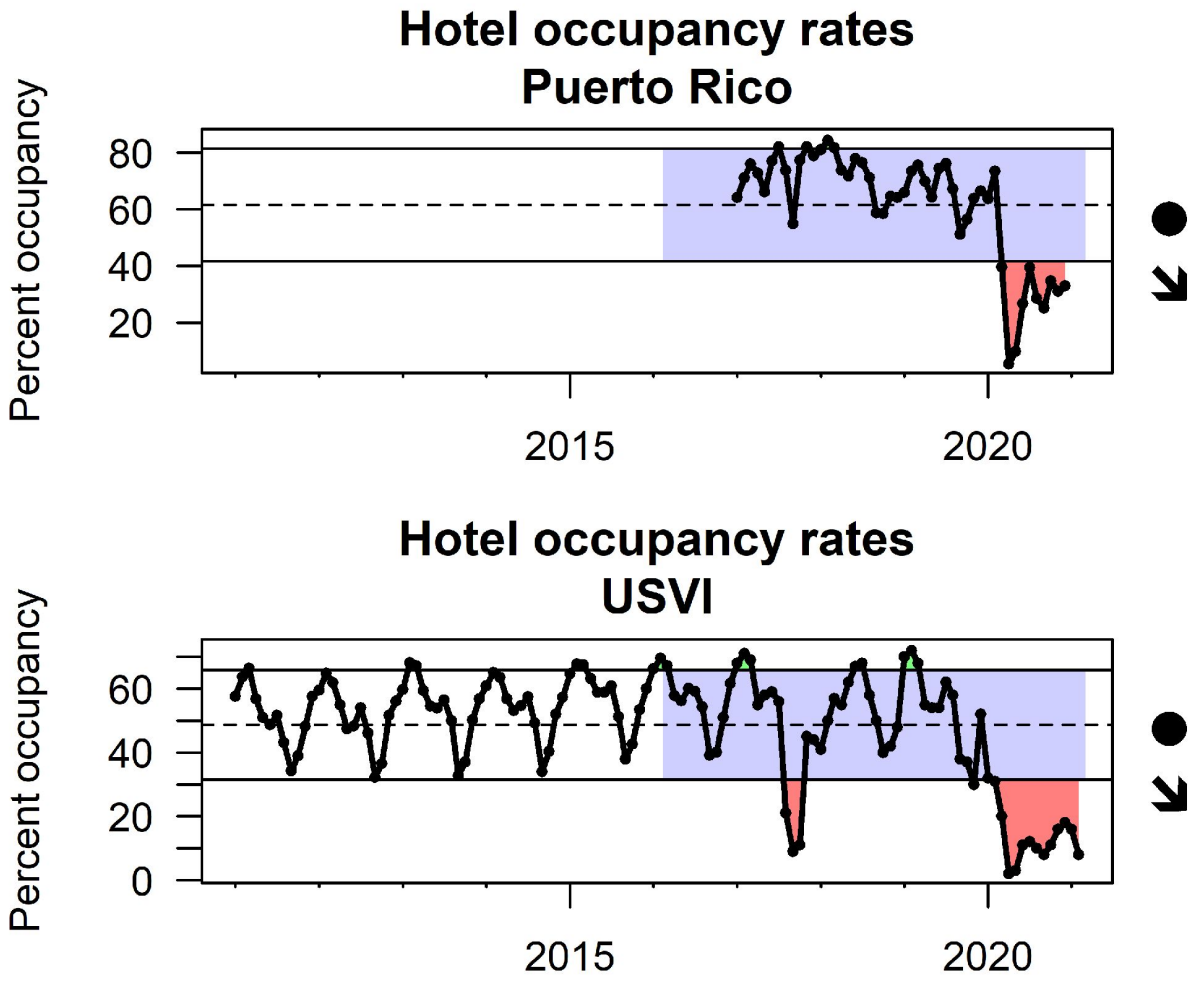




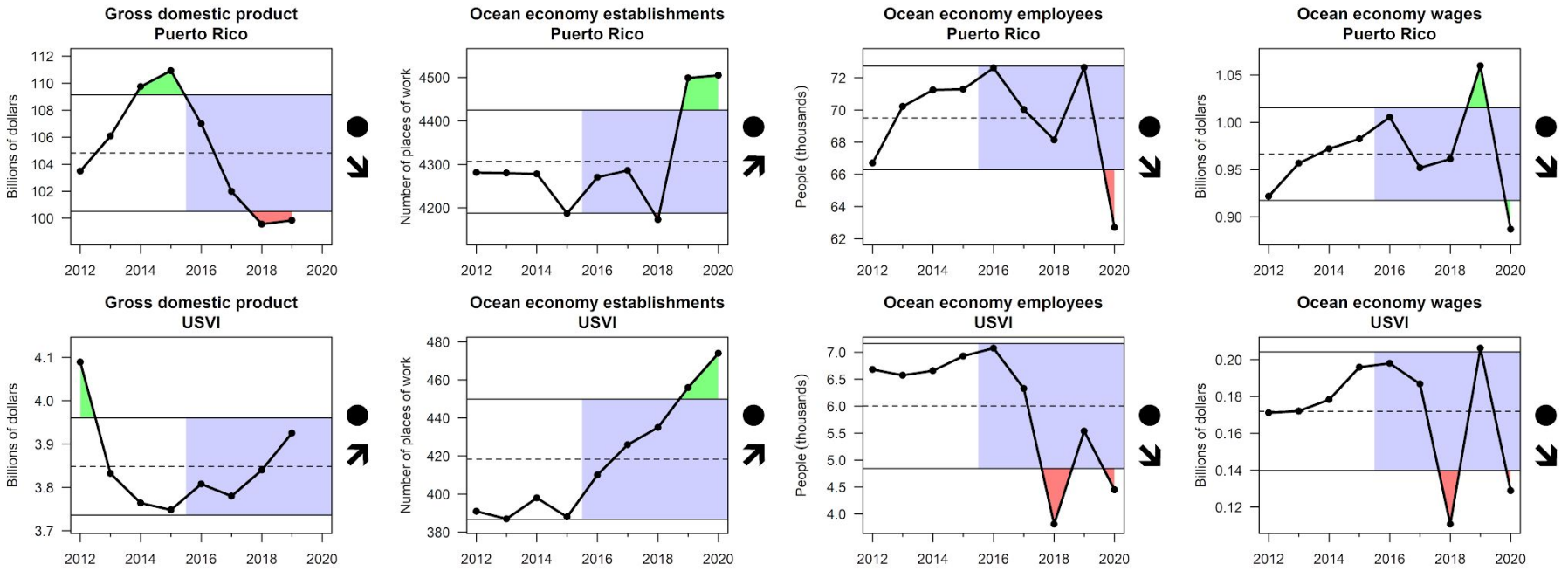
Mean monthly *Sargassum* wet biomass (2011 – 2021), estimated from MODIS satellite measurements using algorithms of Wang and Hu (2016) and Wang et al., (2018). Vertical bars are +/- 1 S.D.

Tourism activity

- Clear impacts from hurricanes Maria and Irma and pandemic



GDP and wages and employee levels

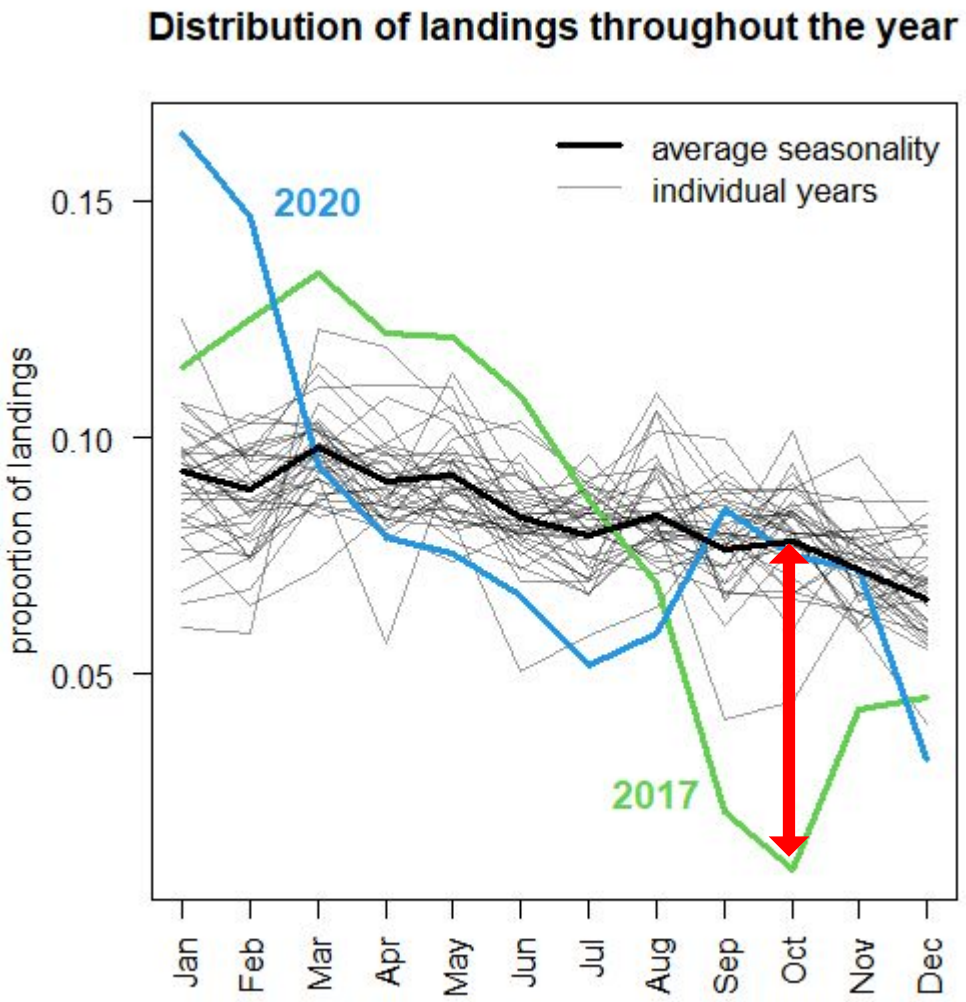


- Impacts from hurricanes Maria and Irma and pandemic, instability

Fishery disturbances

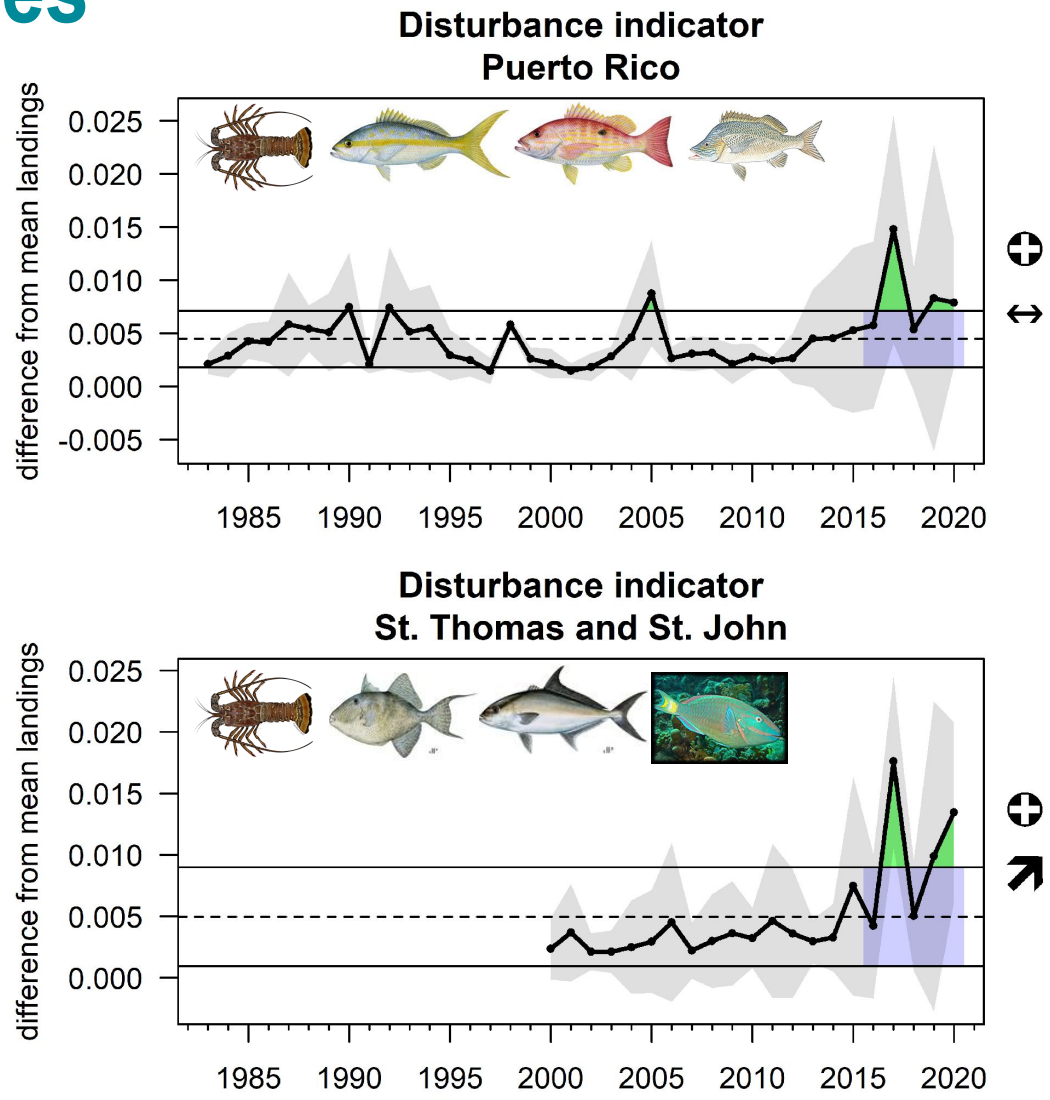
- For primary target species*, calculate proportion of landings in each month, by year
- Sum the square of deviations from the mean for each year
- Anomalies represent level of “disturbance” from typical patterns

*excluded species with seasonal closures implemented during time series



Fishery disturbances

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



Risks to meeting fishery management objectives

Chronic stressors that are increasing:

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

Acute stressors:

- High temperature anomalies, bleaching stress
- Hurricane activity
- COVID
- 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

How can this ecosystem status report be used?

- Indicator suite linked directly to FMP objectives for tracking and evaluation of FMP progress
- Provides identification of long-term and shorter-term datasets as well as information needs
- Meets EBFM roadmap needs for Caribbean
  - Guiding Principle 2: Advance understanding of ecosystem processes
  - Guiding Principle 3: Prioritize vulnerabilities and risks to ecosystems and their components
  - Guiding Principle 5: Incorporate ecosystem considerations into management advice by setting habitat conservation indicators
  - Guiding Principle 6: Maintain resilient ecosystems by: evaluating and track ecosystem-level reference points to assess changes in resilience, by evaluating and tracking ecosystem services, by identifying and tracking community health socio-economic metrics
- Lenfest effort is creating models for CFMC FEP development, ESR can provide status and trends of spatial habitat and social, community and economic indicators.

Next steps

- Summarize overall trends with respect to FMP objectives
- Full ESR tech report reviewed by NMFS and published in the NOAA Institutional Repository
- Potential capacity for more focus on identified needs as well as data visualization

Acknowledgements

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Thank you!

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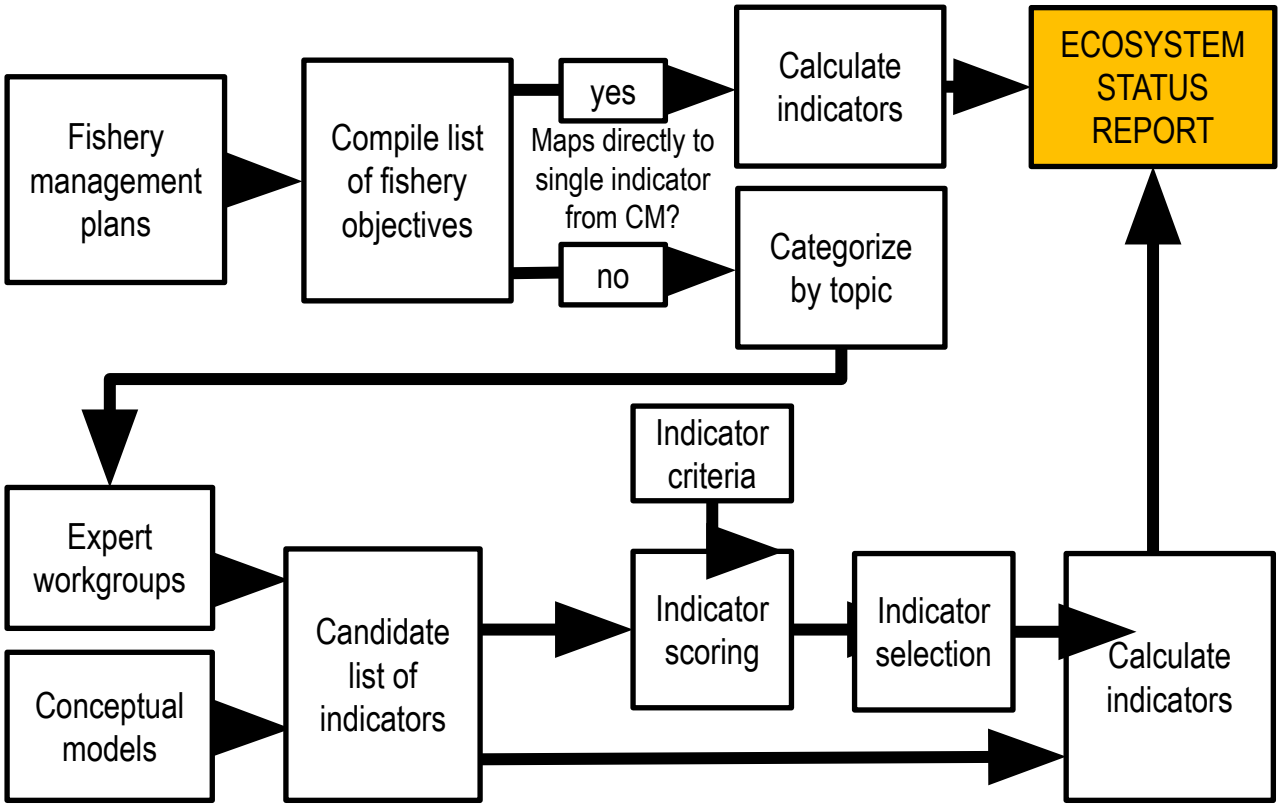
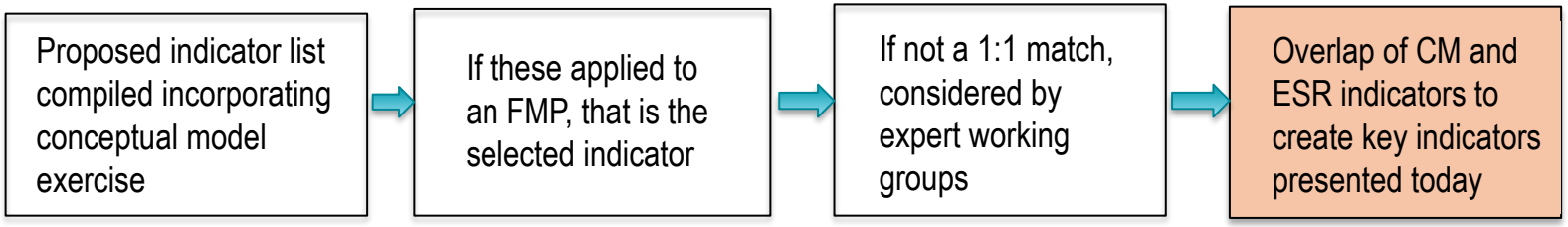
Extra slide: Process for Caribbean ESR



Extra slide: How does this relate to the conceptual model work?



- Top scored connections from conceptual model exercise that are selected indicators in ESR:
  - Pollution (via coastal LBSP), hurricanes, extreme weather, coastal development, sargassum, marine habitats, coral reef condition, climate change, tourism, population, GDP, wages