# 185th CFMC Hybrid Regular Meeting December 4-5, 2024 Embassy Suites Hotel, Isla Verde, Puerto Rico

SCIENTIFIC AND STATISTICAL COMMITTEE (SSC) PRESENTATION

Vance P. Vicente (Chair)

***Eighth National Meeting of the Scientific Coordination Subcommittee of the Council Coordination Committee***

***Participants of the SCS8; Boston, Massachusetts***

The eighth National Scientific Coordination Subcommittee Workshop (SCS8) was held in Boston, MA on August 26-28, 2024. SCS8 focused on the ***theme***: ***Applying Acceptable Biological Catch (ABC) Control Rules in a Changing Environment.***

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- The workshop provided an opportunity for Council delegates to learn from each other as they work to address a range of **shared challenges** such as data gaps, limits of existing models and processes, and managing under the rapid time scale and nature of environmental change.

- Although Councils value social science, and the potential for human dimensions information to contribute to climate informed fisheries management, **delegates acknowledge that social and economic data and expertise are limited and the roles of SSCs in using this type of data are unclear or restrictive.**

- A **limited number of examples were identified where reference points, rebuilding plans, and ABC control rules have been adapted to respond to climactic change**

## Round Robin Presentations: SSC delegates provided an overview of what stocks are managed by their Council, what ABC control rules are used, and what are the challenges with performance of the ABC control rules in a changing environment.

1. ***Gulf of Mexico*** The Council **uses tiered ABC control rules** to set catch for 40 species. Just **three species** have a quantitative assessment with MSY-informed estimates of the overfishing limit (OFL) (Tier 1). Instead, **they are setting ABC at 75% of $F_{MSY}$.** Tier 1 is for stocks with a quantitative assessment with an MSY-informed estimate of OFL and estimation of scientific uncertainty.

2. ***Western Pacific*** The Council **also uses a tiered control rule** based on data quality **for setting catch levels for 44 species** in its five Fishery Ecosystem Plans (539 species are ecosystem component species without specifications). **A 'P-star' (P*) approach is used for stocks with more quantitative assessments**. The region is challenged with survey data **quality (e.g., creel surveys in territorial waters**) **Environmental and climate factors are not included in assessment models**,. However, the Council uses **a Social Economic Ecological Management (SEEM)** process **to set annual catch limits (ACLs)** that account for uncertainties.

3. ***Mid-Atlantic*** The region is relatively **data rich with a model-estimated OFL and ABC set using a P* approach for ten of 14 species managed by the Council. While the Council has been successful at rebuilding stocks with infrequent overfishing,. Challenges such as the noticeable degradation and more frequent interruption of survey data. However, state-spaced assessment approaches are being explored for more explicit inclusion of environmental effects.**

**4. *Caribbean*** While t**he Council uses a tiered approach to set ABCs** based on data availability. **Just one stock is managed under Tier 3** (use of MSY proxy) and **the remaining 88 stocks with catch limits are managed with Tier 4 The region is relatively data limited**, with major challenges including a high level of uncertainty, additional uncertainty due to changing climate, lack of fishery effort data, limited life history data (especially ages), delays in available commercial catch data, and very limited to no recreational data. There have been recent efforts to improve understanding of life history, increased social and economic data collection, monitor highly diverse multi-species fisheries following a single species protocol, and expanding the options and applications of measuring stock health despite data limitations.

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5. ***Pacific*** The Council manages **100 stocks with threshold or kinked ABC control rules** (*KINKED CONTROL RULES are sensitive to climate driven uncertainty and biomass changes*). **Sea surface temperature is an added component for the control rule for one coastal pelagic species**. **For groundfish species, threshold-based rules provide inherent climate resilience.** For **salmon** species**, highly kinked control rules** may be sensitive to climate-driven uncertainty and shifts in biomass. There are ongoing efforts to use **risk tables** in prioritizing stock assessments and adjusting catch limits.

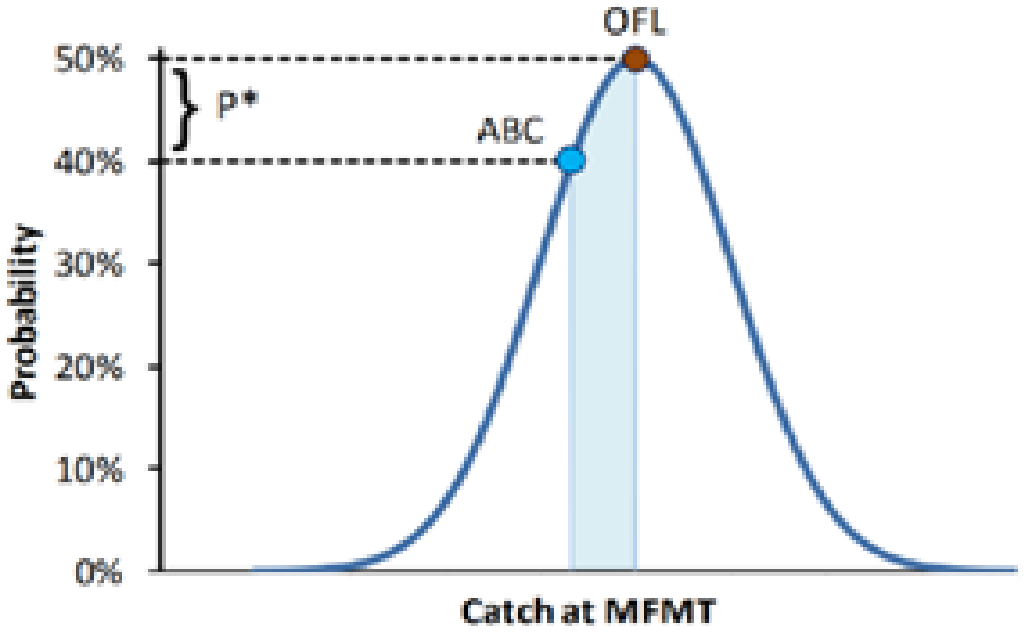
6. ***South Atlantic*** The Council **recently revised their ABC control rule, with changes implemented in early 2024 for the Snapper-Grouper, Dolphin-Wahoo, and Golden Crab fishery management plans, but it has not been applied to any stocks yet. Stock assessments have been conducted for 22 of the 70 managed species under the jurisdiction of the SAFMC. The new ABC control rule approach categorizes stocks into four hierarchical categories based on available data and resulting complexity of the assessment methods. The SSC assesses scientific uncertainty in the assessment and advises the Council on a stock risk rating. The Council's risk tolerance policy results in an accepted probability of overfishing (P*) based on relative stock biomass and the stock risk rating.**

7. ***North Pacific*** **The Council manages 39 stocks with model-based control rules (based on biomass and fishing mortality) and about 16 stocks with empirical approaches**. Current approaches **and harvest control rules (HCRs) are generally successful at avoiding overfishing, but recent marine heatwaves highlight increased risks. The big challenge is understanding how to adjust for non-stationarity in the system, including prevailing assumptions about stock dynamics and highly variable recruitment. Another issue is how to factor transient events like marine heat waves into models. The Council has been supportive of using risk tables as a framework to articulate justification for setting the ABC lower than maximum permissible in the uncommon situation where there is uncertainty not directly captured in the assessment, tier system, or harvest control rules.**

8. New England

**The region has model-based assessments with control rules for about 44% of the stocks, but over half of the stocks are assessed and managed with empirical assessments. Climate impacts on these stocks are broadly recognized in the region, but very few stocks are assessed with models that integrate environmental conditions, resulting in uncertainty about stock biomass and fishing mortality rates. Further**, ABC control rules are not simulation tested with respect to their robustness to climate or ecosystem change. Additionally, there are challenges associated with unrealistic timelines and targets for rebuilding plans. Lastly, it is difficult to determine catch advice when stock status is unknown.

Round Robin Presentations: SSC delegates provided an overview of what stocks are managed by their Council, what ABC control rules are used, and what are the challenges with performance of the ABC control rules in a changing environment.
MFMT = Maximum Fishing Mortality Threshold. If MFMT is exceeded, a stock is going overfishing.




*The P* approach to setting ABC, where ABC is based on an acceptable probability of exceeding the OFL, i.e., of overfishing (Image courtesy of NOAA Fisheries).*

# Caribbean Fishery Management Council Managed Stocks by Island

3 Island-Based Fishery Management Plans, 275 species, **89** stocks

Puerto Rico FMP

**37 Stocks; 265 species**

*Fish (32 stocks; 63 species)*
*Spiny Lobster (1 stock; 1 species)*
*Queen Conch (1 stock; 1 species)*
*Coral Reef Resources*
*(3 stocks, 200+ no-take)*

St. Thomas - St. John FMP

**26 Stocks; 245 species**

*Fish (21 stocks; 43 species)*
*Spiny Lobster (1 stock; 1 species)*
*Queen Conch (1 stock; 1 species)*
*Coral Reef Resources*
*(3 stocks, 200+ no-take)*

St. Croix FMP

**26 Stocks; 249 species**

*Fish (21 stocks; 47 species)*
*Spiny Lobster (1 stock; 1 species)*
*Queen Conch (1 stock; 1 species)*
*Coral Reef Resources*
*(3 stocks, 200+ no-take)*

# ABC Control Rules Applied to CFMC Stocks

**ABC Control Rule: Tier 1, 2, 3, 4a and 4b**
**(1=Data rich › 4=Data limited)**

| | |
|---|---|
| **Tiers 1, 2** | May rely in MSY proxies where spawner-recruit relationship cannot be well estimated |
| **Tiers 3, 4** | Data limitations require the use of MSY proxies. |
| **Tier 4** | The most data-limited of the options, an MSY proxy, MFMT, and MSST are defined with respect to assumptions about fishing mortality rate and biomass, but cannot be quantified due to data limitations. Tier 4 introduces the SYL |

3-step process to define MSY (or its proxy), SDC, ABC, ACL, and OY for each stock/stock complex in the FMP:

***Step 1***: Chosen Tier › Reference point estimates › ABC for stock/stock complex

***Step 2***: MSY proxy

***Step 3***: Applies reduction factor to ABC › ACL for stock/stock complex

# Challenges: Data limitation
# Success: Caribbean Branches

- Lacking effort data
- Limited life history information, specifically age
- Delays in availability of catch data – commercial
- Very limited or lacking recreational data

# What are the challenges with performance of the ABC control rule under climate change?

1. SEA LEVEL RISE:
2. SEA SURFACE TEMPERATURE
3. OCEAN ACIDIFICATION
4. EVALUATING CLIMATE CHANGES TO CORAL REEF-BASED FISH STOCKS

# Synthesis

- Information considered in the development of reference points and ABC CR heavily influenced by industry expertise since data are limited for the majority of species in the U.S. Caribbean
- Currently increasing effort on life history data – is it too late?
- Monitoring of highly diverse multi-species fisheries following single species protocol – is it a good idea?
- Increased efforts from the SEFSC – Caribbean Branch to find ways of evaluating the data limited stocks.

# Sea level rise (PROJECTIONS)

National Ocean Service (NOAA) 2022 Sea Level Rise Technical Report

Updated projections available **through 2150** for all U.S. coastal waters.

Rise in the next three decades is anticipated to be, on average:

a) 10 - 14 inches (0.25 - 0.35 meters) for the East coast;

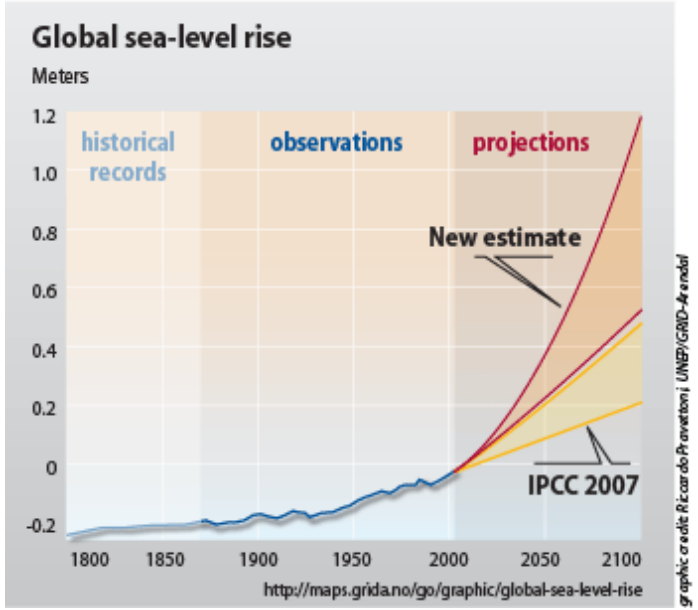
b) 2. 14 - 18 inches (0.35 - 0.45 meters) for the Gulf coast;

c) 4 - 8 inches (0.1 - 0.2 meters) for the West coast;

d) **8 - 10 inches (0.2 - 0.25 meters) for the Caribbean;**

e) 6 - 8 inches (0.15 - 0.2 meters) for the Hawaiian Islands; and,

f) 8 - 10 inches (0.2 - 0.25 meters) for northern Alaska



# Sea level rise (GEOLOGICAL) Caribbean Sea signal: rapid rise to about 5000 ybp followed by a slower rate.

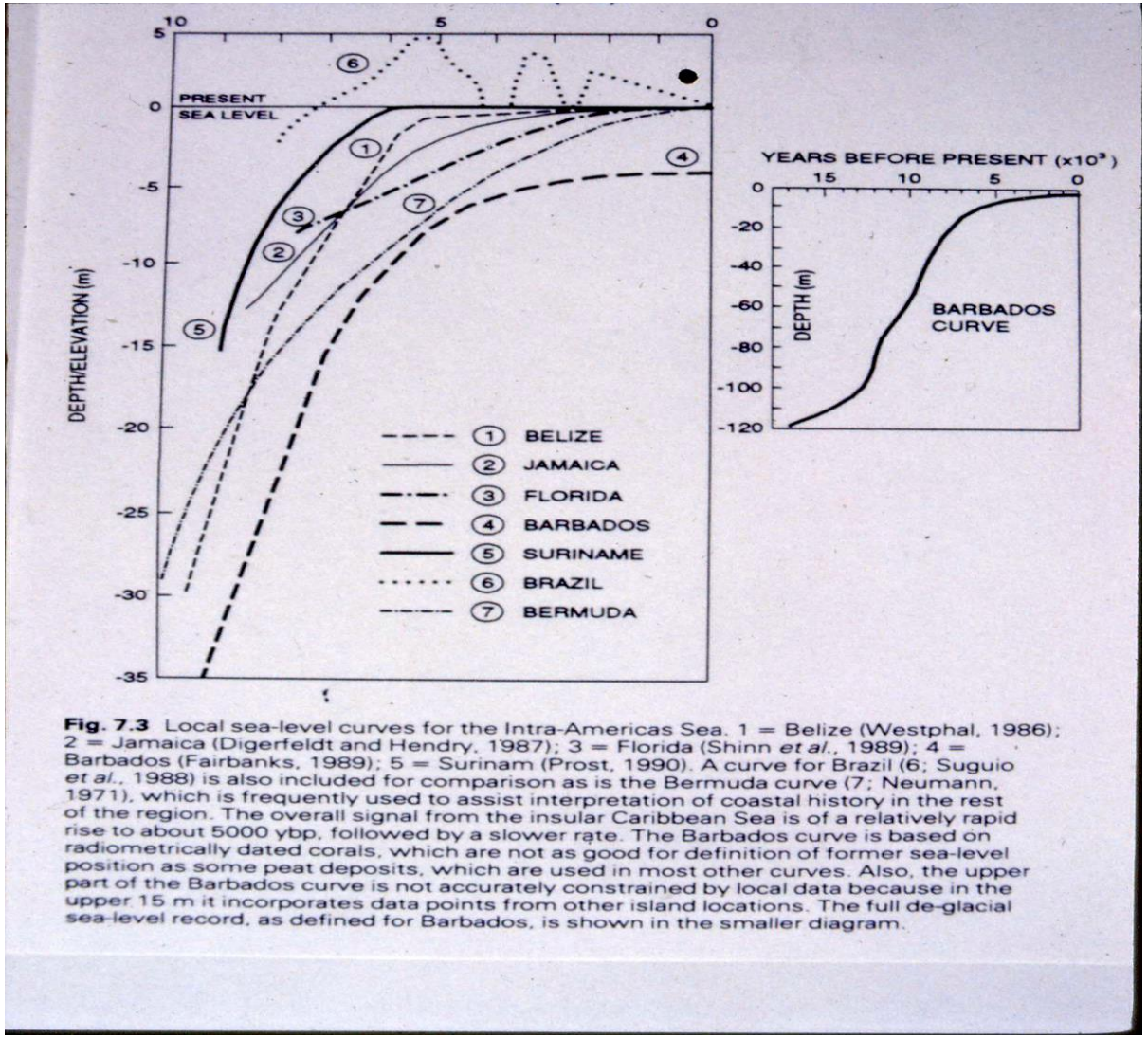
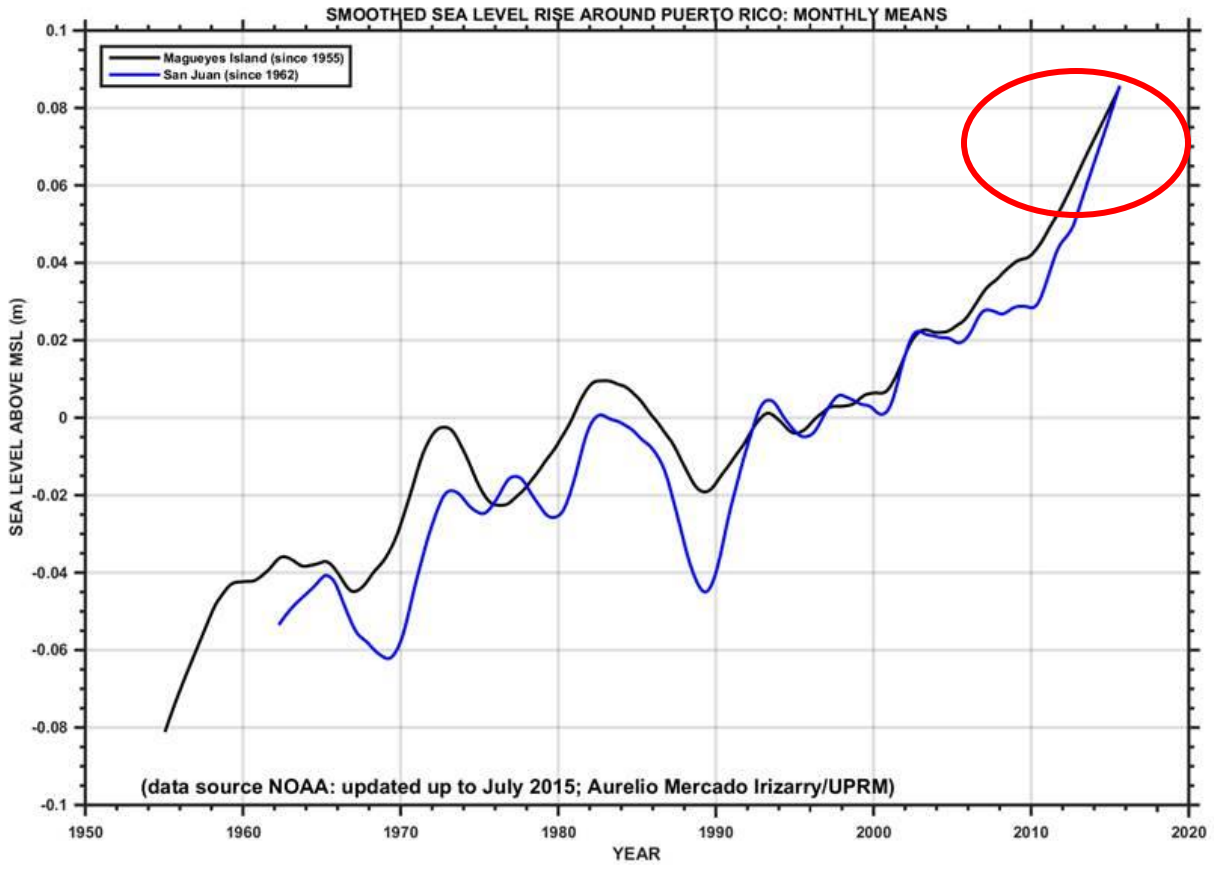
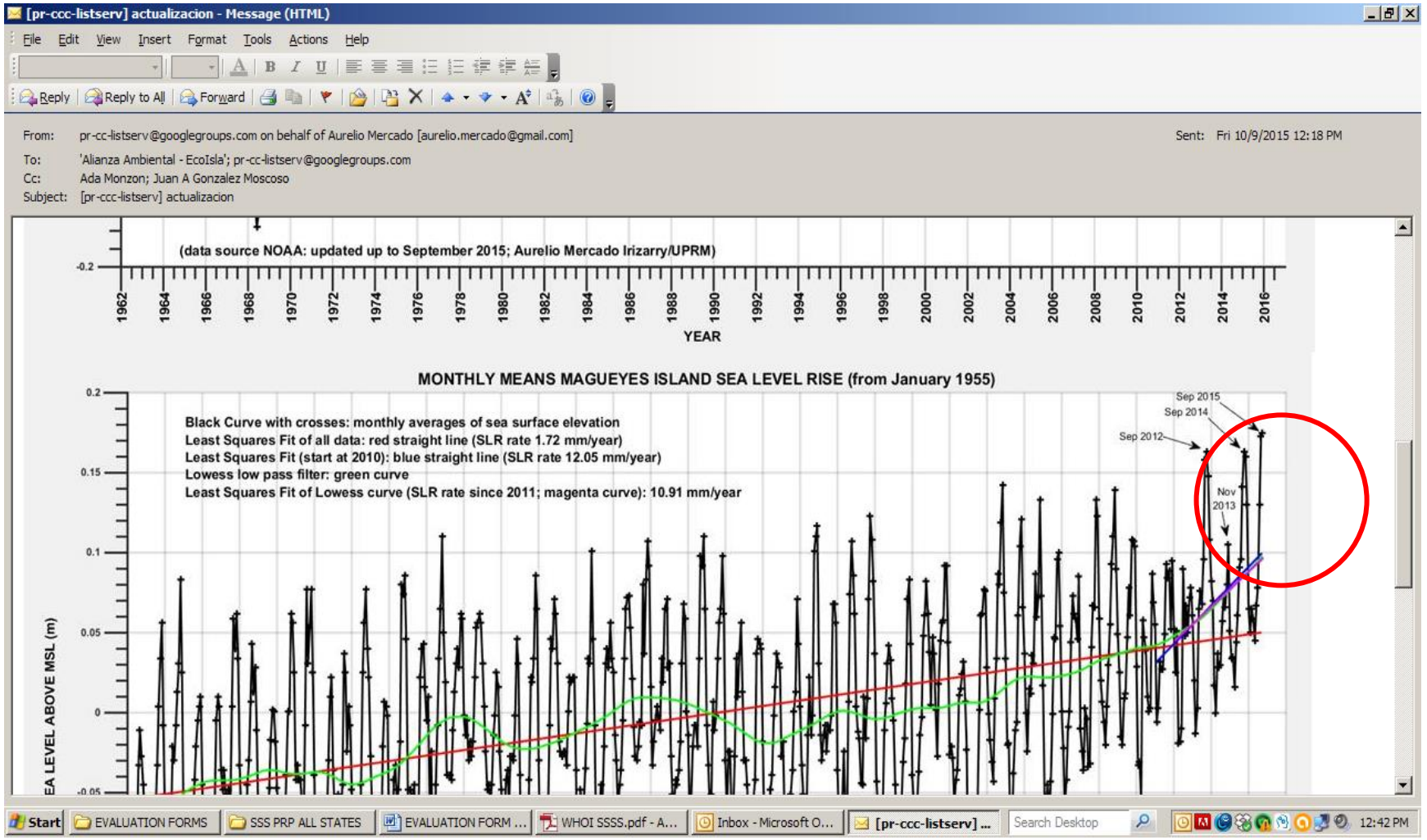



**Fig. 7.3** Local sea-level curves for the Intra-Americas Sea. 1 = Belize (Westphal, 1986); 2 = Jamaica (Digerfeldt and Hendry, 1987); 3 = Florida (Shinn *et al.*, 1989); 4 = Barbados (Fairbanks, 1989); 5 = Surinam (Prost, 1990). A curve for Brazil (6; Suguio *et al.*, 1988) is also included for comparison as is the Bermuda curve (7; Neumann, 1971), which is frequently used to assist interpretation of coastal history in the rest of the region. The overall signal from the insular Caribbean Sea is of a relatively rapid rise to about 5000 ybp, followed by a slower rate. The Barbados curve is based on radiometrically dated corals, which are not as good for definition of former sea-level position as some peat deposits, which are used in most other curves. Also, the upper part of the Barbados curve is not accurately constrained by local data because in the upper 15 m it incorporates data points from other island locations. The full de-glacial sea-level record, as defined for Barbados, is shown in the smaller diagram.

# Sea level rise (RECENT)
# Smoothed Sea Level Rise PR (1950-2023)



# Sea level rise (RECENT)
# Caribbean Coast PR



# Sea Surface Temperatures (Geological Analysis) Central Caribbean

Emiliani, C. (1966), Paleotemperature analysis of Caribbean cores P6304-8 and P6304-9 and a generalized temperature curve for the past 425,000 years, J. Geol., 74, 109–123.

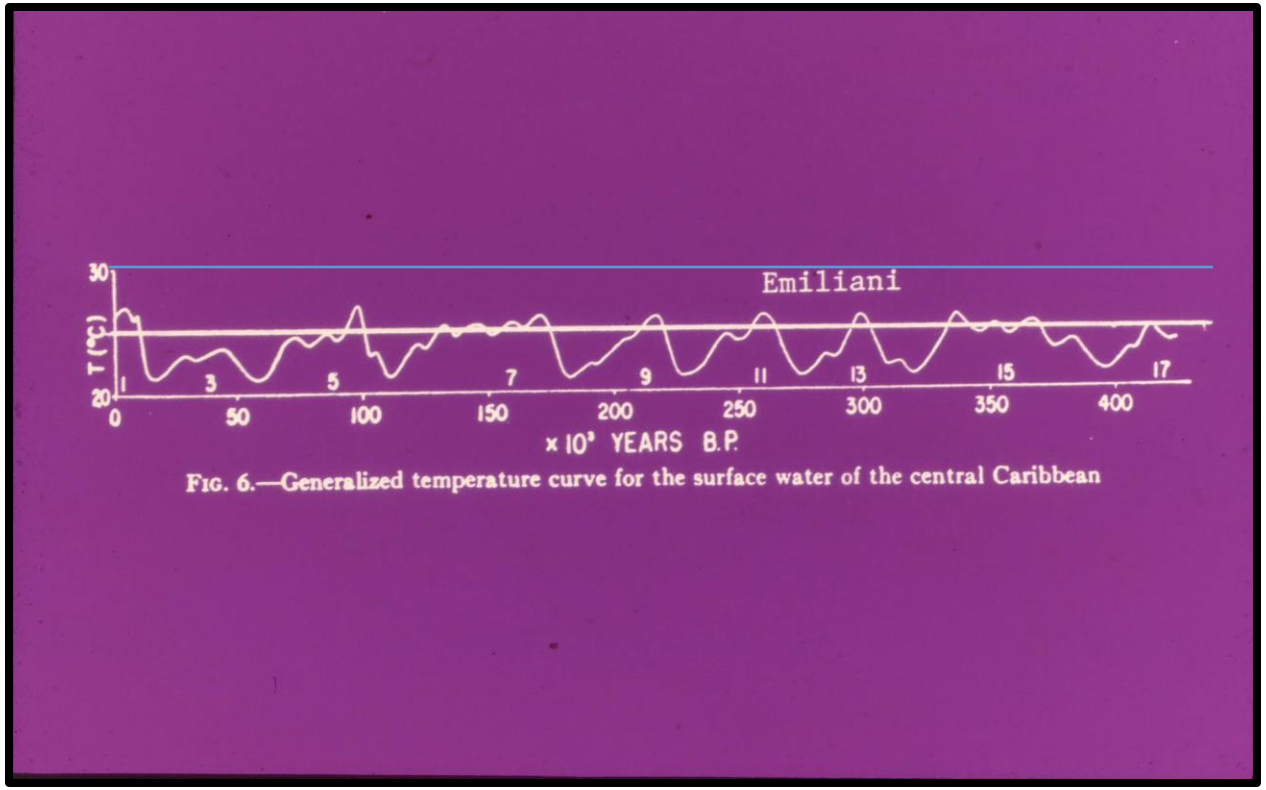
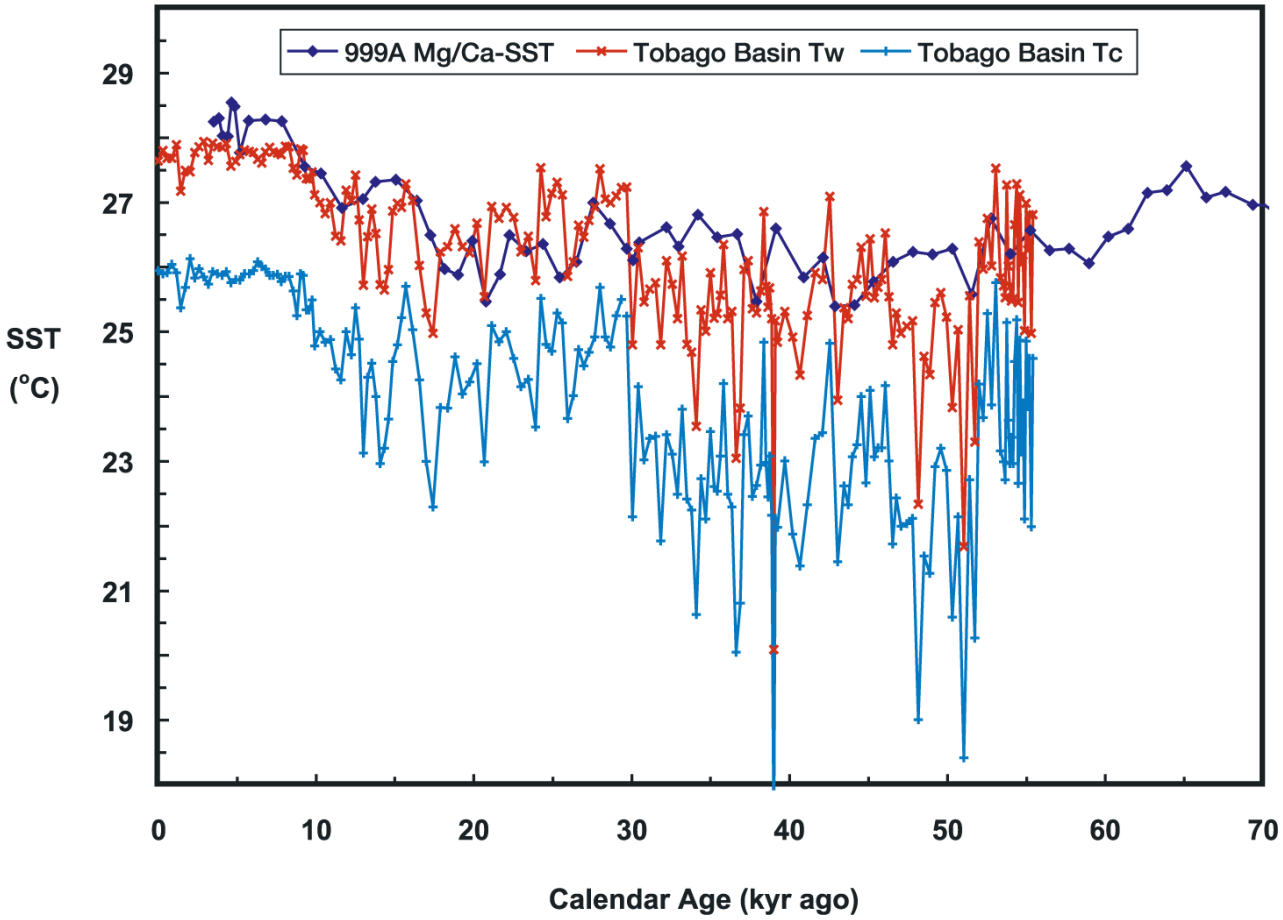


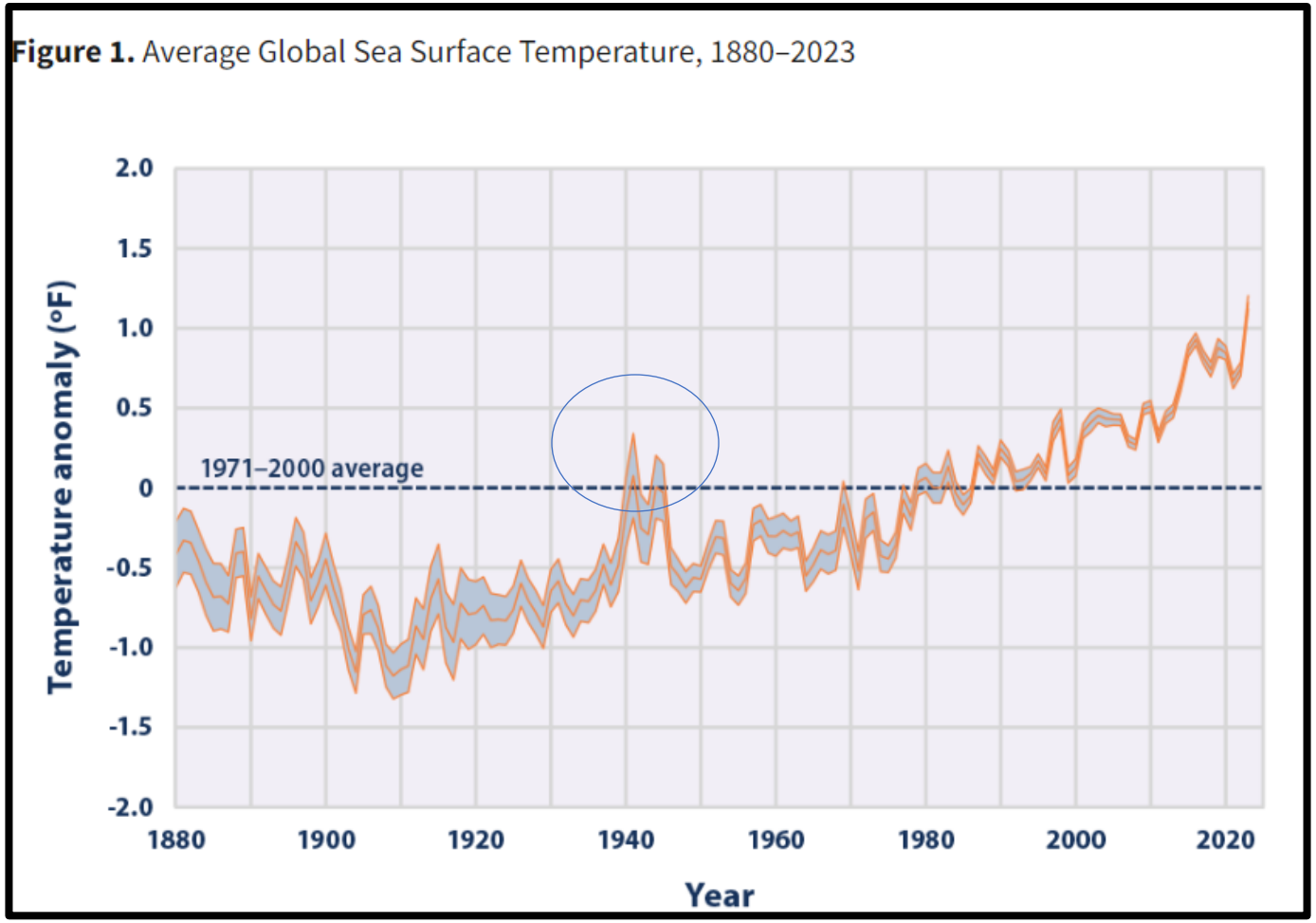

FIG. 6.—Generalized temperature curve for the surface water of the central Caribbean

# SST (Geological analysis)

Comparison of the ODP 999A Mg/Ca-SST record (closed blue diamonds) over the past 55 kyr with the Tobago Basin faunal SST (modern analog technique) reconstruction for summer months (Tw) (red crosses) and for winter months (Tc) (blue pluses) [Hu¨ls and Zahn, 2000]. Mg/Ca ratios in the planktonic foraminifera *Globigerinoides ruber* from Colombian Basin core ODP 999A suggest that Caribbean sea surface temperatures (SSTs) were from **2.1 to 2.7°C colder than the present during the last three glacial maximums.**



# SST: 1880-2023
# GLOBAL



SST RECENT POSITIVE, SUSTAINED THERMAL ANOMALIES IMPACTS: Extinctions, Bleaching, Ethological).

- **Commercial sponge Extinctions**: **Vicente, V.P. 1989. Regional commercial sponge extinctions in the West Indies: Are recent climatic changes responsible?** ***Marine Ecology, 10(2):179-191*****.**

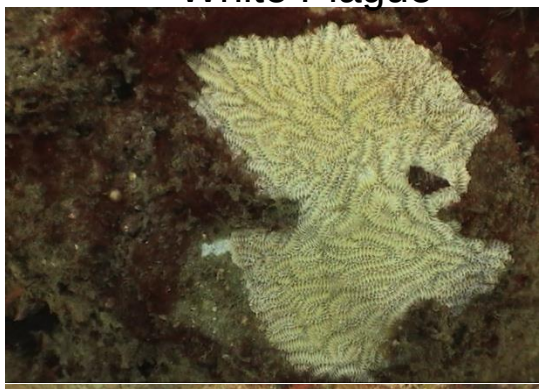
# Coral Reef Bleaching/Diseases

Bleaching: Williams, E.H. Goenaga, C., V.P. Vicente. 1987. Mass bleaching on Atlantic coral reefs. *Science*, 238: 877 – 878.

Coral Diseases/White Plague



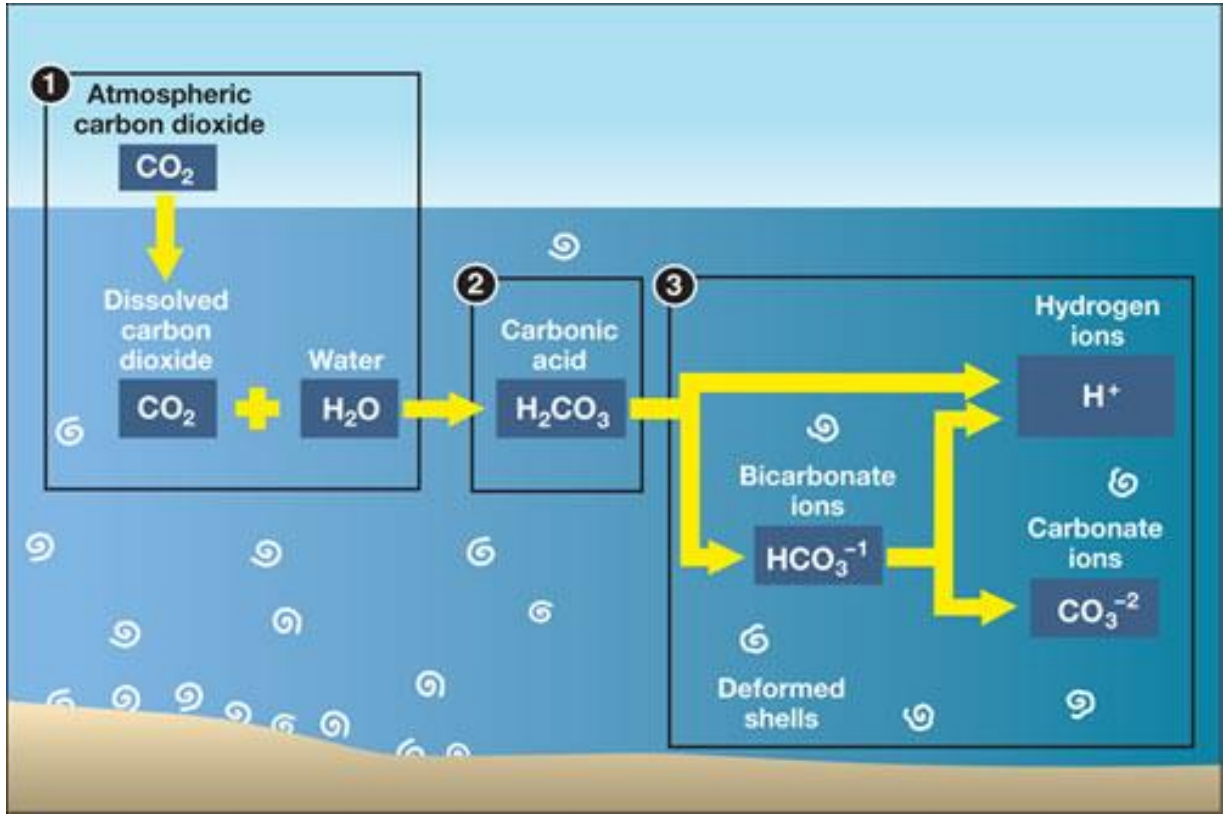
Coral Diseases/Bleaching-White Plague



Coral Diseases/Dark Spot


# OCEAN ACIDIFICATION

**1.** CO2 absorbed by seawater (H2O).
**2.** CO2 reacts to form carbonic acid; makes water more acidic (more hydrogen atoms).
**3.** Carbonic acid breaks down into bicarbonate and hydrogen ions (H+).
4. Bicarbonate breaks down into more H+ and carbonate, key to organisms like oysters, clams, corals, and other marine organisms that make shells and skeletons.
5. But as acidity increases, less bicarbonate changes into carbonate.



# Ocean Acidification

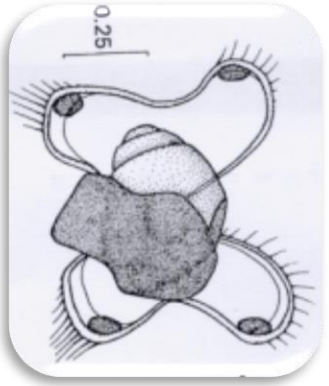
(Marine Biology, 162 (10): 2047-20)

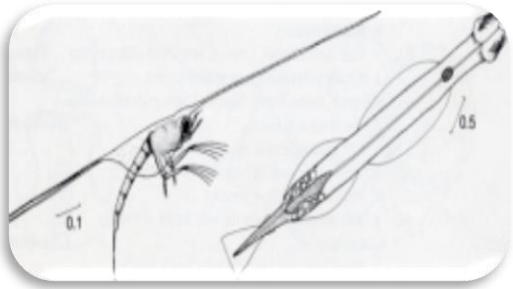
**Ocean acidification** is causing changes to the chemistry and biology of the marine environment, in ways that we are only just beginning to understand.

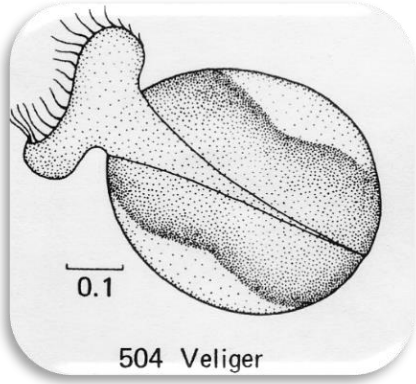
**Ocean acidification** affect the survival, growth, development, and physiology of marine invertebrates.

**Ocean acidification** affect **Especially larval stages** with thin outer carbonate shells (VELIGERS) as shown below:

A team of researchers working on a Carnegie expedition in Australia's Great Barrier Reef has documented **that coral growth rates have plummeted 40%** since the mid-1970s. The scientists suggest that **ocean acidification** may be playing an important role in this perilous slowdown.



# SSC PARTICIPATION 2024
# Caribbean seminar series - Tuesday, November 19th, 2024

This month's speaker is **Nathan Vaughan** (SEFSC, Vaughan Analytics)
presenting: **Quantifying hurricane impacts on United States Virgin Islands reef fishes using a catchability invariant approach to compare uncalibrated survey indices**

**Abstract:** The United States Virgin Islands (USVI) coral reefs support many economically and ecologically important fish species. Located in the Caribbean Sea, they are subject to frequent severe weather disturbances, including two category 5 hurricanes, Irma and Maria, in 2017. The overarching goal of this study was to identify reef fish community impacts following these extreme events using discontinuous survey indices.

Long-term (2001–2021), in situ, **fishery-independent survey data** using two methods were standardized to the extent possible in two regions of the **USVI, St. Thomas/St. John (STT/STJ) and St. Croix (STX**). Comparable data were assessed, 73 species collected on hard- bottom habitat, to identify the number of these species with significant changes in density and/or mean length between 2-yr survey intervals over the historic baseline (2001–2015), disturbance (2017–2019), and post disturbance (2019–2021) periods.

The results varied by region: STT/STJ had no disturbance impact and **STX had a significant disturbance impact. In STX, 20 species had significant changes in density in the disturbance period compared to an average of 9.7 (SD 3.8) species for the baseline period.** The proportion of species with significant density increases and decreases were similar suggesting that **overall disturbance impacts are nuanced.** Mean length observations were less informative, likely due to survey method and sample size changes. However, in combination with density they provided useful insights into the possible causes of population change. The successful use of discontinuous survey indices to obtain meaningful biological insights has broader applications to ecosystem and fishery datasets with similar limitations.

# SSC PARTICIPATION 2024

## Caribbean seminar series - Tuesday, October 15th Noon (EST/AST), 11am (CST)

Inbox

This month's speakers are **Mandy Karnauskas** (SEFSC) and **Carissa Gervasi** (CIMAS) presenting: **An overview of the first Ecosystem Status Report for the U.S. Caribbean Region – and how you can contribute**

**Abstract: Ecosystem Status Reports are documents that summarize a suite of indicators used to track trends in conditions of marine ecosystems**. These reports provide context for decisions affecting marine ecosystems and support an ecosystem-based approach to fishery management.
An initial Ecosystem Status Report for the U.S. Caribbean region is being developed to support the newly adopted Island-based Fishery Management Plans, as well as the Fishery Ecosystem Plan in progress for the region.

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# SSC PARTICIPATION 2024

CARI-CAN 2024

# SSC PARTICIPATION 2024

## VICENTE PROPOSAL EVALUATIONS 2024

FY24 Cooperative Research Program (CRP) **VPV 1**
EVALUATIONS BY VANCE P. VICENTE FEBRUARY 2024
PROPOSAL TITLE: Post-release survival of **fine-tooth sharks**, *Carcharhinus isodon*, captured in recreational fisheries in the southeastern U.S.

FY24 Cooperative Research Program (CRP) **VPV 2**
EVALUATIONS BY VANCE P. VICENTE FEBRUARY 2024
PROPOSAL TITLE: Title: Using Close-Kin Mark Recapture to Estimate the Census Size of **Sandbar Sharks:** Phase Development of Molecular Tools and Experimental Design.

FY24 Cooperative Research Program (CRP) **VPV 3**
EVALUATIONS BY VANCE P. VICENTE FEBRUARY 2024
PROPOSAL TITLE: Title: Collaborating with fishers to improve our understanding of **Scamp** reproductive potential.

FY24 Cooperative Research Program (CRP) **VPV 4**
EVALUATIONS BY VANCE P. VICENTE FEBRUARY 2024
PROPOSAL TITLE: Data-Poor Caribbean Reef Fishes: Addressing Critical Gaps in **Red Hind Population** Demographics and Life History in Preparation for Stock Assessments in St. Thomas/St. John and St. Croix

# SSC PARTICIPATION 2024

## VICENTE PROPOSAL EVALUATIONS 2024

FY24 Cooperative Research Program (CRP) **VPV 5**
EVALUATIONS BY VANCE P. VICENTE FEBRUARY 2024
PROPOSAL TITLE: Evaluating the Need for Continued Protection of **Spawning Special Management Zones** in the Southeastern United States

FY24 Cooperative Research Program (CRP) **VPV 6**
EVALUATIONS BY VANCE P. VICENTE FEBRUARY 2024
PROPOSAL TITLE: Project Title: Engaging citizen scientists **to quantify depredation** in the U.S. Gulf of Mexico and South Atlantic Ocean

FY24 Cooperative Research Program (CRP) **VPV 7**
EVALUATIONS BY VANCE P. VICENTE FEBRUARY 2024
PROPOSAL TITLE: **Gag grouper** management has become a contentious issue in the Gulf of Mexico (GoM) as fishers lack confidence in the quality of data underlying recent stock y Inhouse assessments. The Mote Marine Laboratory (MML). Fisheries Electronic Monitoring (CFEMM).

FY24 Cooperative Research Program (CRP) **VPV 8**
EVALUATIONS BY VANCE P. VICENTE FEBRUARY 2024
PROPOSAL TITLE: Movement, habitat use, and post release mortality of **bigeye thresher** shark (*Alopias superciliosus*). Long-lifespan satellite tags, FLORIDA INTERNATIONAL UNIVERSITY

# SSC PARTICIPATION 2024

## VICENTE PROPOSAL EVALUATIONS 2024

FY24 Cooperative Research Program (CRP) **VPV 9**
EVALUATIONS BY VANCE P. VICENTE FEBRUARY 2024
PROPOSAL TITLE: Evaluating the use of an **electromagnetic shark repellent** to reduce shark depredation in the Gulf of Mexico and South Atlantic shrimp fishery. The primary objective of the proposed study is to determine if devices designed to repel sharks through the use of electromagnetic fields (FISH02 Ocean Guardian; Shark Shield) can effectively reduce shark depredation in the Gulf of Mexico and South Atlantic commercial shrimp fishery.

FY24 Cooperative Research Program (CRP) **VPV 10**
EVALUATIONS BY VANCE P. VICENTE FEBRUARY 2024
PROPOSAL TITLE: Title: Evaluating post-release mortality of sandbar sharks (Carcharhinus plumbeus) in the Gulf ofMexico recreational charter fishery.Identifying best handling practices for shore-based recreational shark fisheries: The effect of **air exposure on blacktip shark (***Carcharhinus limbatus***)** post-release mortality. This project will cooperatively engage recreational shore-based shark anglers to deploy Acceleration Data Loggers (ADLs) on blacktip sharks to quantify the effect of air exposure(e.g., landing locations on PRM.

FY24 Cooperative Research Program (CRP) **VPV 11**
EVALUATIONS BY VANCE P. VICENTE FEBRUARY 2024
PROPOSAL TITLE: Mote Marine Laboratory Center for Fisheries Electronic Monitoring (CFEMM) Proposal Submission to NOAA Cooperative Research Program YR 2024 –**Assessing Marine Mammal Interactions** and Avoidance Strategies Through Electronic Monitoring in the Eastern Gulf of Mexico Bottom Longline Reef Fish Fishery.

FY24 Cooperative Research Program (CRP) **VPV 12**
EVALUATIONS BY VANCE P. VICENTE FEBRUARY 2024
PROPOSAL TITLE:  Title: Evaluating post-release mortality of sandbar sharks (*Carcharhinus plumbeus*) in the Gulf of Mexico recreational charter fishery. To achieve this goal, we will use our well-established relationships with experienced recreational headboat captains to cooperatively tag sandbar sharks in the GOM with PSAT tags.