An update on the West Florida Shelf ecosystem model and red tide mortality estimation

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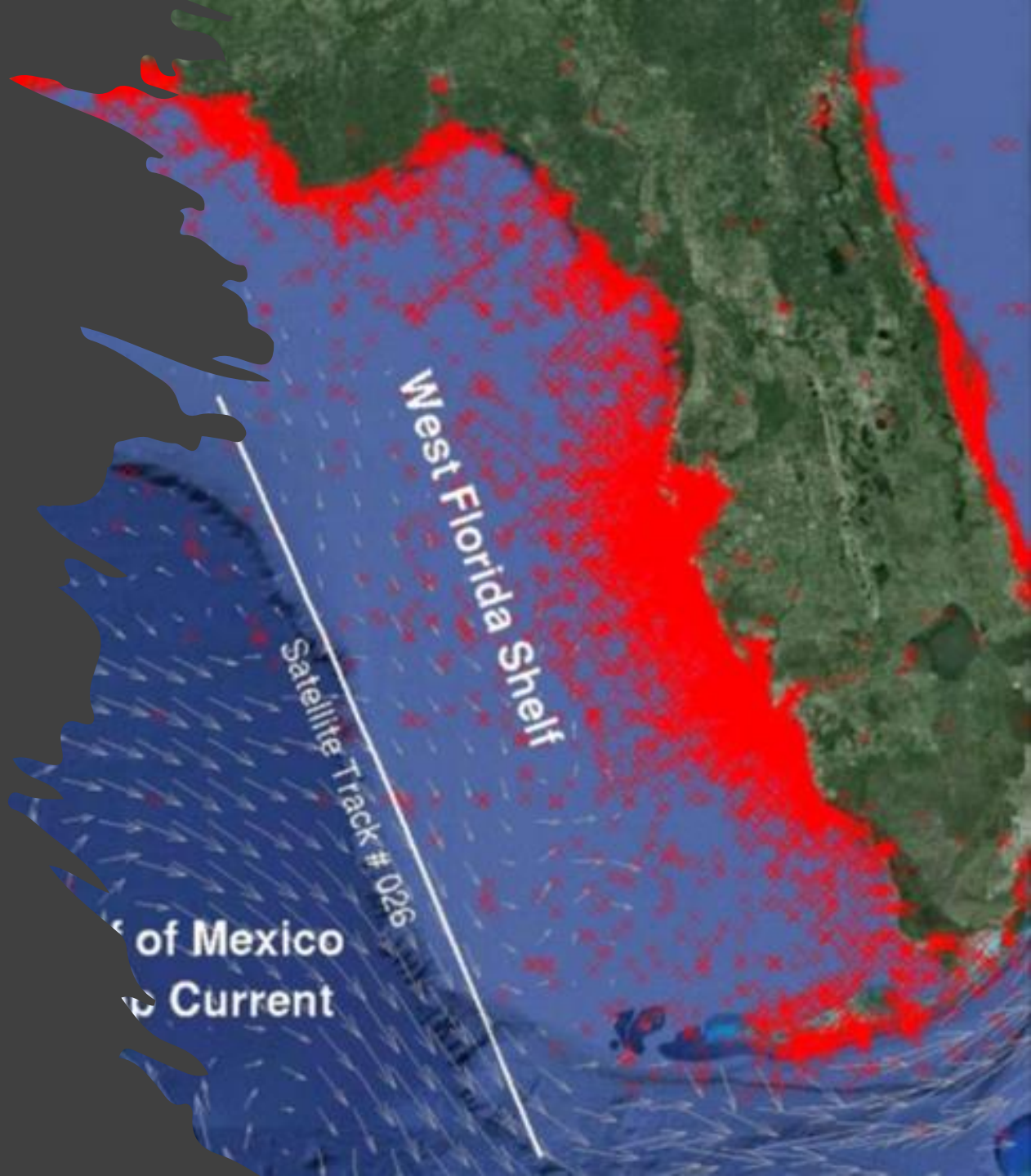
SEDAR 88 Red Tide Topical Working Group

Scoping Webinar

November 27, 2023

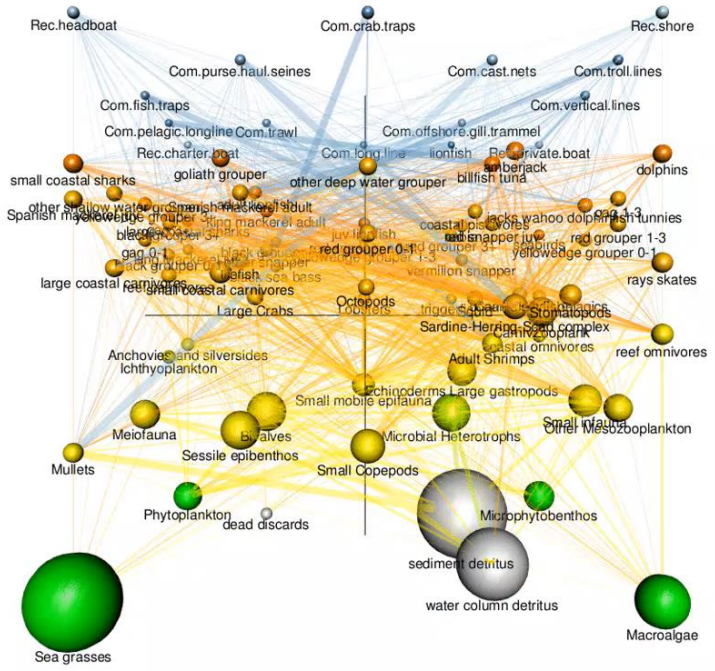


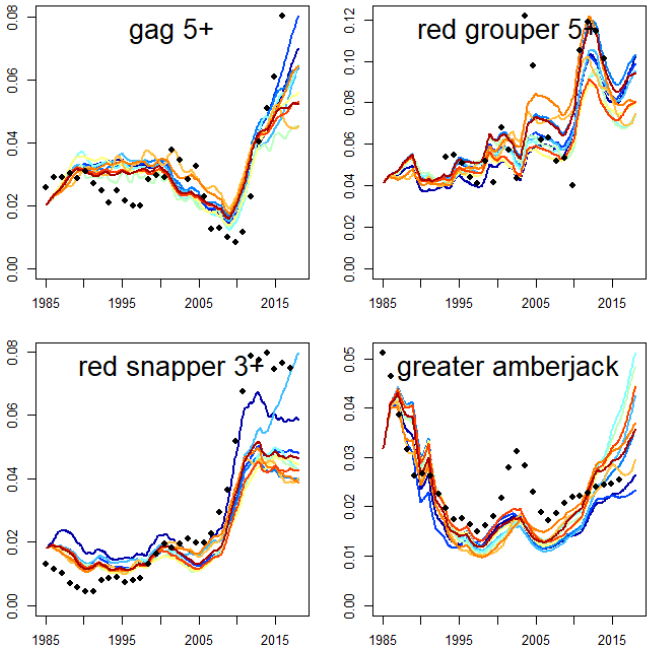
The WFS EwE Model

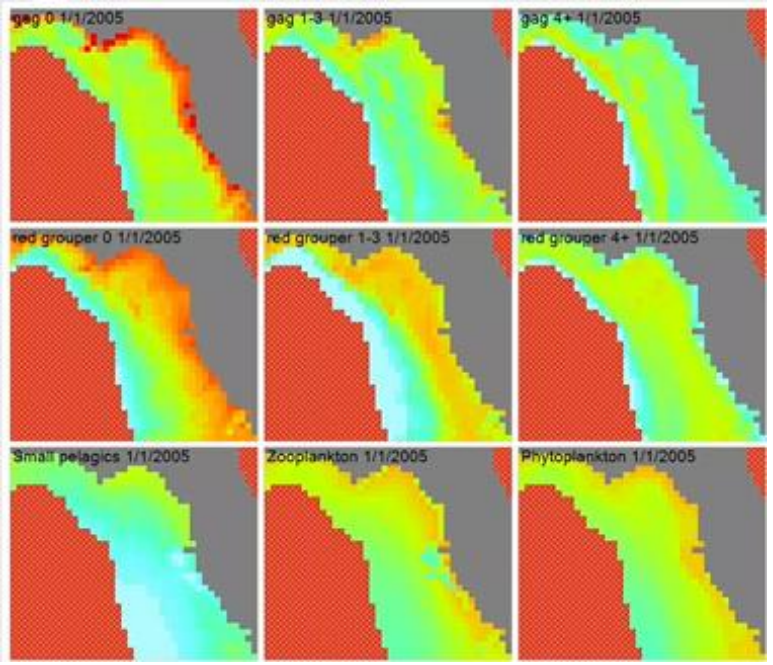
Ecopath with Ecosim

No fish is an island

www.ecopath.org







Ecopath

- Static snapshot of the ecosystem
- Input: biomass, mortality, consumption, diet, and fishery removals
- Requires mass balance
- Starting point for dynamic simulations

Ecosim

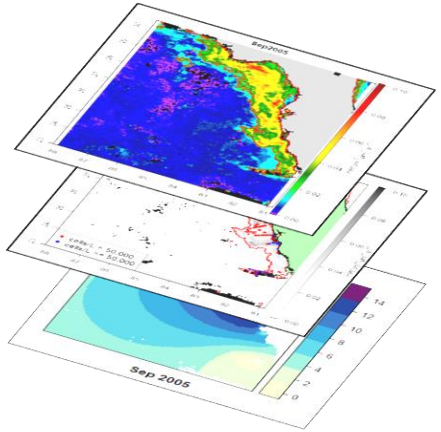
- Biomass dynamic food web model
- Environmental forcing
- Parameter estimation & time series calibration
- Future projection scenarios
- Policy analysis and tradeoffs

Ecospace

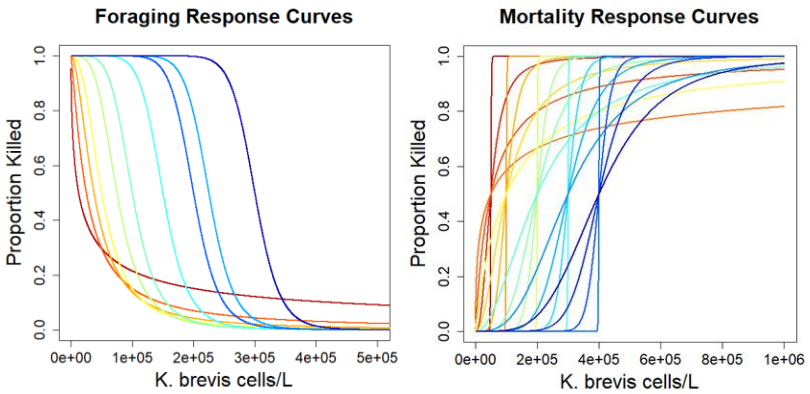
- Spatially explicit simulations
- Input: dispersal rates, habitat maps, habitat preferences, fishing areas, MPAs, port locations
- Spatial-temporal drivers
- Red tide mortality

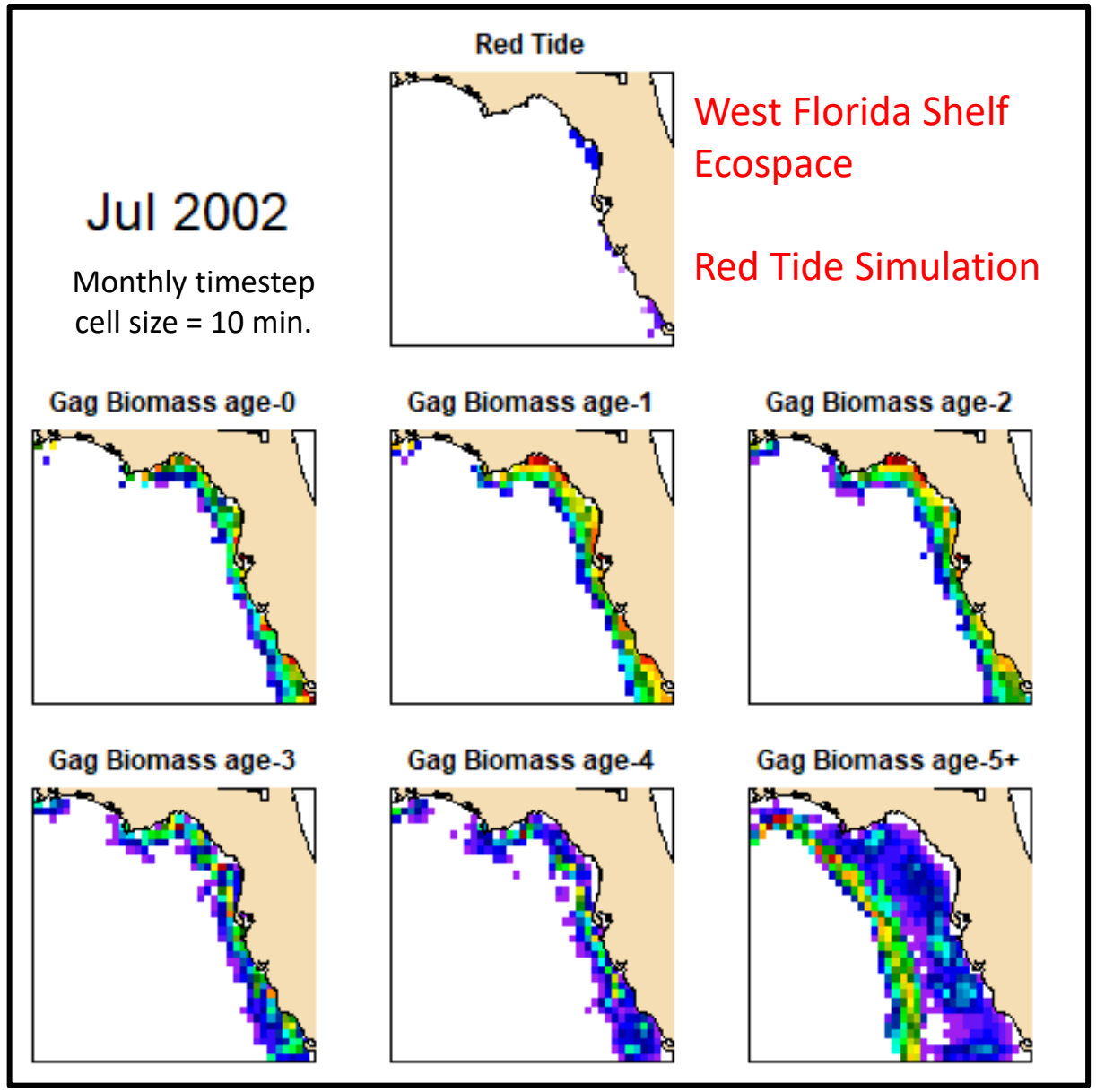
Simulating Red Tide Effects in WFS Ecospace

Monthly red tide maps (cells/L) derived from nFLH satellite imagery and FWC HAB sampling. Input as spatial driver into WFS Ecospace Model.



Red Tide foraging & mortality response curves (160 different combinations)

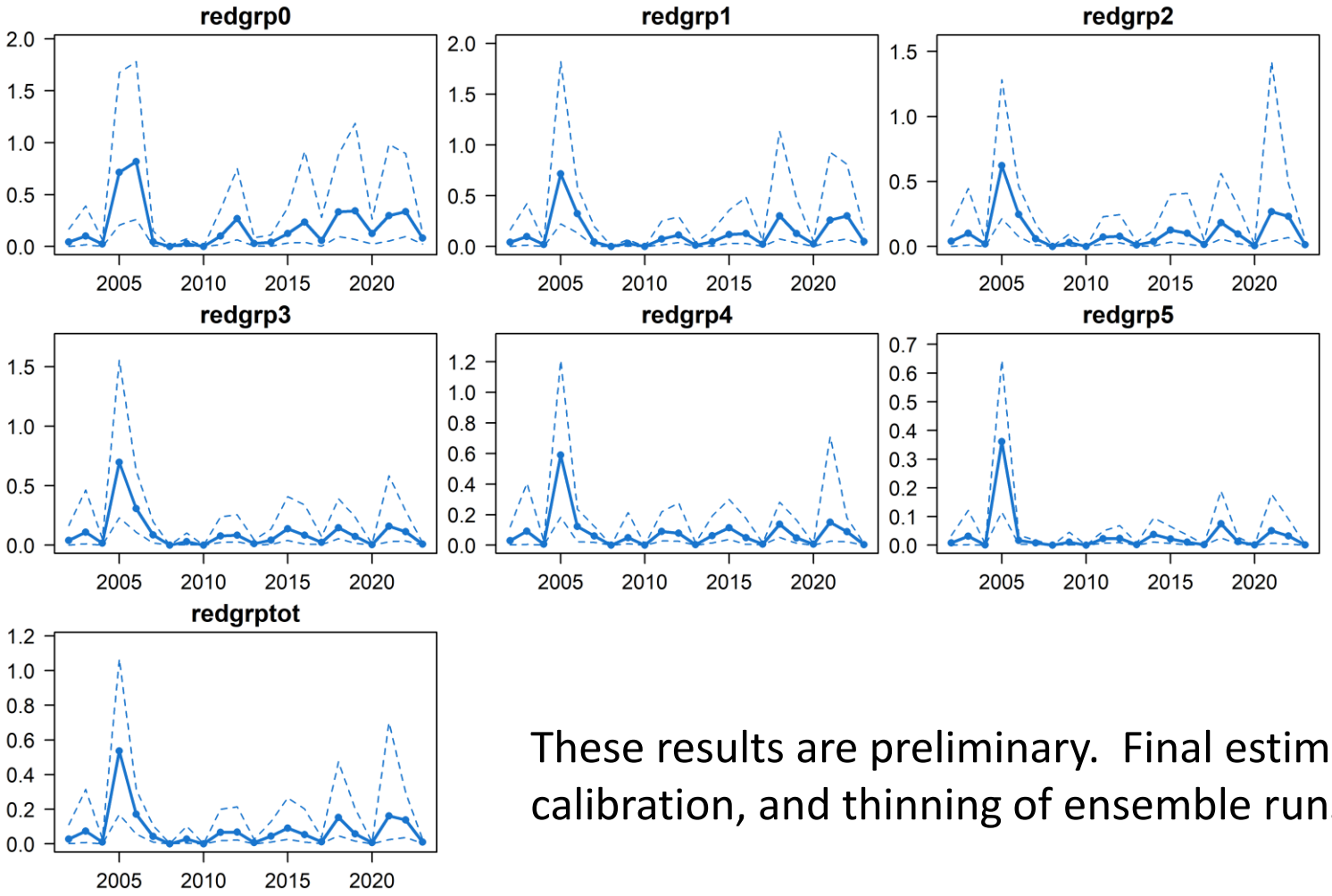




- ✓**Spatial overlap**
- ✓**Bloom duration and severity**
- ✓**Direct mortality**
- ✓**Sub-lethal effects**
- ✓**Avoidance**
- ✓**Food web effects**

Vilas et al. 2023. Evaluating red tide effects on the West Florida Shelf using a spatiotemporal ecosystem modeling framework. Scientific Reports, 13(1), p.2541. https://doi.org/10.1038/s41598-023-29327-z.

Red Tide Mortality on Red Grouper ages 0-5+ Jan 2002- June 2023 – *uncalibrated example*



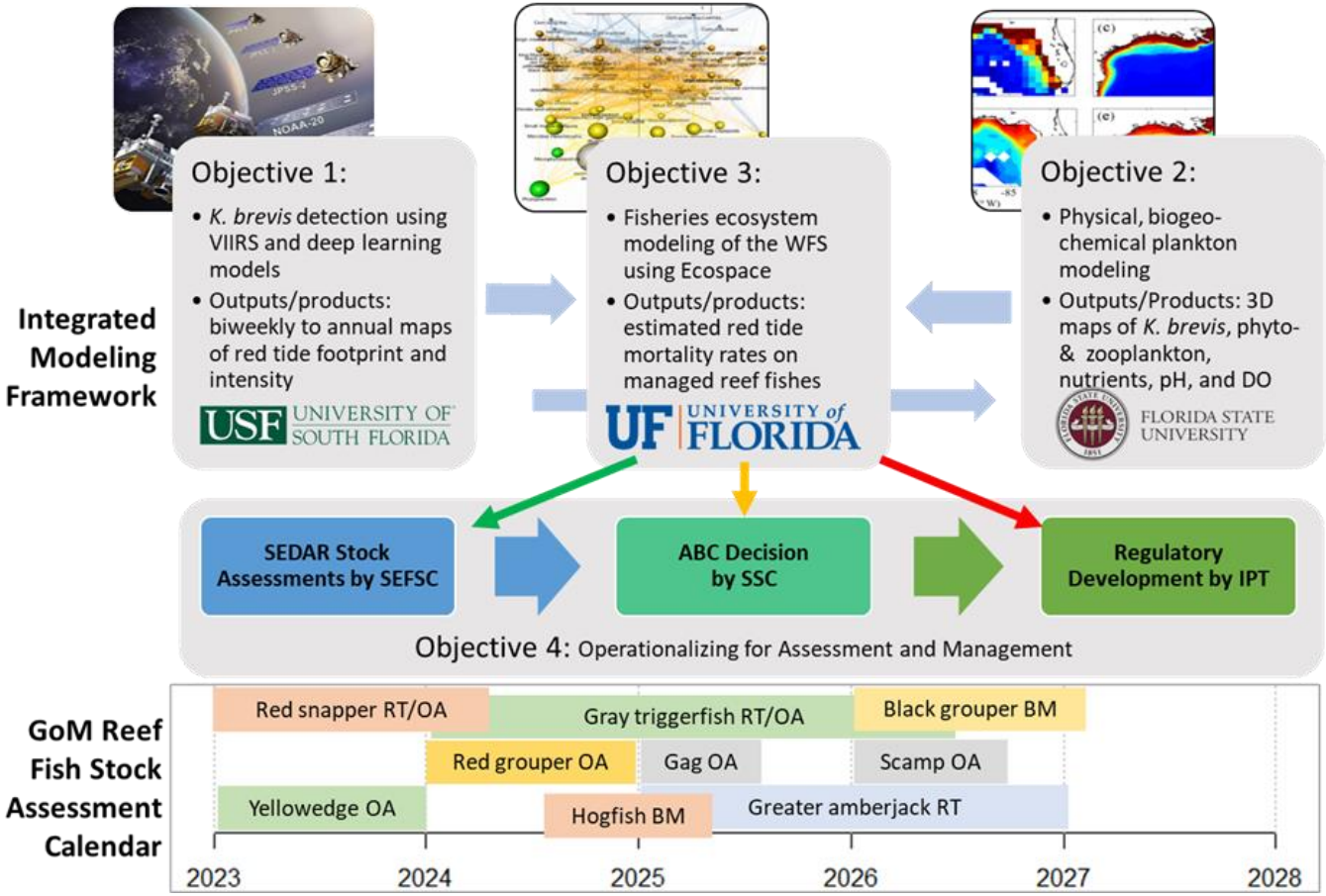
year	age-0 mean	combined ages mean
2005	0.714	0.537
2006	0.819	0.171
2012	0.268	0.068
2014	0.041	0.041
2016	0.235	0.054
2018	0.334	0.153
2019	0.343	0.058
2020	0.125	0.008
2021	0.297	0.162
2022	0.337	0.138
To June 2023	0.082	0.010

These results are preliminary. Final estimates will have undergone additional calibration, and thinning of ensemble runs that are unreasonable.

Operationalizing the WFS Ecosystem Model

Overall goal is to account for red tide mortality when assessing GoM reef fishes and setting their acceptable biological catch (ABC).

- 5-year project (2023-2028)
- 4 Objectives
  1) Remote Sensing
  2) Biogeochemical modeling
  3) Ecosystem modeling
  4) Operational management application



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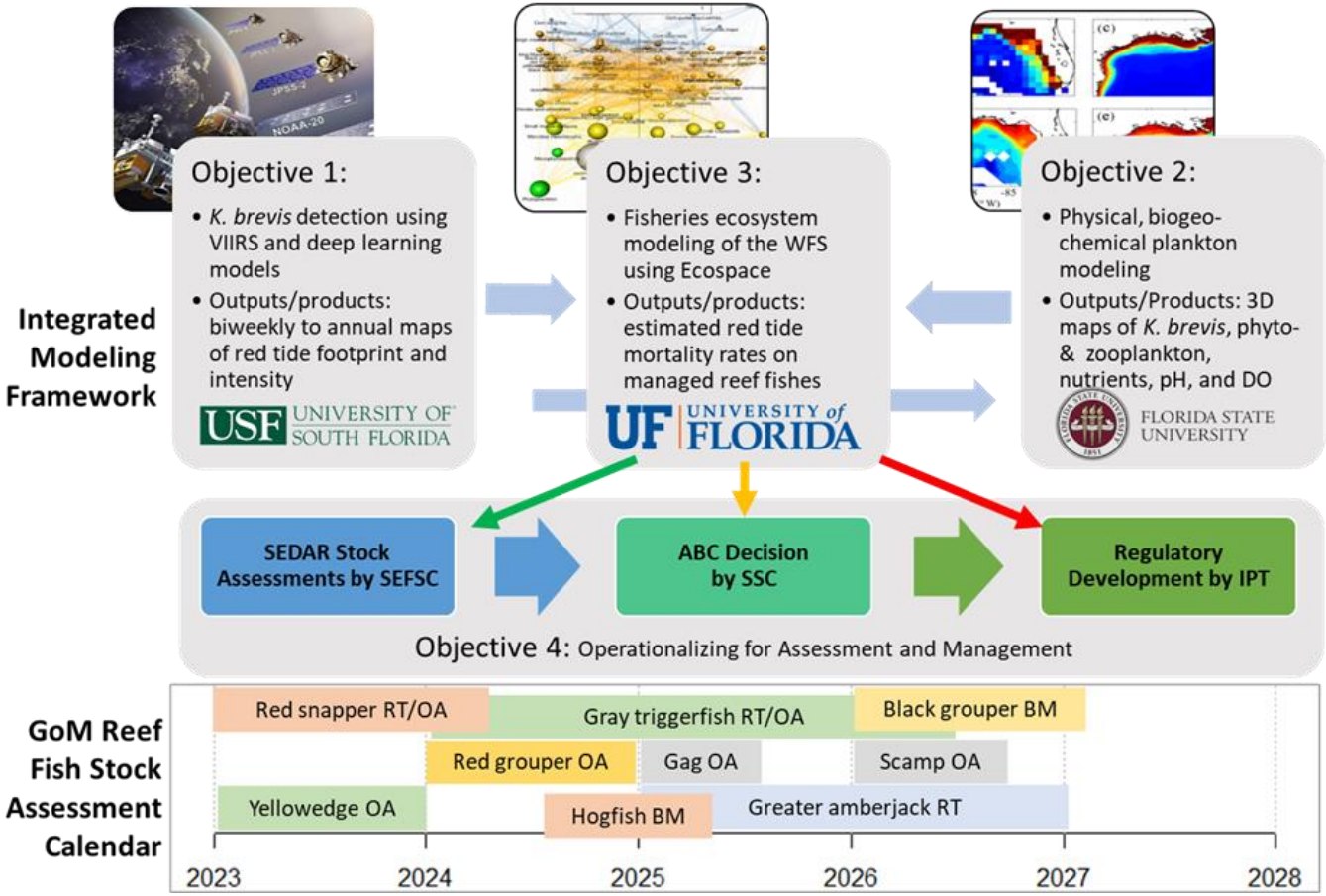
Operationalizing the WFS Ecosystem Model

Project Team:

- Modeling: David Chagaris (UF, lead); Chuanmin Hu (USF), Mike Stukel (FSU) & Sven Kranz (Rice)
- Collaborators: Ted Switzer (FWC); Kate Siegfried, Mandy Karnauskas, Skyler Sagarese (SEFSC)
- Resource Managers: Ryan Rindone (Gulf Council); Daniel Luers (SERO)
- Stakeholder Engagement: Mike Sipos (UF/FSG), Casey Streeter, Dylan Hubbard



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