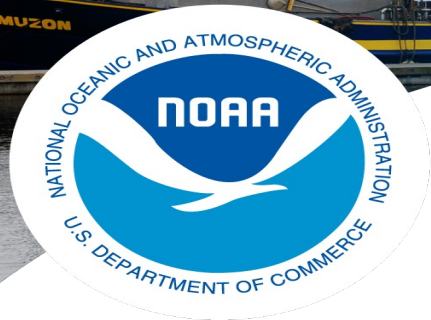




# Red tide impacts to Gulf of Mexico fisheries and community ecosystem workshops



**NOAA  
FISHERIES**

Mandy Karnauskas

Ecosystem Science Lead

NOAA Fisheries Southeast Fisheries Science Center

Council Member Ongoing Development Meeting

November 15-16th, 2022



**NOAA FISHERIES**

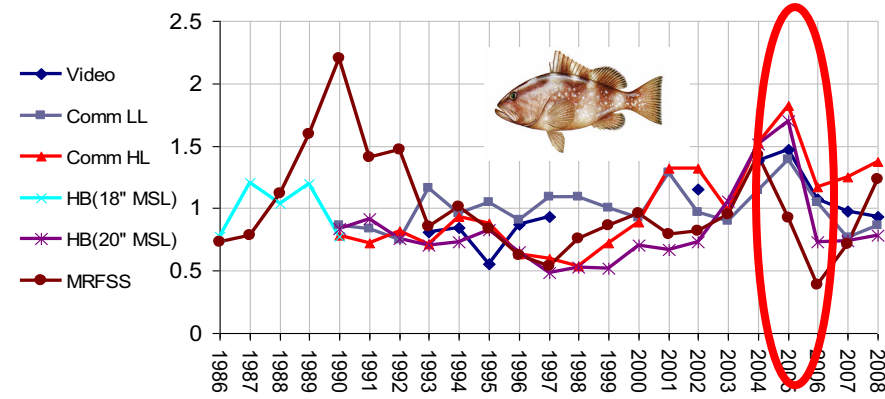
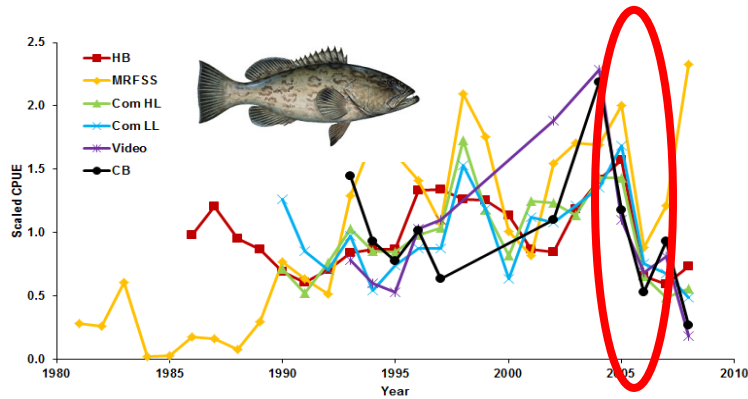
# Challenges in the Southeast Region

- Highly diverse biological and human communities
- No systematic framework for tackling EBFM (until recently)
- Limited resources (1 Science Center covering 3 Councils + HMS/ICCAT)
- Where to start?
- Who gets to define the priorities?



# Red tide harmful algal blooms – an obvious priority

Red tide harmful algal blooms caused by dinoflagellate (*Karenia brevis*)



Red and Gag grouper indices declined 50% from 2005-2006

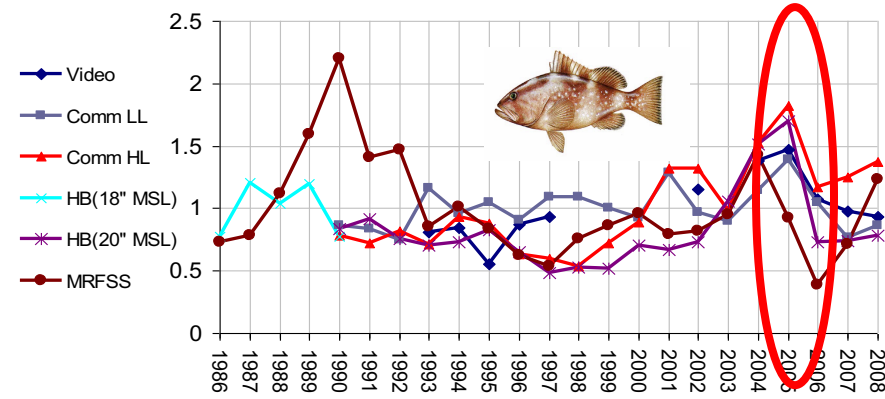
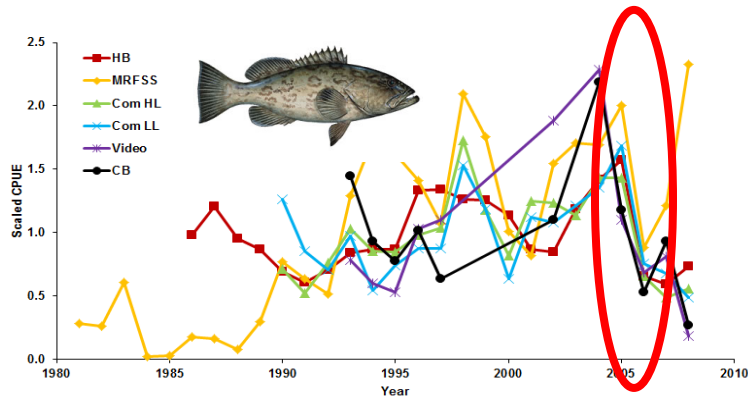
Google Trends

- Kim Kardashian  
Search term
- red tide  
Search term

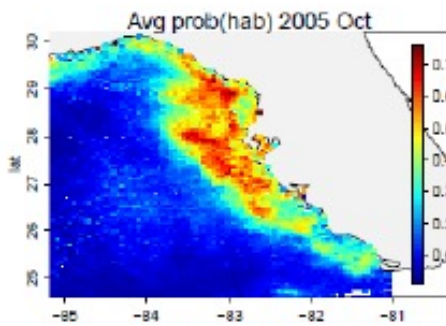


# Red tide harmful algal blooms – an obvious priority

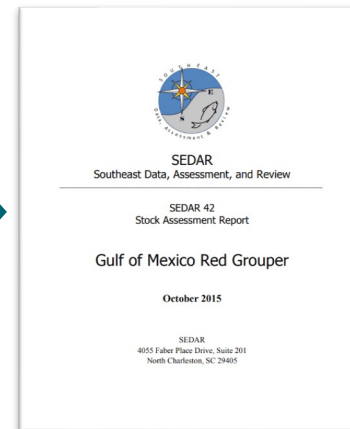
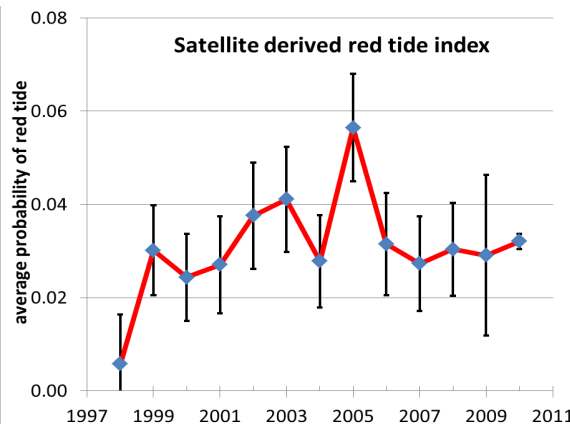
Red tide harmful algal blooms caused by dinoflagellate (*Karenia brevis*)



## Development of index for stock assessment



Walter et al. 2013

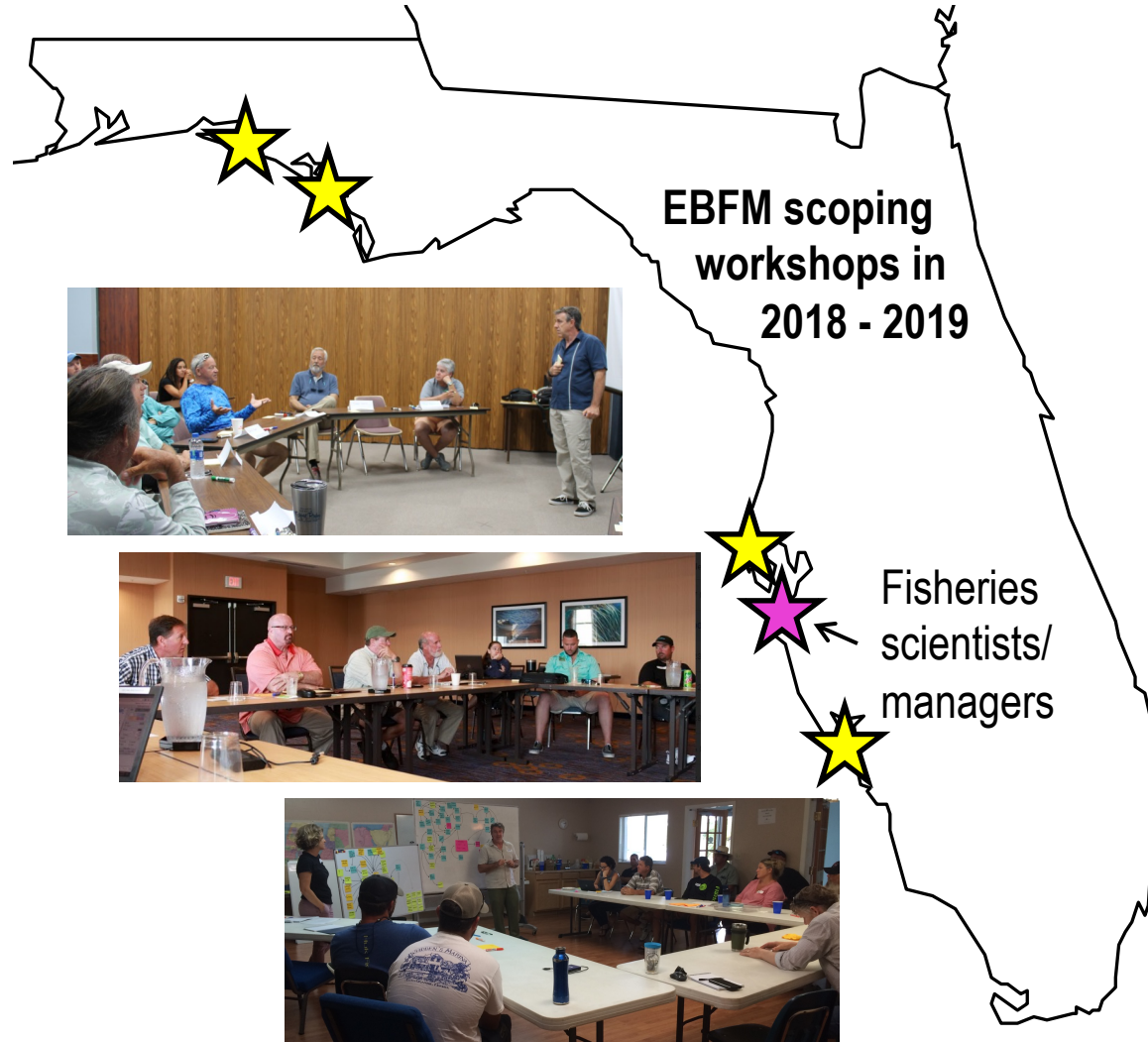




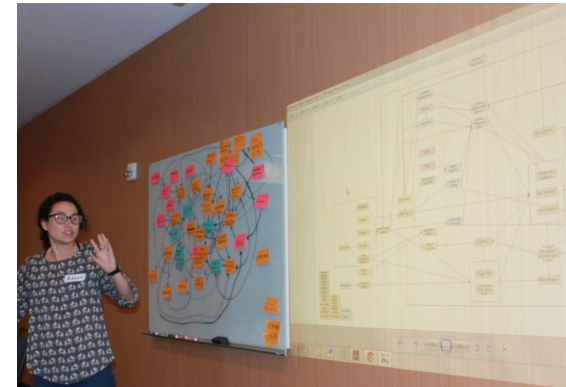
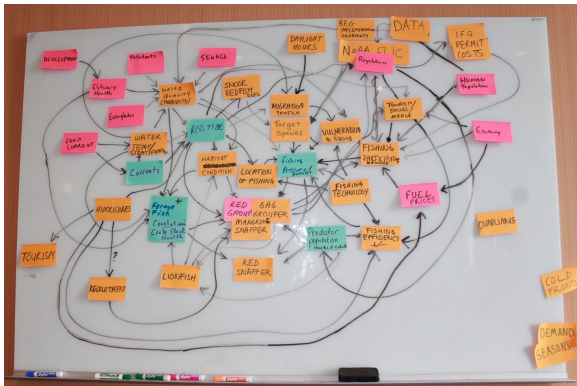
# EBFM scoping and prioritization

**Participatory system dynamics modeling**  
(Community Based System Dynamics, Hovmand 2014)

**Goal:** To increase information flow between scientists, managers, and stakeholders, in support of improved stock assessment and ecosystem assessment in the Gulf of Mexico.



# Participatory system dynamics modeling



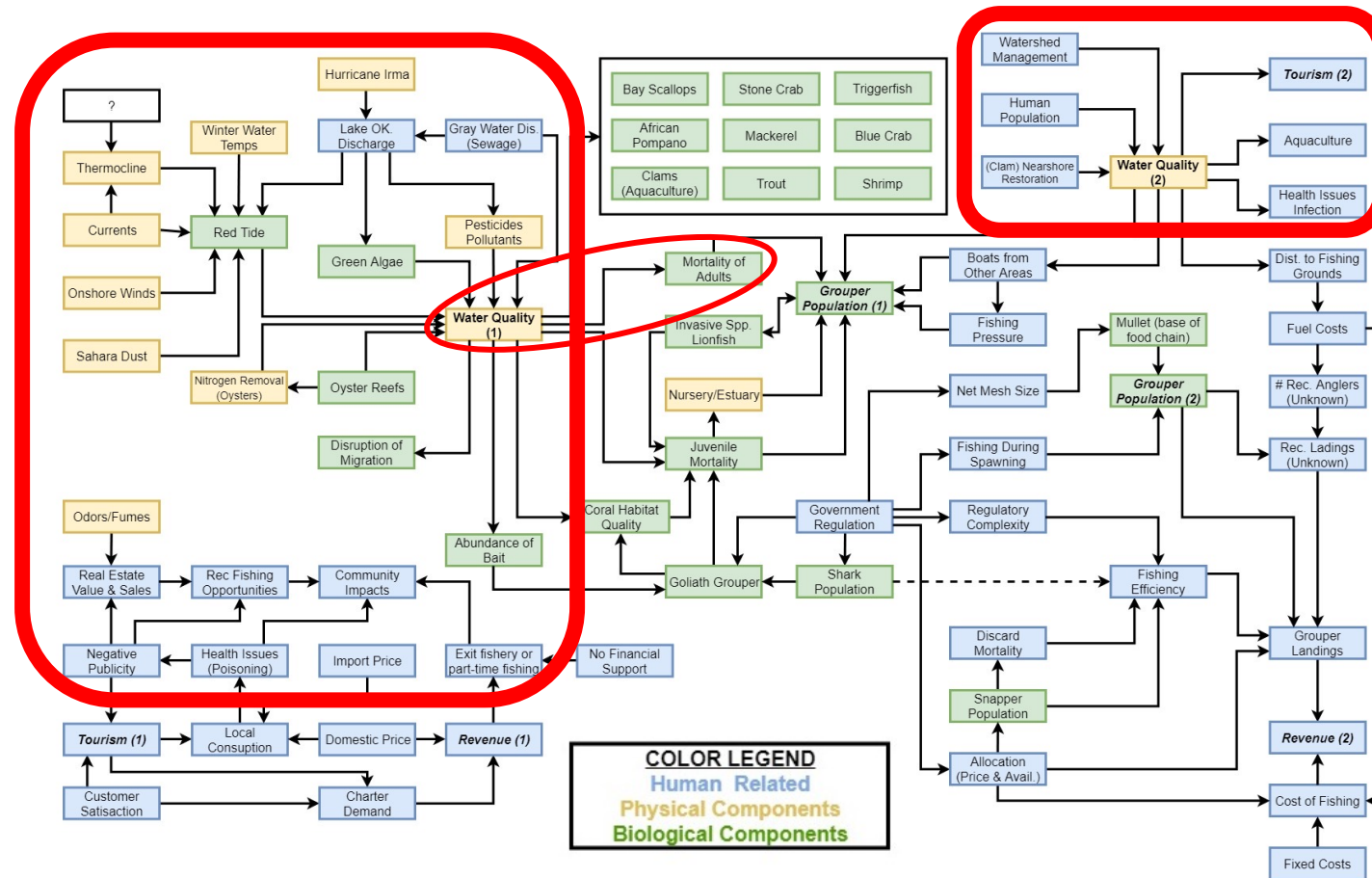
- What are the major factors affecting your fishery?
- Where do the major risks in the fisheries system lie?
- How do changes in ecosystems affect your businesses and communities?
- What do you value in the ecosystem?



# Addressing red tide from EBFM perspective

Red tide affects target fish stocks, but also prey base, habitat, aquaculture, publicity, tourism, seafood demand, real estate, health...

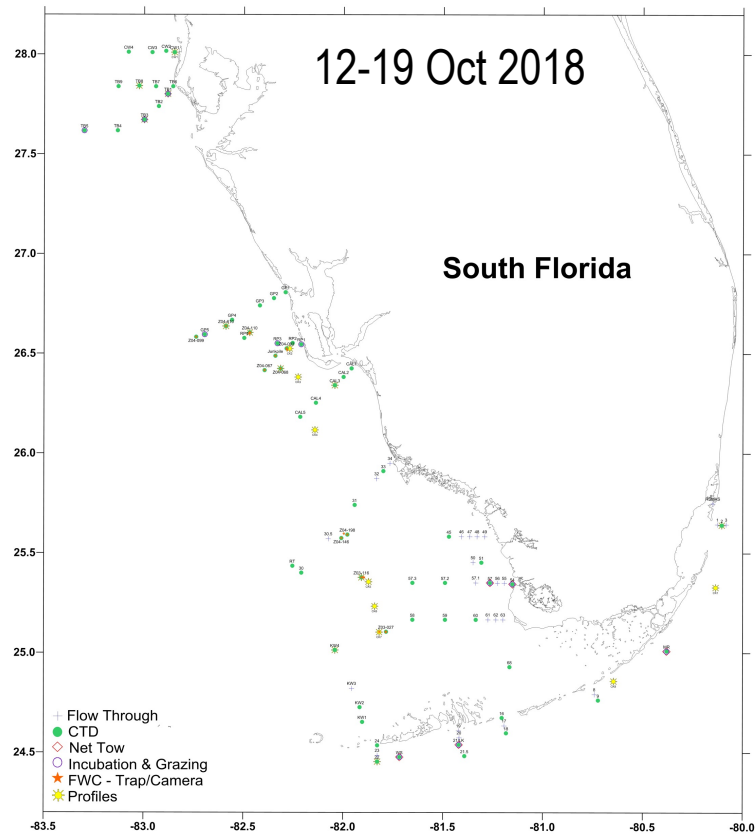
Red tide and its direct impacts on ecosystem



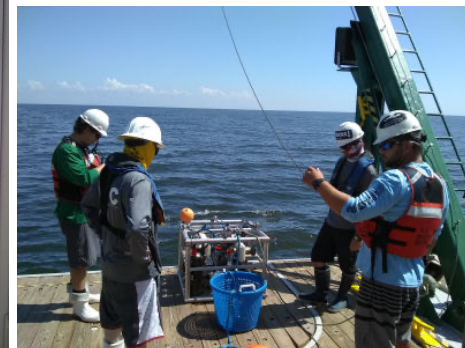
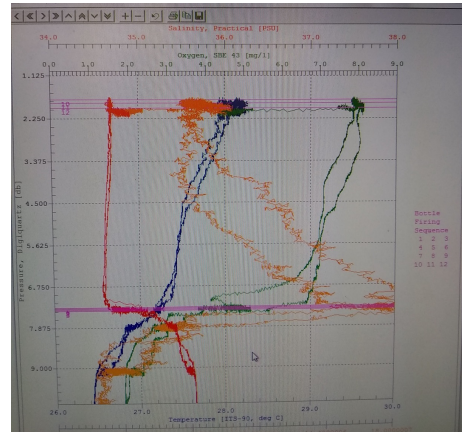
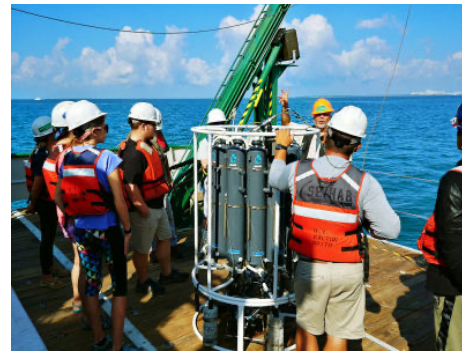
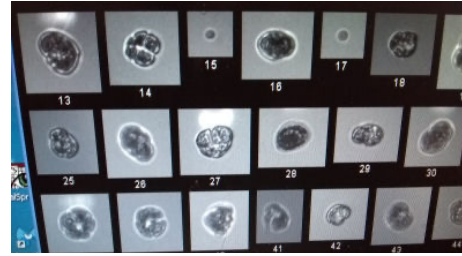


# Understanding ecological impacts of red tide

## Red tide response cruise



NOAA-AOML in collaboration with NOAA-SEFSC, NOAA-NESDIS, CIMAS, FWC-Fish and Wildlife Res. Institute, Mote Marine Lab, Univ. of South Florida, NCCOS





# Understanding human impacts of red tide

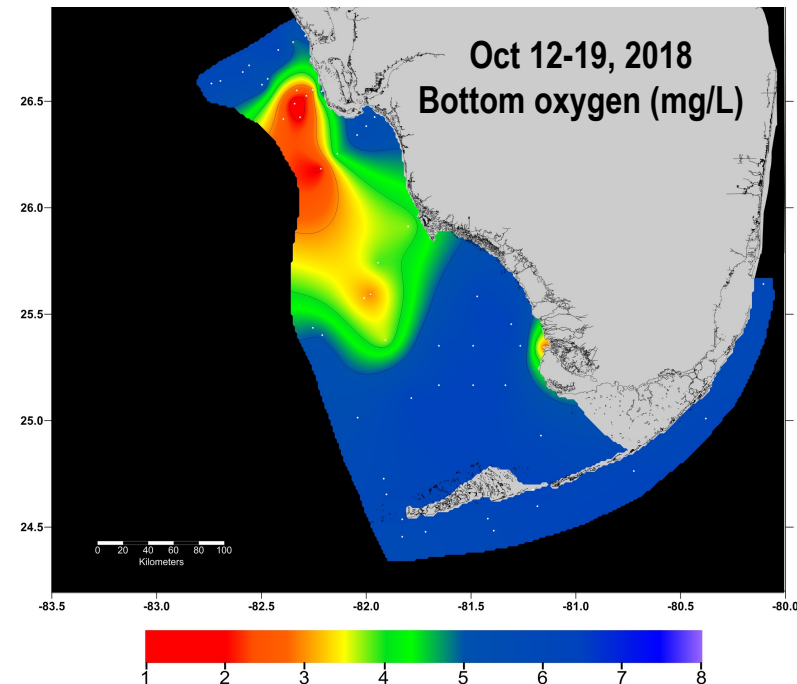
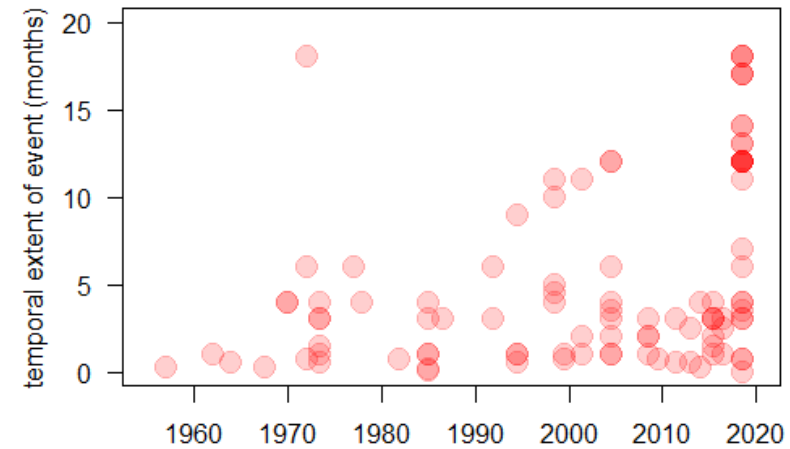


## Goals:

- How has red tide varied in time and space historically?
- What have been the impacts of red tides on fish populations, habitats and humans?
- How have fishermen and coastal communities adapted to red tide?

# Knowledge gained

- Perception of increasing red tide severity, duration, system recovery (Blake et al. 2022)
- Ecosystems most impacted by blooms associated with hypoxia; hypoxia forms in fall when blooms persist over summer (Turley et al. 2022)
- Red tide impacts at vessel level (displacement) but not fleet level (Perruso et al. in prep)
- Decline in vacation rentals during 2018 event equating to losses of \$184 million (Court et al. 2021)

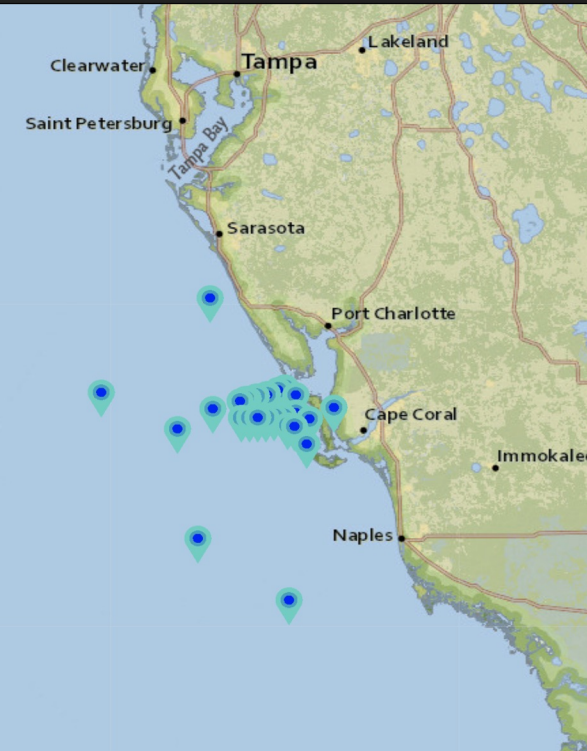
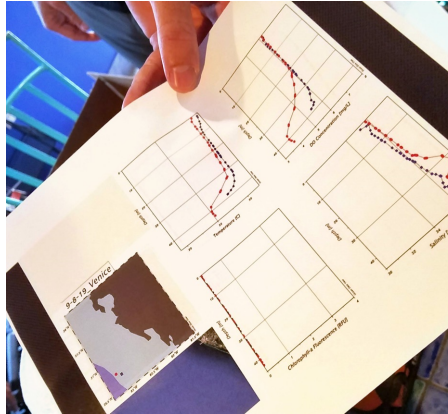




# Other outcomes: coordinated monitoring effort



Home Maps Videos RT-NASBA About

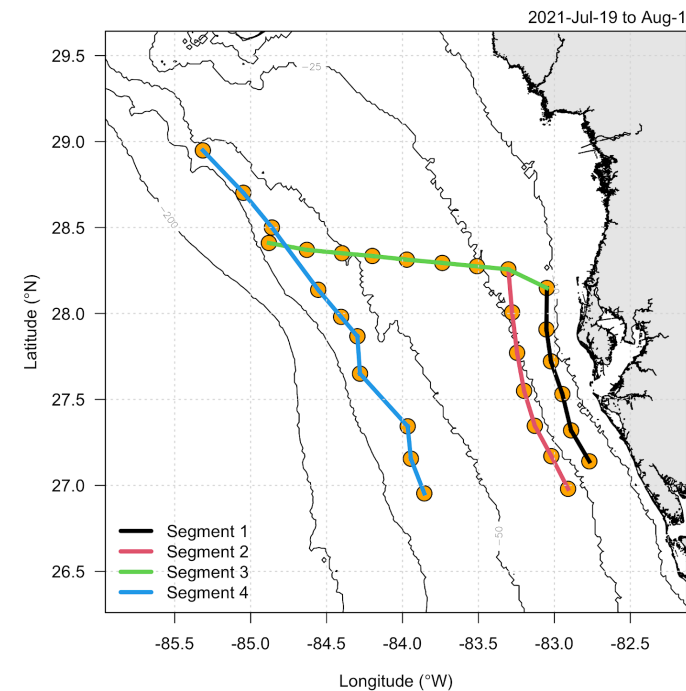
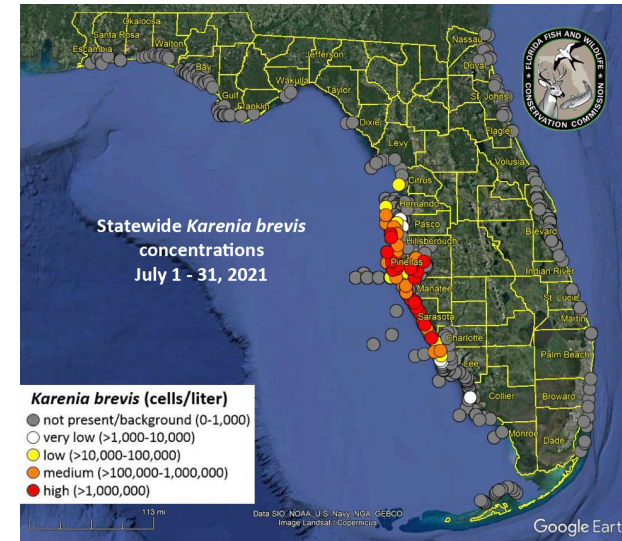


# Informing catch limits

2021: major inshore red tide but no data offshore

- Fisherman did extensive sampling on shelf while in transit
- No unusual conditions found
- Presented to Gulf SSC in August 2021

Influenced SSC decisions about assumptions of red grouper mortality in stock assessment projections; SSC opted to recommend less conservative (greater) catch limit





# Acknowledgments

John Walter, Brendan Turley,  
Skyler Sagarese, Chris Kelble,  
Ian Smith, Matt McPherson,  
Suzana Blake, Larry Perruso,  
Casey Streeter



All the fishermen and stakeholders who  
have participated in this project



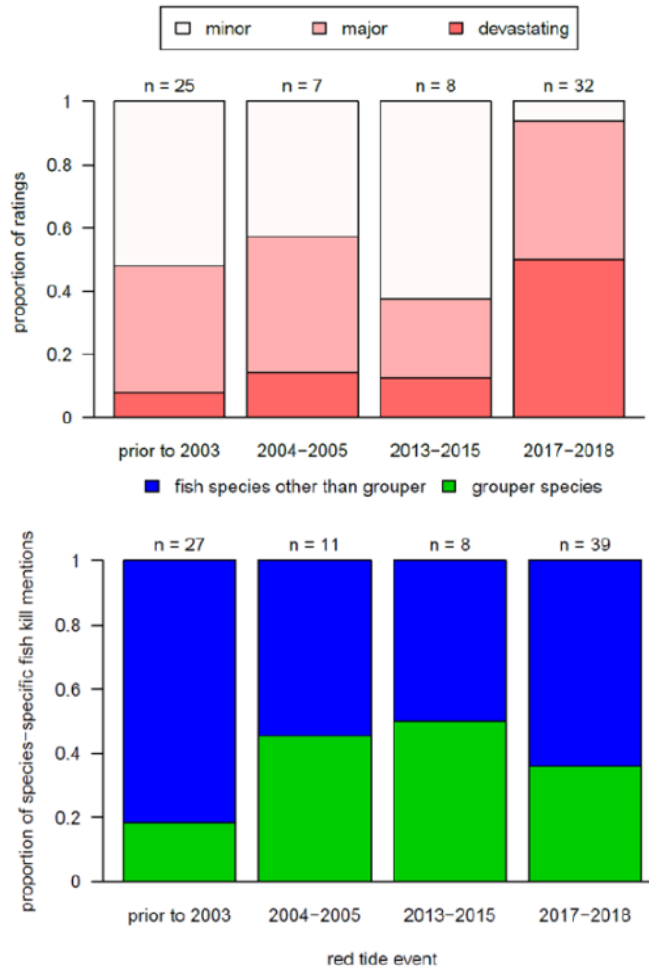
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# EXTRAS

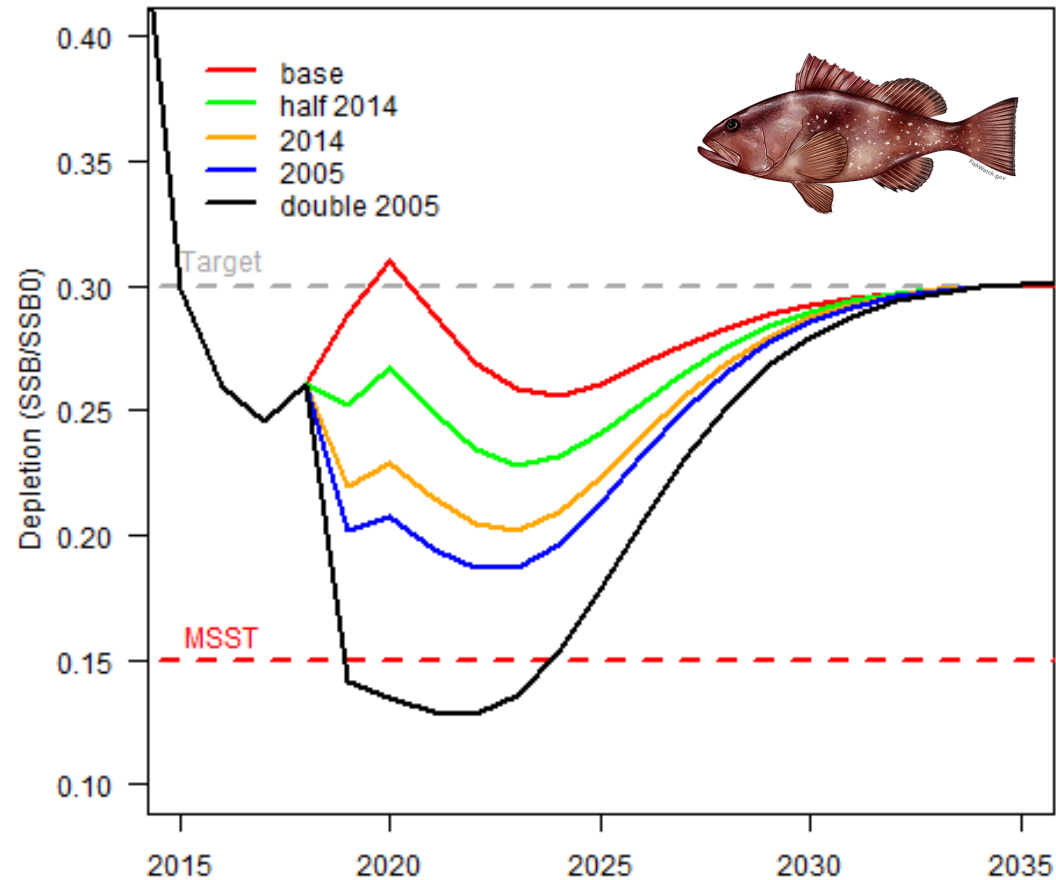


# Incorporating local knowledge in stock assessment

- Real-time information in stock assessment catch forecasts

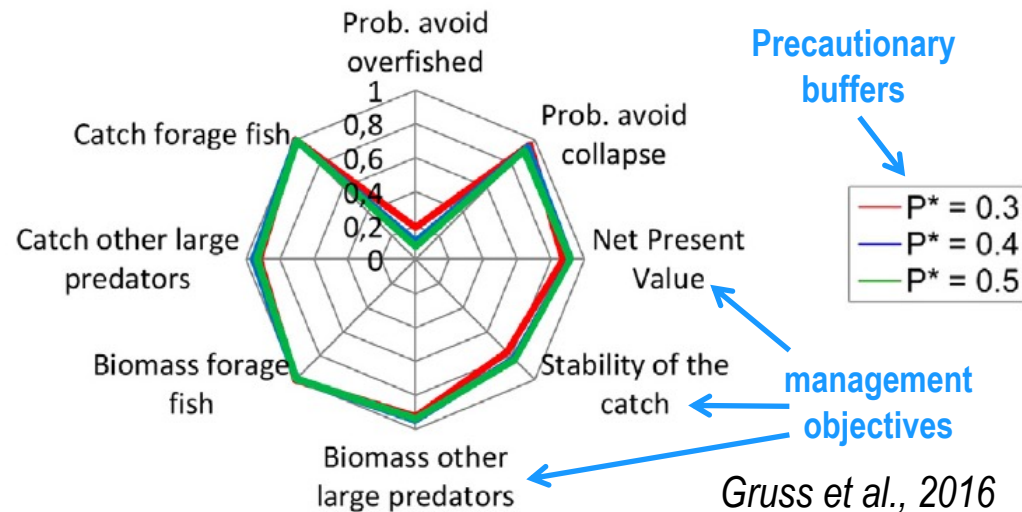
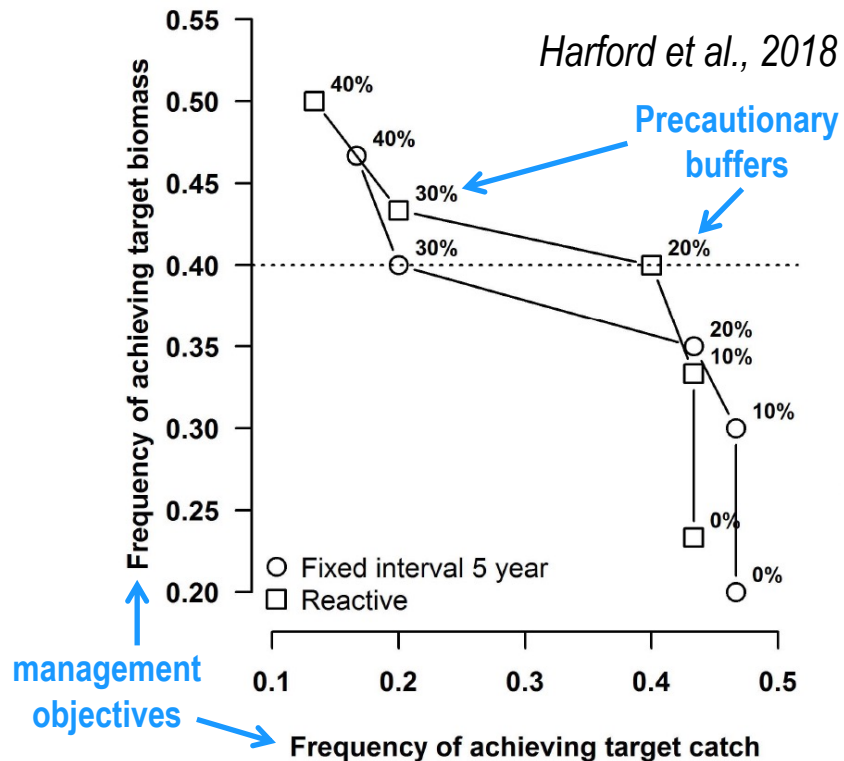


2018 red grouper stock assessment projections



# Management Strategy Evaluation

Are current harvest policies robust to possible future changes in frequency of red tides?





# How to improve resilience to red tide?

## Adaptation to Typical Events

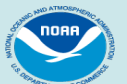
- Fish around patchy blooms
- Extended gear deployment, trial and error
- Move to fish offshore or inshore, north or south; temporarily change target species
- Temporarily delay harvesting clams and shellfish

## Adaptation to Extreme Events

- Move fishing location (often very far from home port)
- Fish in deeper areas; redirect effort to other species
- run charters to fish in the “backcountry”

### **resilience begins to break down... resilience gone**

- Stop fishing and get temporary job (construction, Uber, Home Depot)
- Get job as captain/crew in a different area of the country
- switch from commercial to charter fishing, ecotourism, photo tourism
- Sell gear and equipment and leave the industry
- Retire
- Clam and shellfish harvests completely lost, aquaculture businesses shut down



# Incorporating local knowledge into management

How can we improve resilience to red tides?

Factors that affect adaptation and resilience:

- ***Timely, relevant ecosystem information***
- Restrictive regulations (e.g. IFQs, licenses, tags)
- Effort and cost involved in switching gear to target different species
- Distance from alternate fishing grounds
- Increase in trip costs
- Early fishery closures due to effort shifts (e.g. crabs to kingfish)
- Bad press
- Personal circumstances