

A satellite-style map of the Caribbean region, showing the Gulf of Mexico, the Caribbean Sea, and the surrounding landmasses including North America, Central America, and the Caribbean islands. The text is overlaid on the map.

Use of Models

Production Potential Models



Essential Fish Habitat

NOAA Fisheries



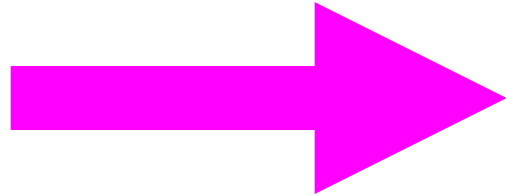
National Marine
Fisheries Service



What is good habitat for a pelagic fish?

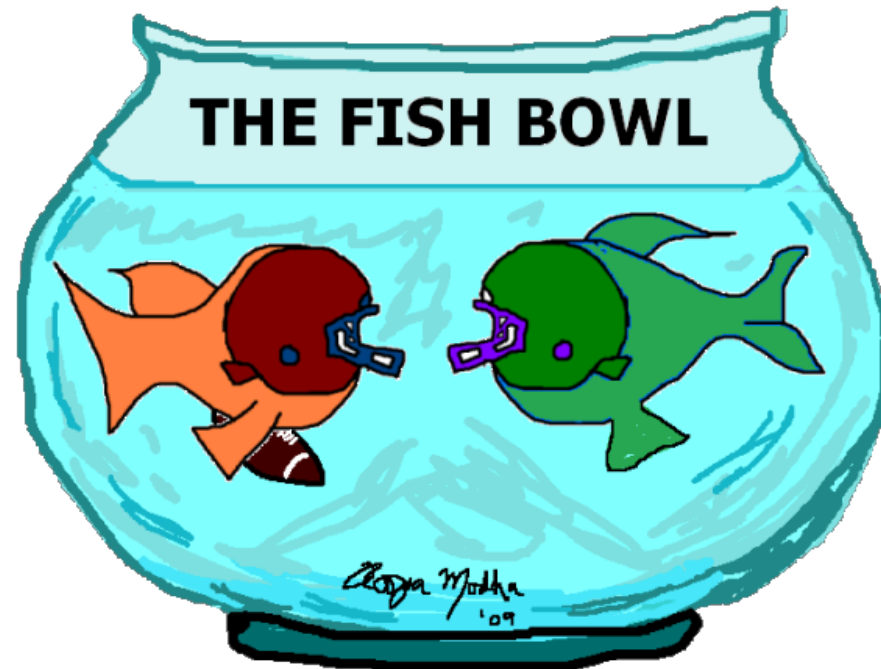
- How can it be quantified and compared...
 - Among species or age class?
 - Across physical and biological gradients?
 - Across time and space?
 - In response to environmental stressors?

Habitat Quality Defined by species-specific vital needs



Habitat Quality = Growth Rate Potential

- Expected daily growth rate of a fish if placed in a volume of water with known conditions such as prey size and density, temperature, oxygen and light

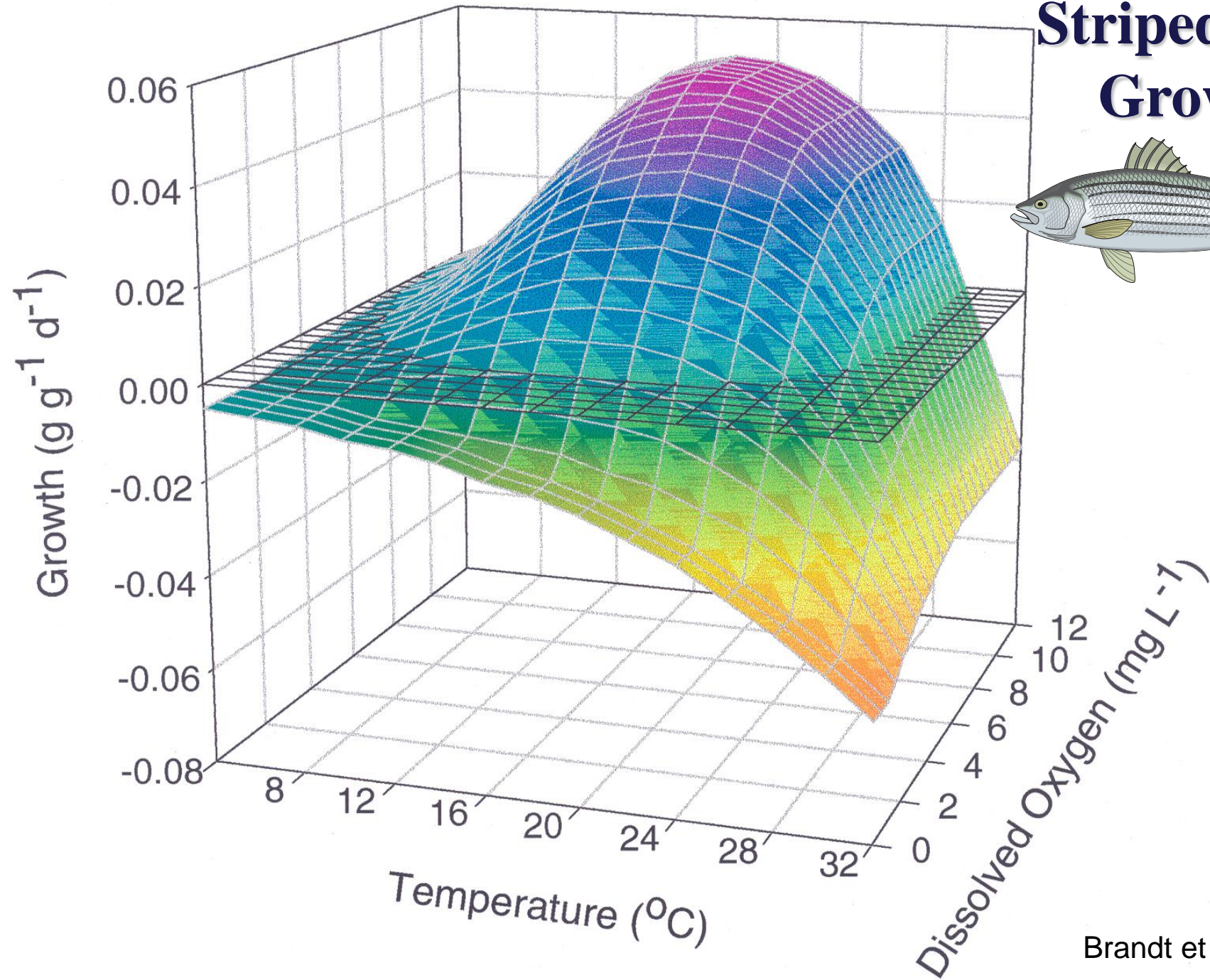
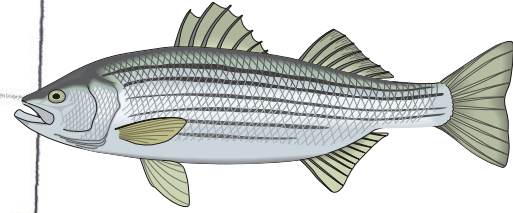


Why Fish Growth Rate?

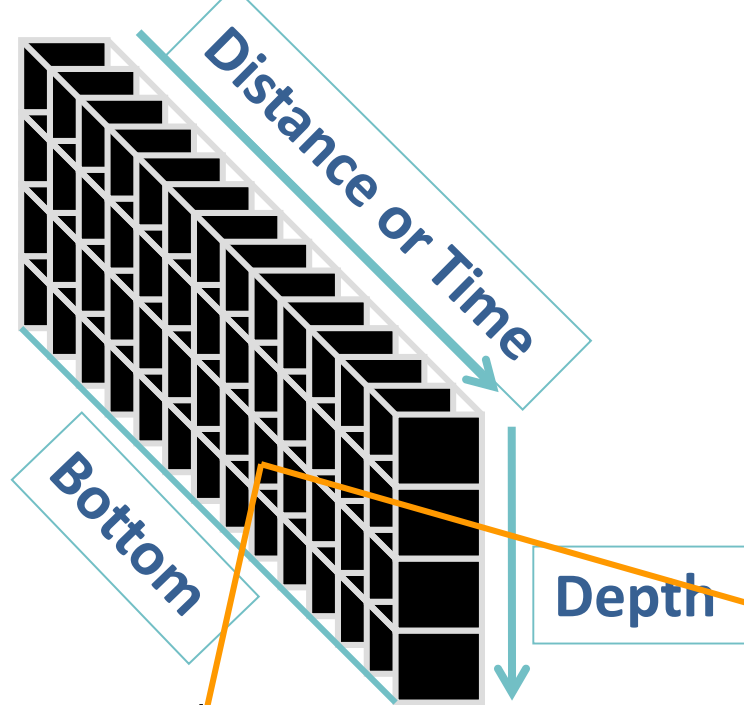
- Integrative response of fish performance – related to survival rates and reproductive capacity
- Based on fish's requirements and prevailing environmental conditions
- Differs among species and life stages
- Varies in time and space
- Nonlinear response to physical and biological factors



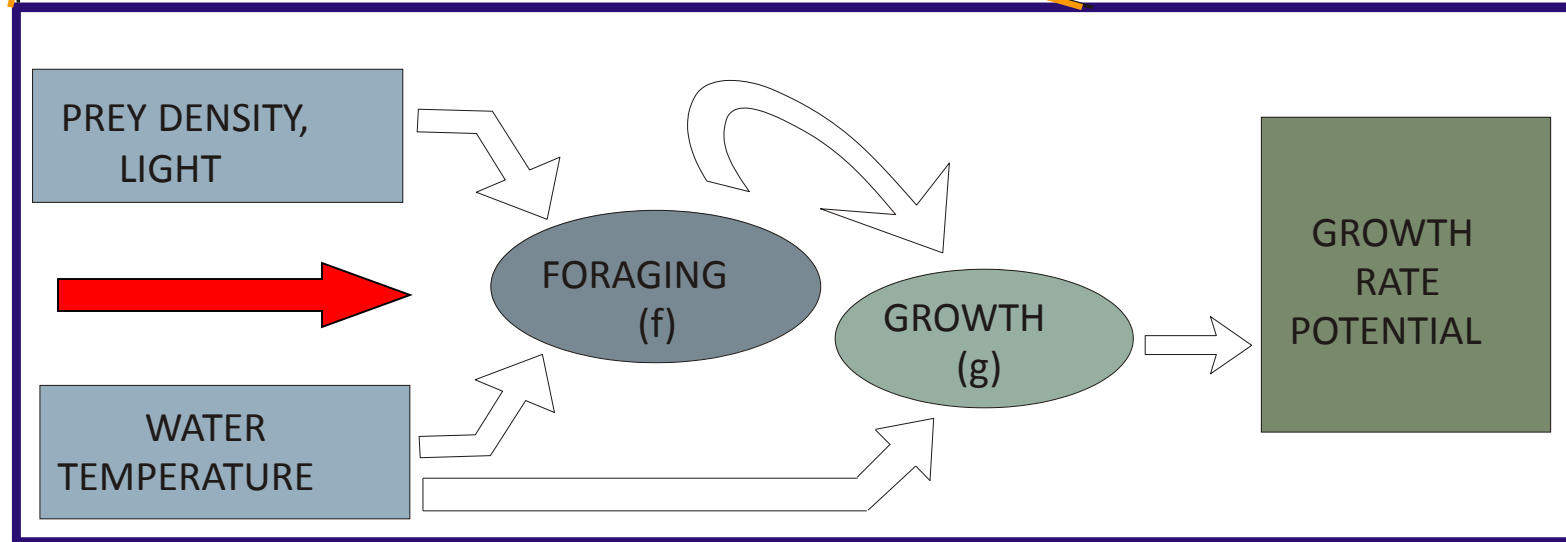
Striped Bass Growth



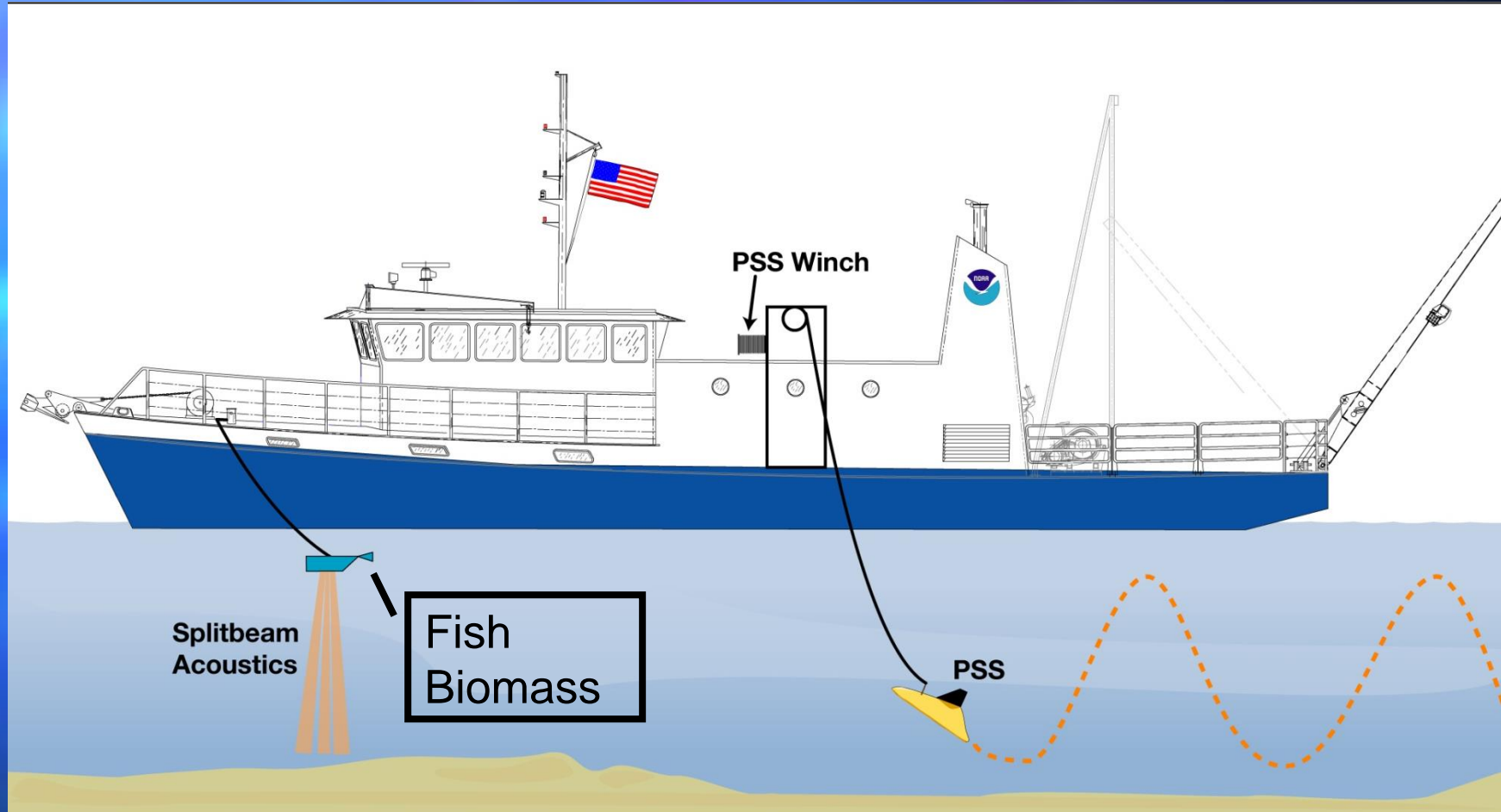
Growth Rate Potential Spatial/Temporal Model



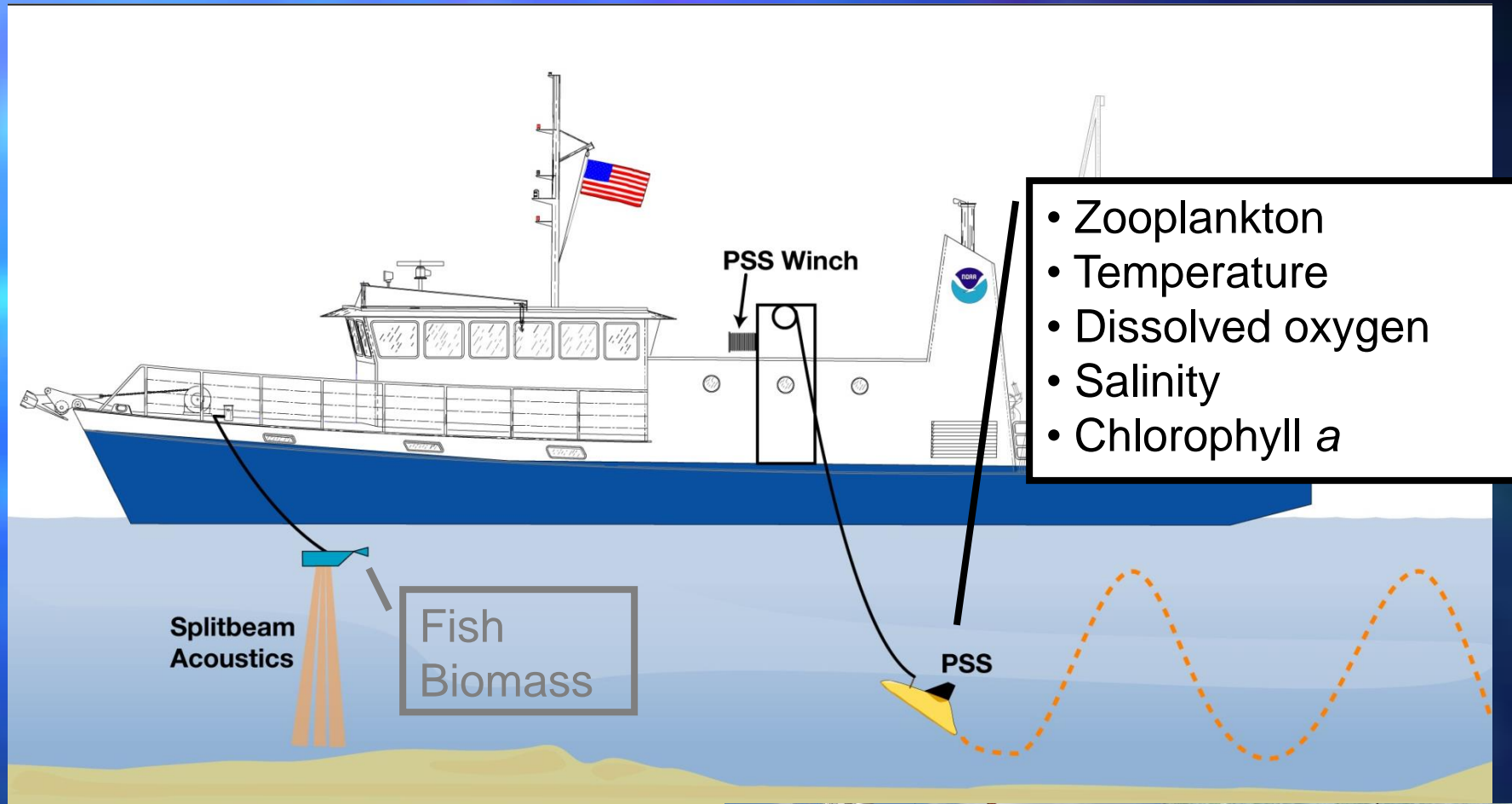
Oxygen
availability

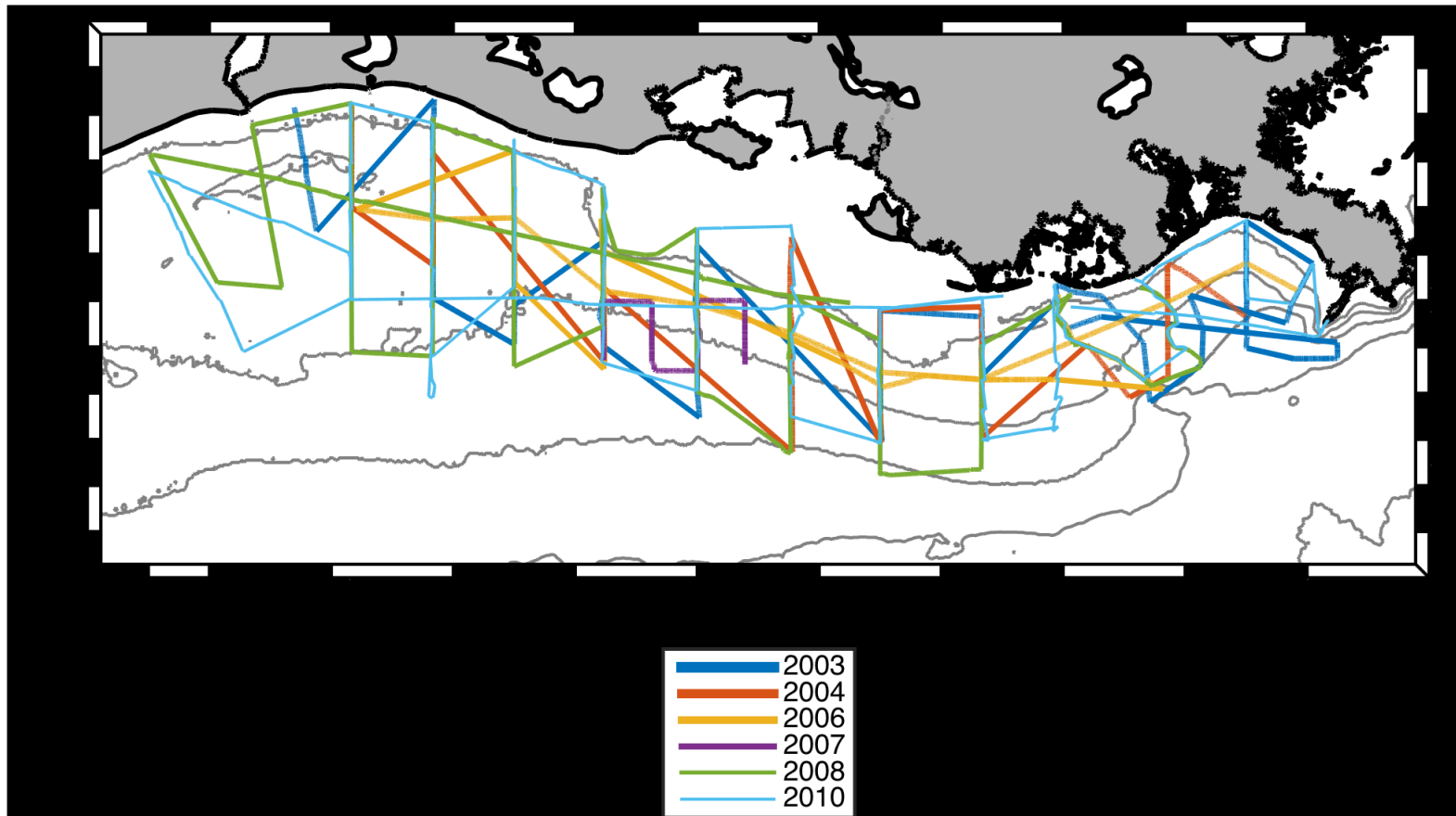


Baseline Field Sampling

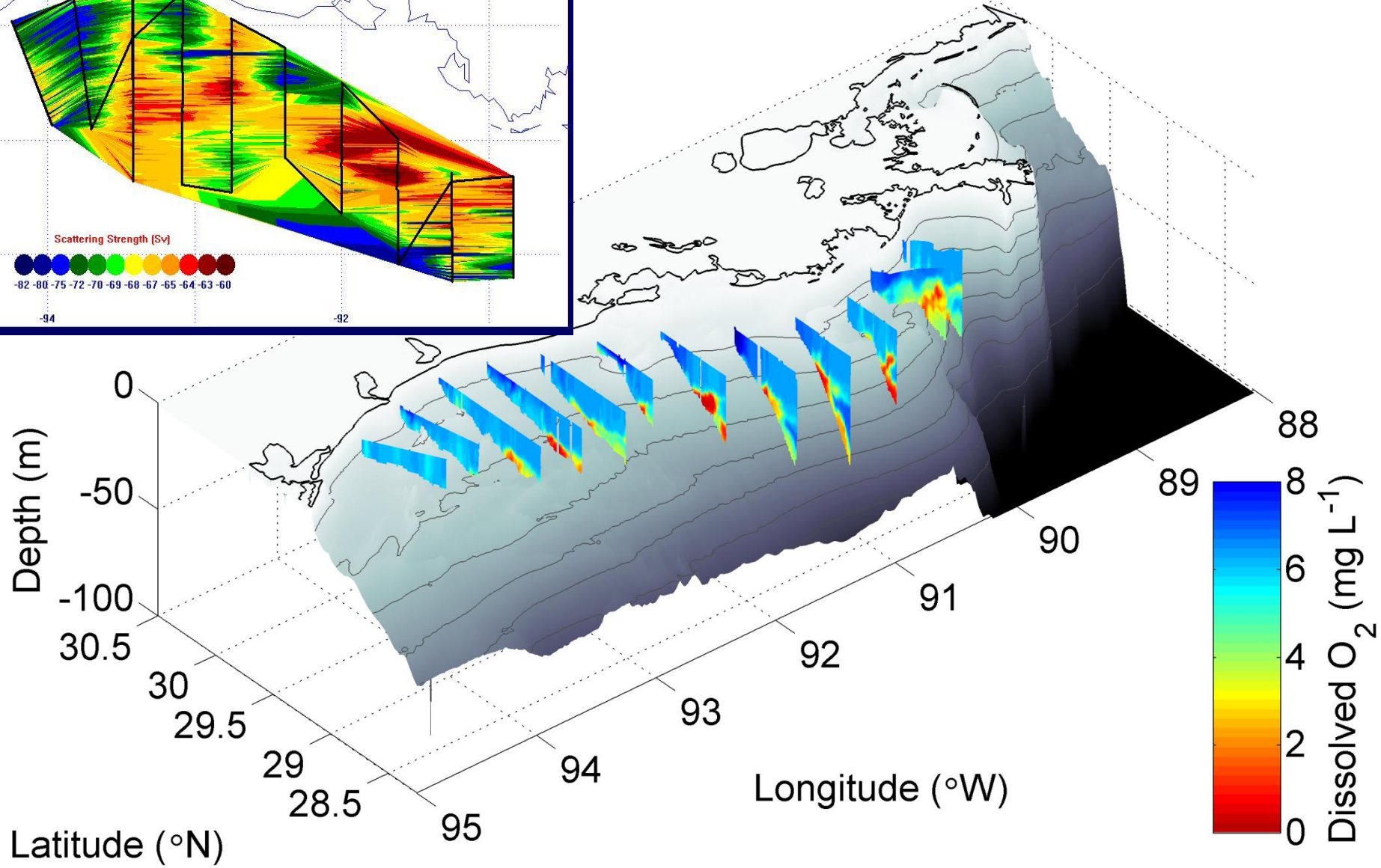
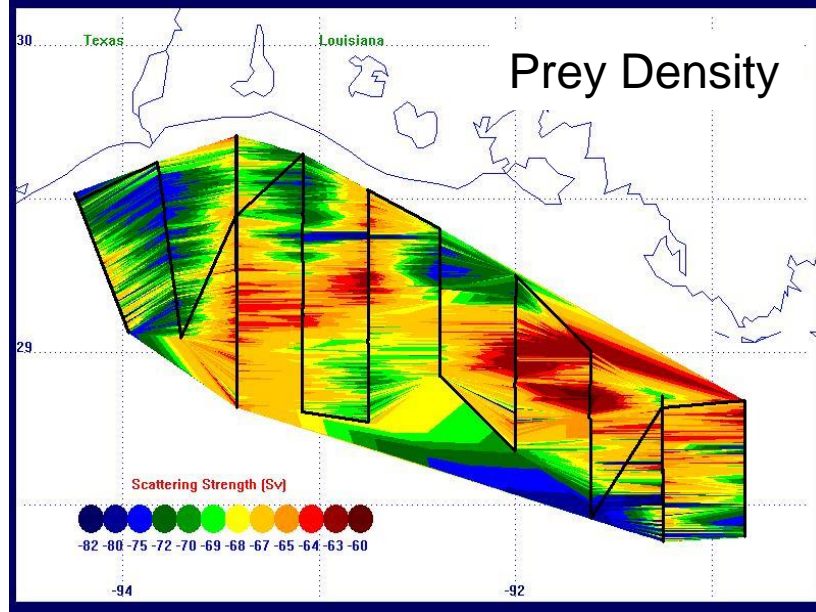


Baseline Field Sampling

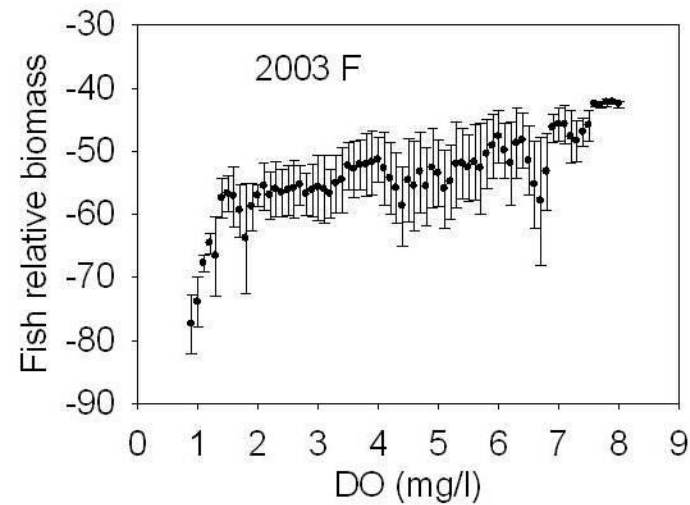
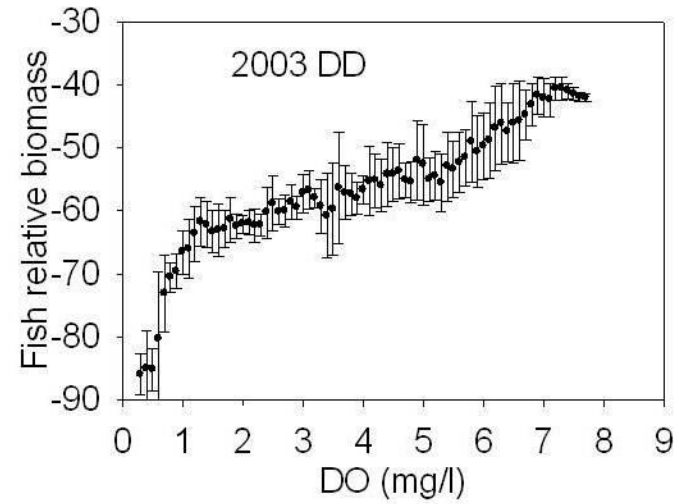




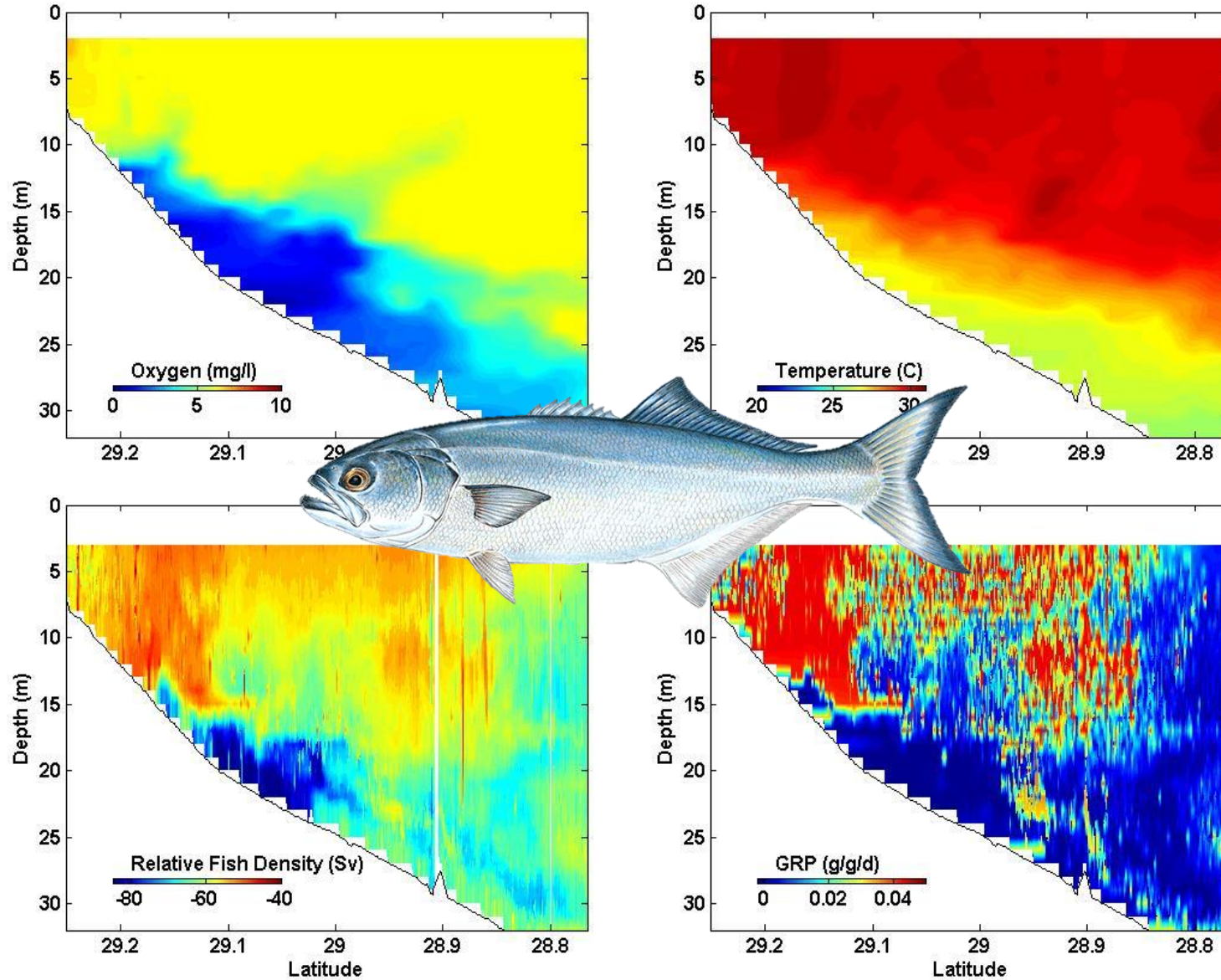
- 7 cruises between 2003 and 2011
- 140 trawls
- > 4,000 stomachs
- >> 234 h acoustic profiles
- >> 2.5 million data points



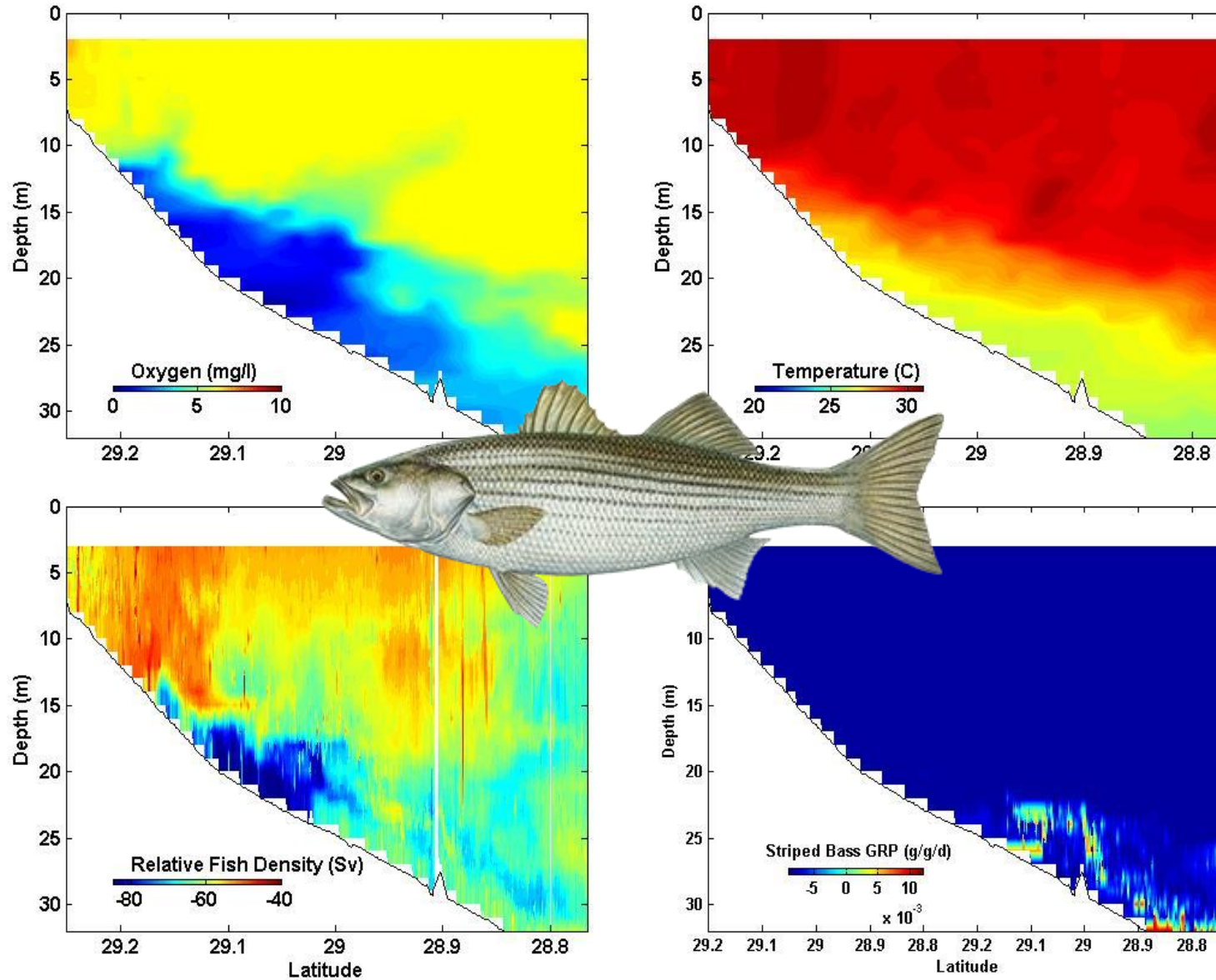
Fish Density and Oxygen levels

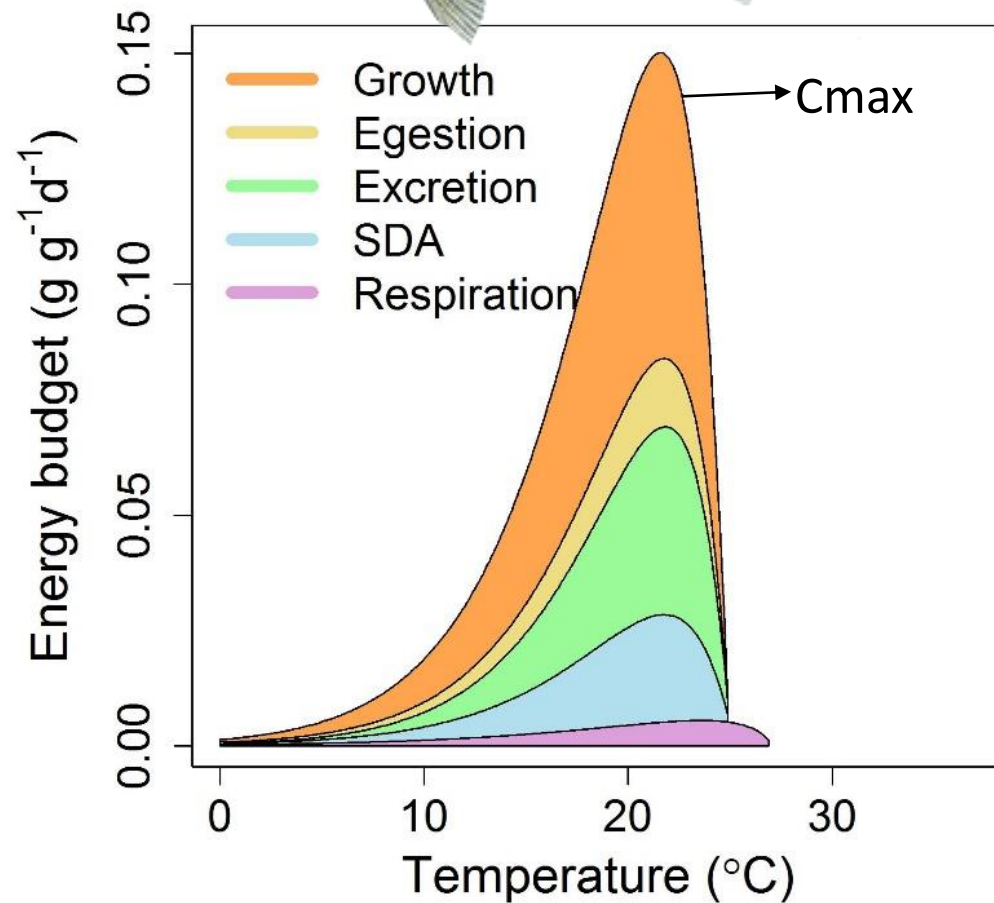
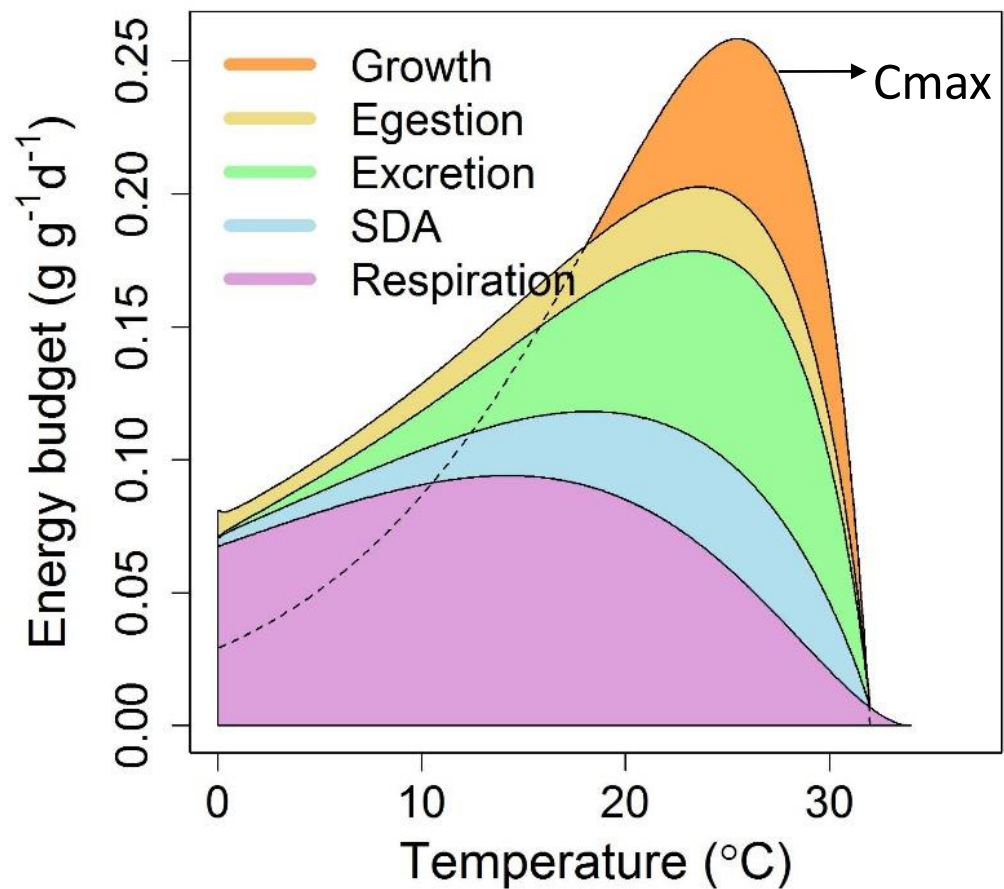
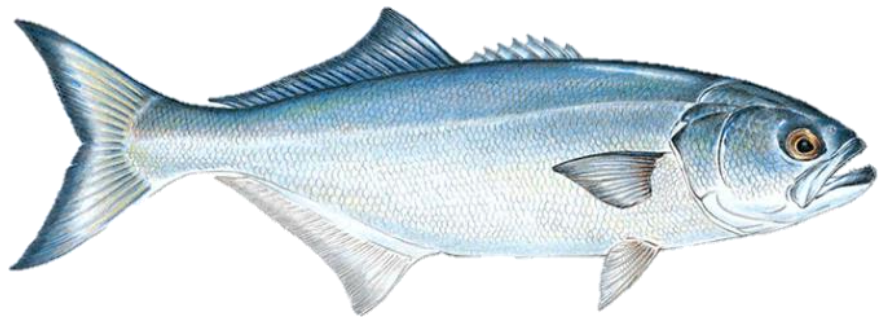


Mapping EFH: Bluefish

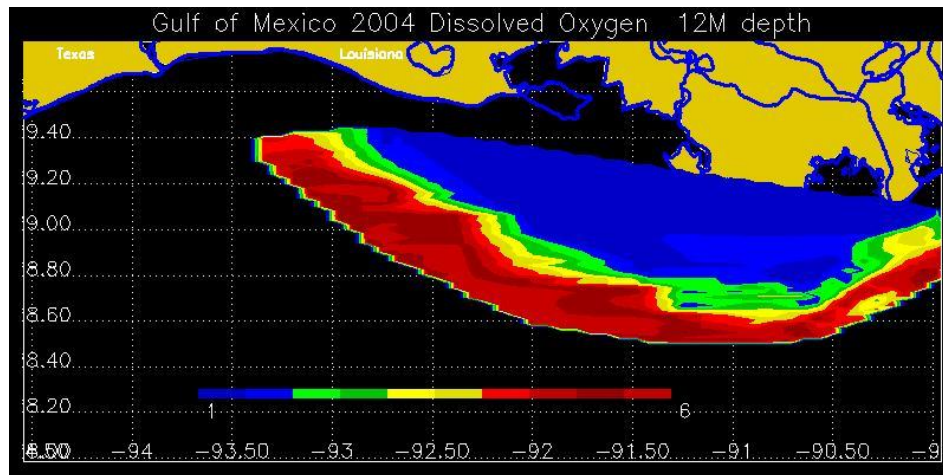


Mapping GRP: Striped Bass

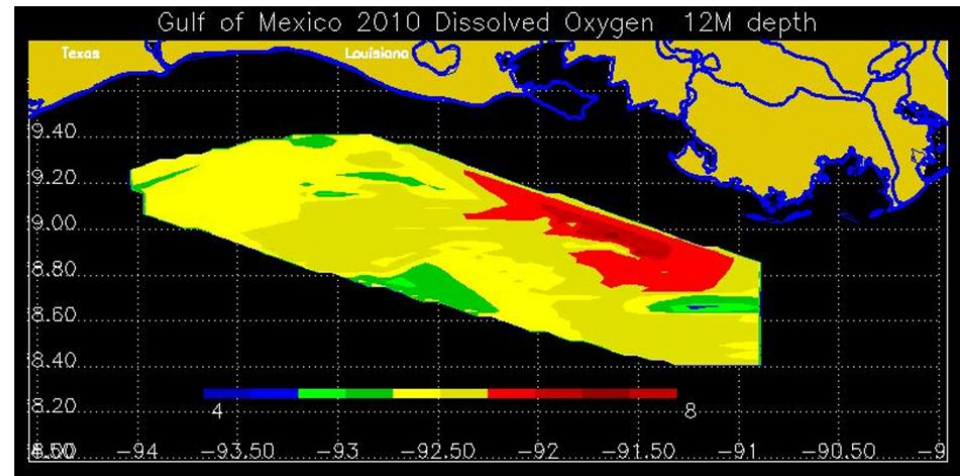




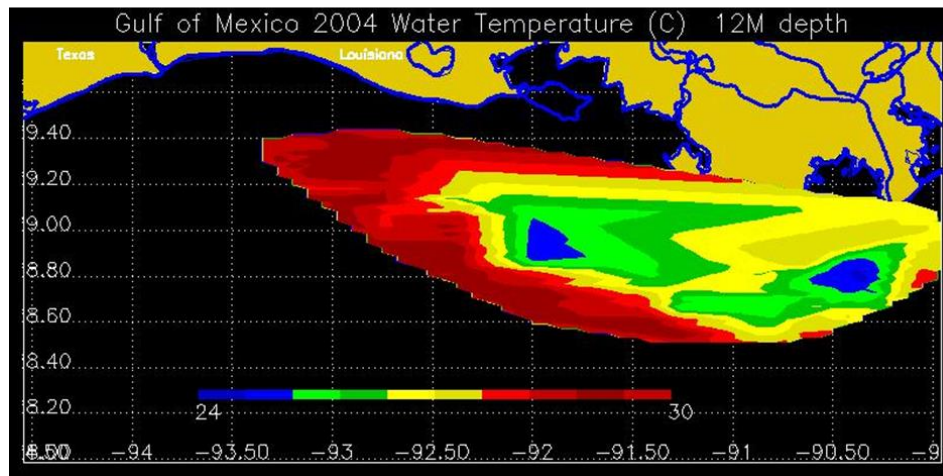
Dissolved Oxygen at 12 M for 2004



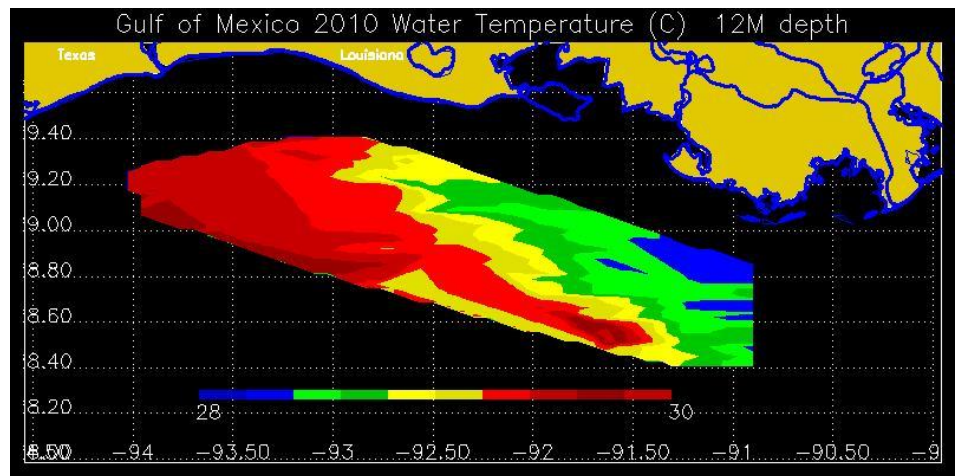
Dissolved Oxygen at 12 M for 2010



Water Temperature at 12M for 2004



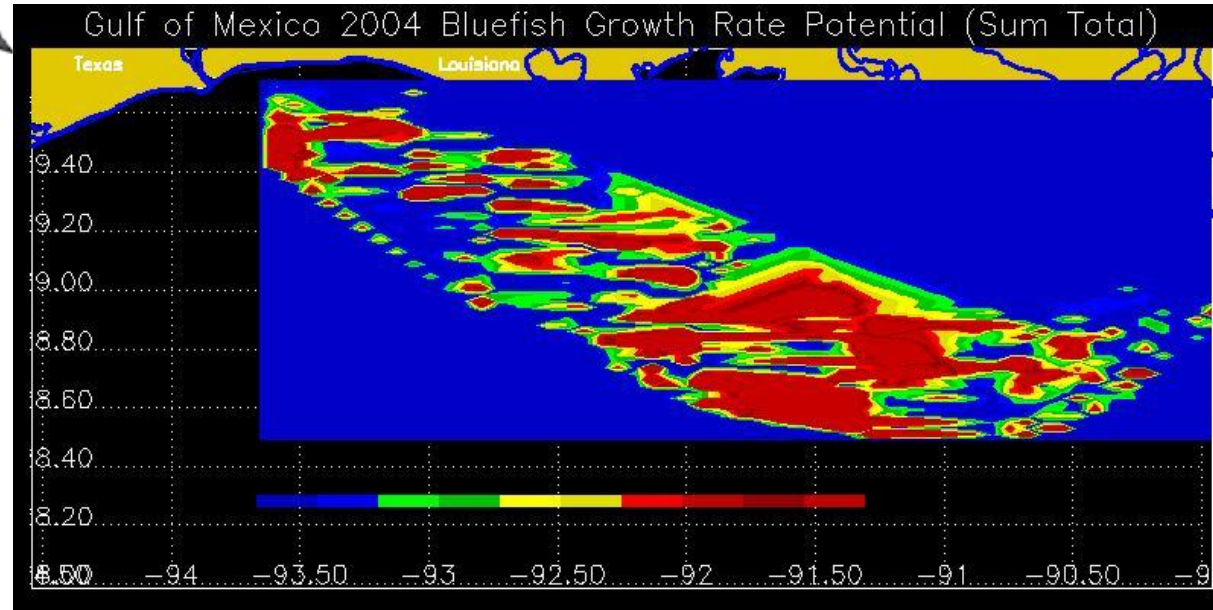
Water Temperature at 12 M for 2010



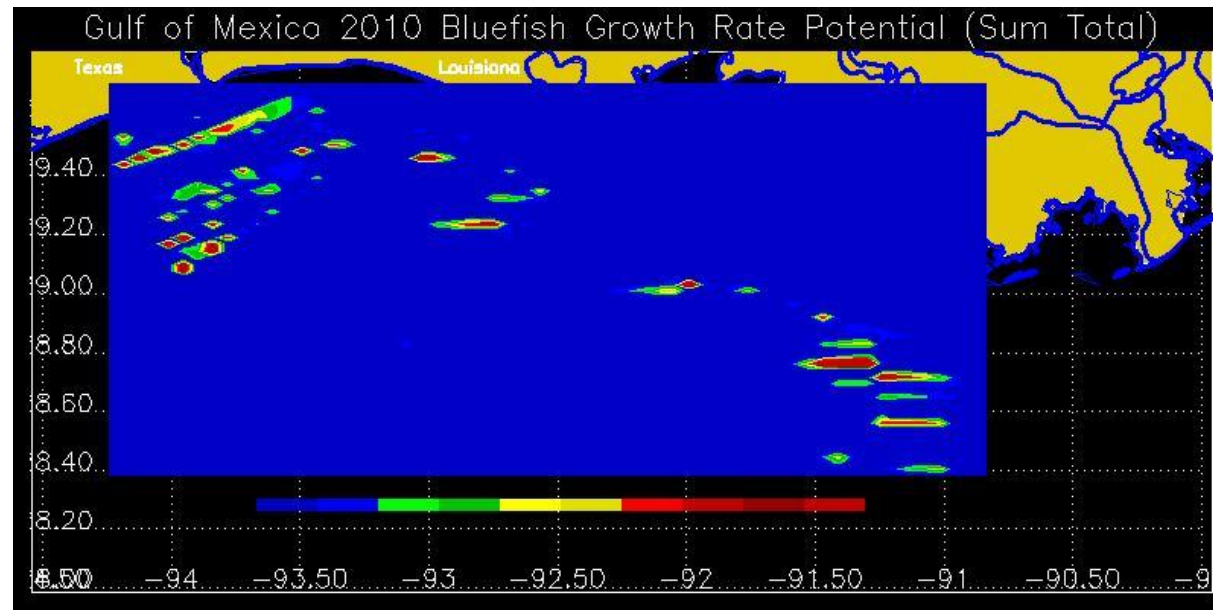


Total Growth Rate Potential

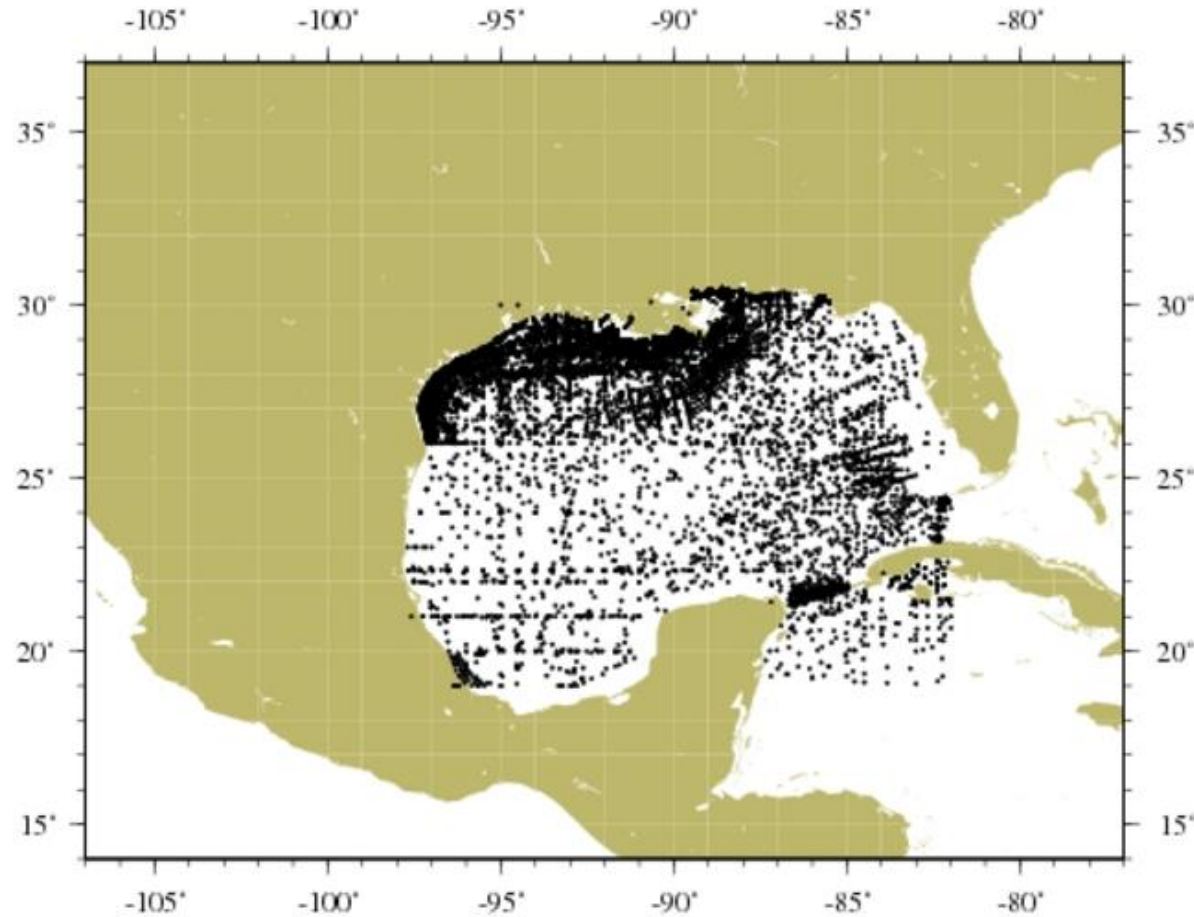
2004



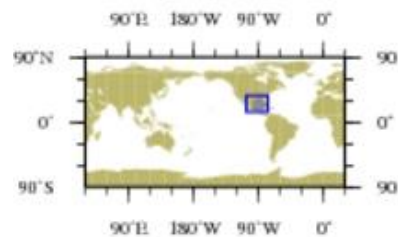
2010



Next Steps: Leveraging Additional Data



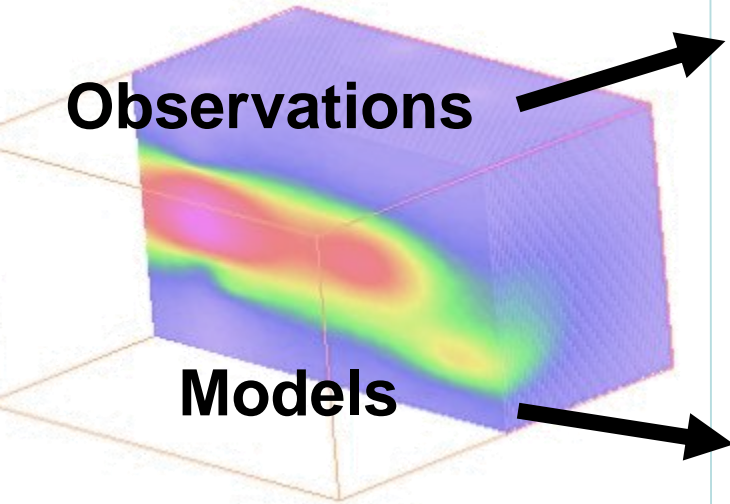
- 14,600 CTD casts from NOAA NODC Ocean Climate Laboratory
- (1930 – 2014)
- Additional input from hydrodynamic models, food web models



Geographic distribution of casts
Number of casts = 14600

NOAA NODC Ocean Climate Laboratory
<http://www.nodc.noaa.gov/OCL/>

Drivers



Models

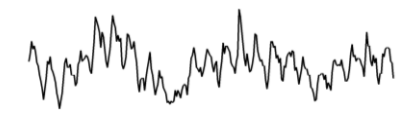
GRP Models

- Menhaden
- Bay anchovy
- Bluefish

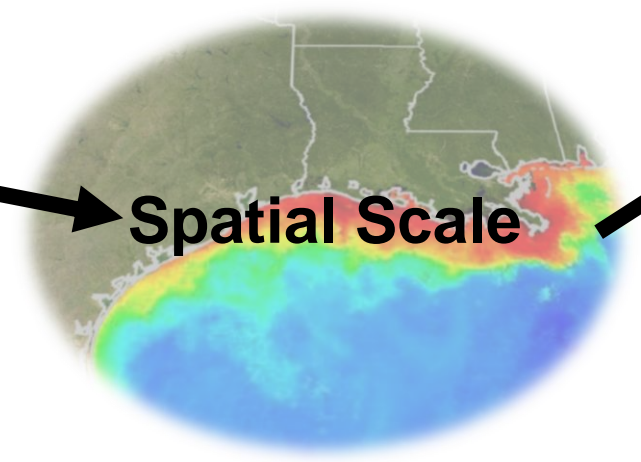
?

Products

Temporal Scale



Spatial Scale

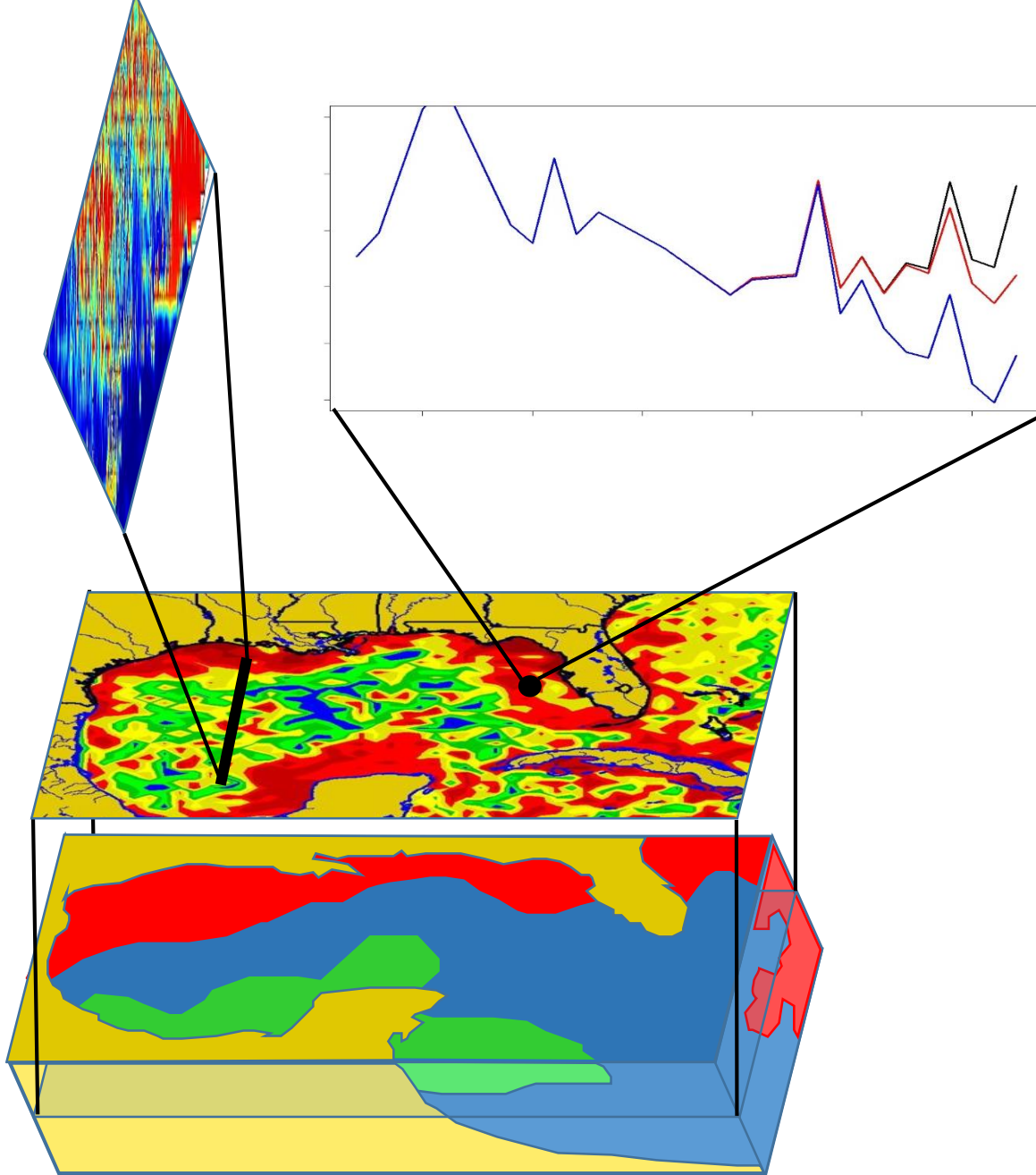


Habitat Quality Indices



Tools & Products

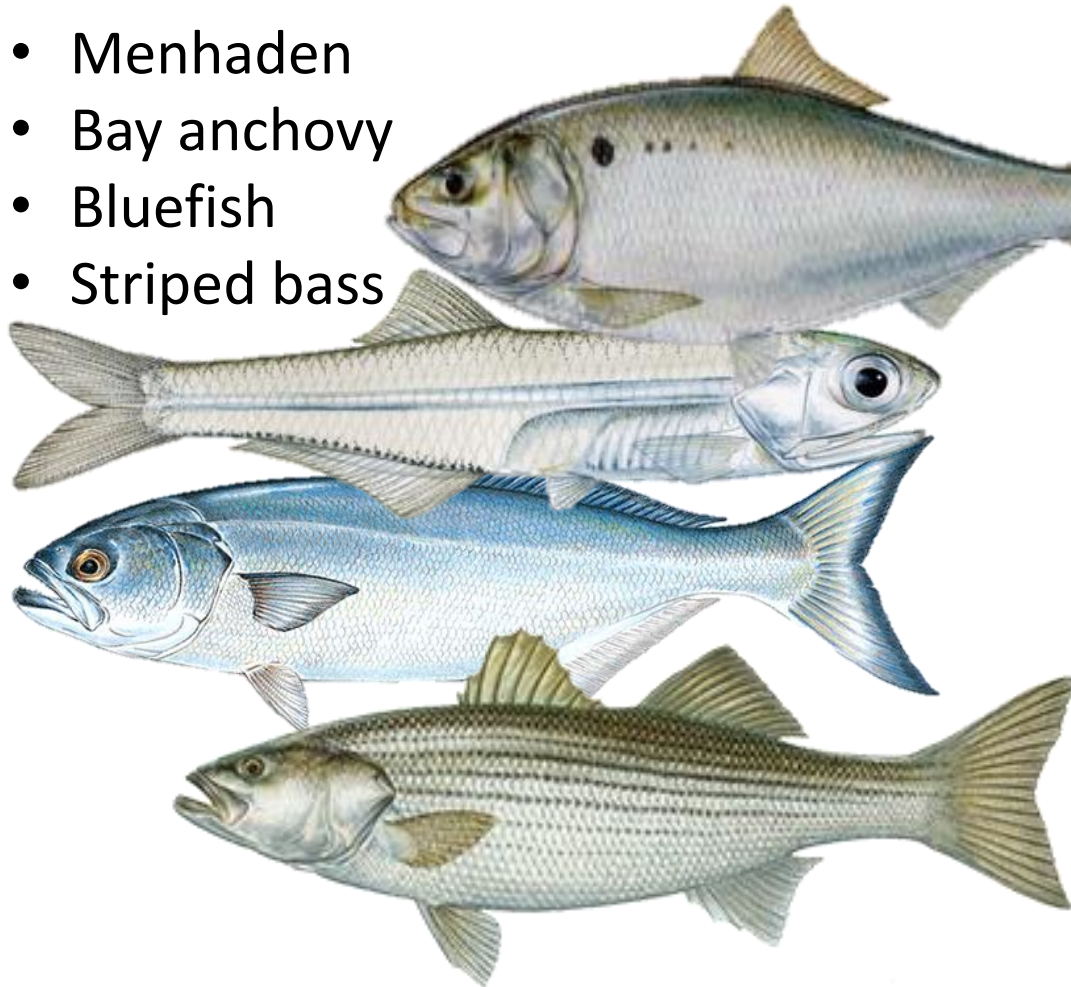
- Parameterized and validated habitat models for ~ 6 species
- Quantitative habitat maps and annual production potential
 - Data Driven
 - Model driven with Nutrient loading scenarios
- Spatial/temporal indices of fish habitat quality and production



Next Steps: Better Coverage of the Food Web

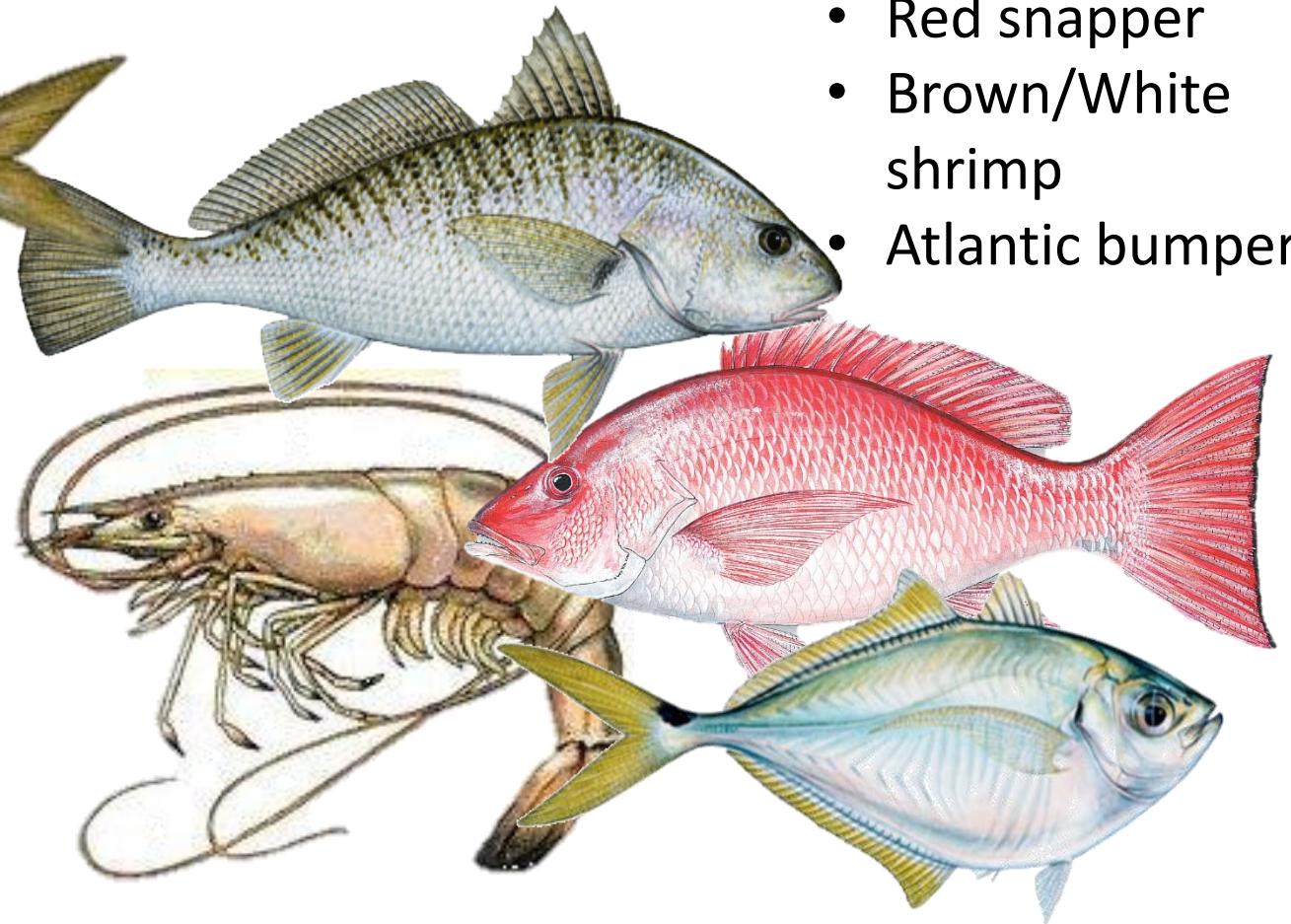
Current models

- Menhaden
- Bay anchovy
- Bluefish
- Striped bass



Potential new species

- Atlantic croaker
- Red snapper
- Brown/White shrimp
- Atlantic bumper



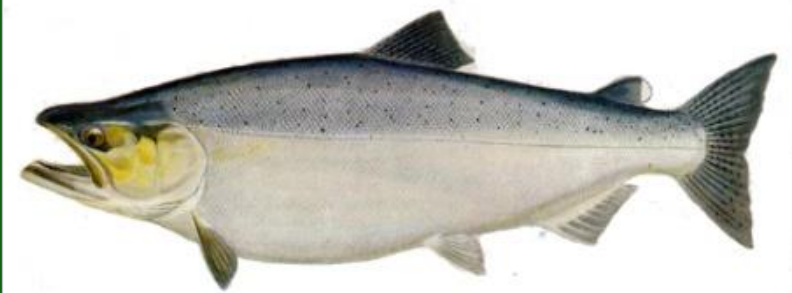
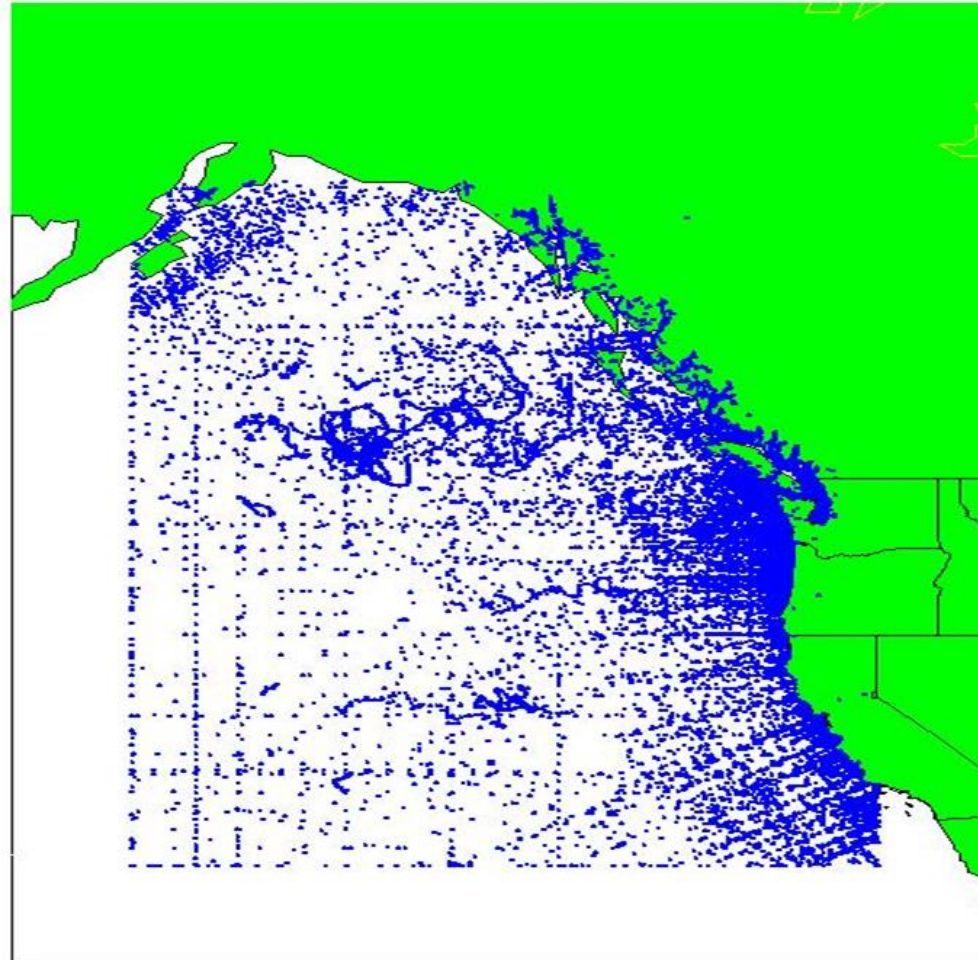
Next Steps: Links to Production

- Incorporate indices of habitat quality in population models
- Conversion of growth to production through body size-fecundity-recruitment relationships

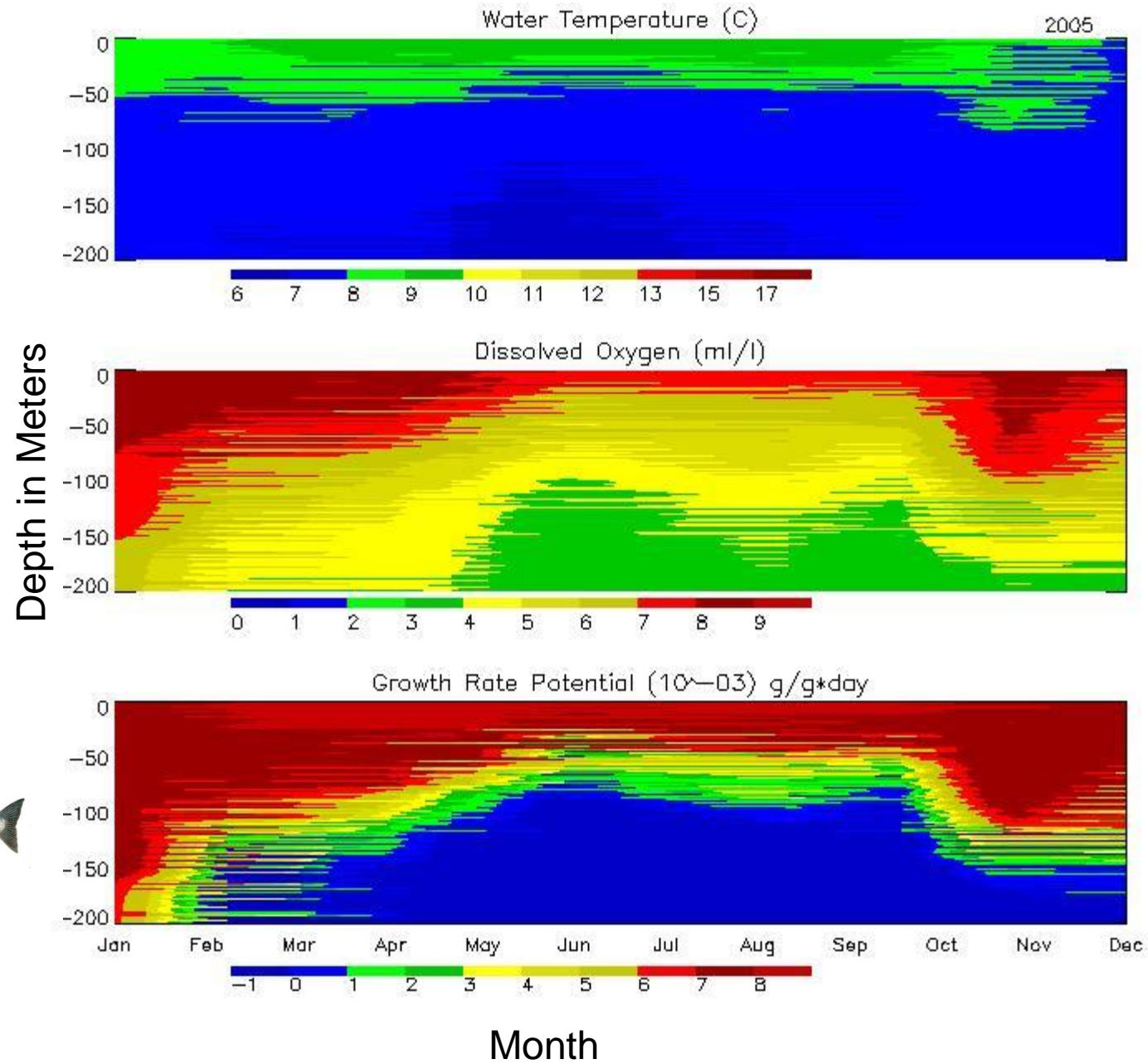


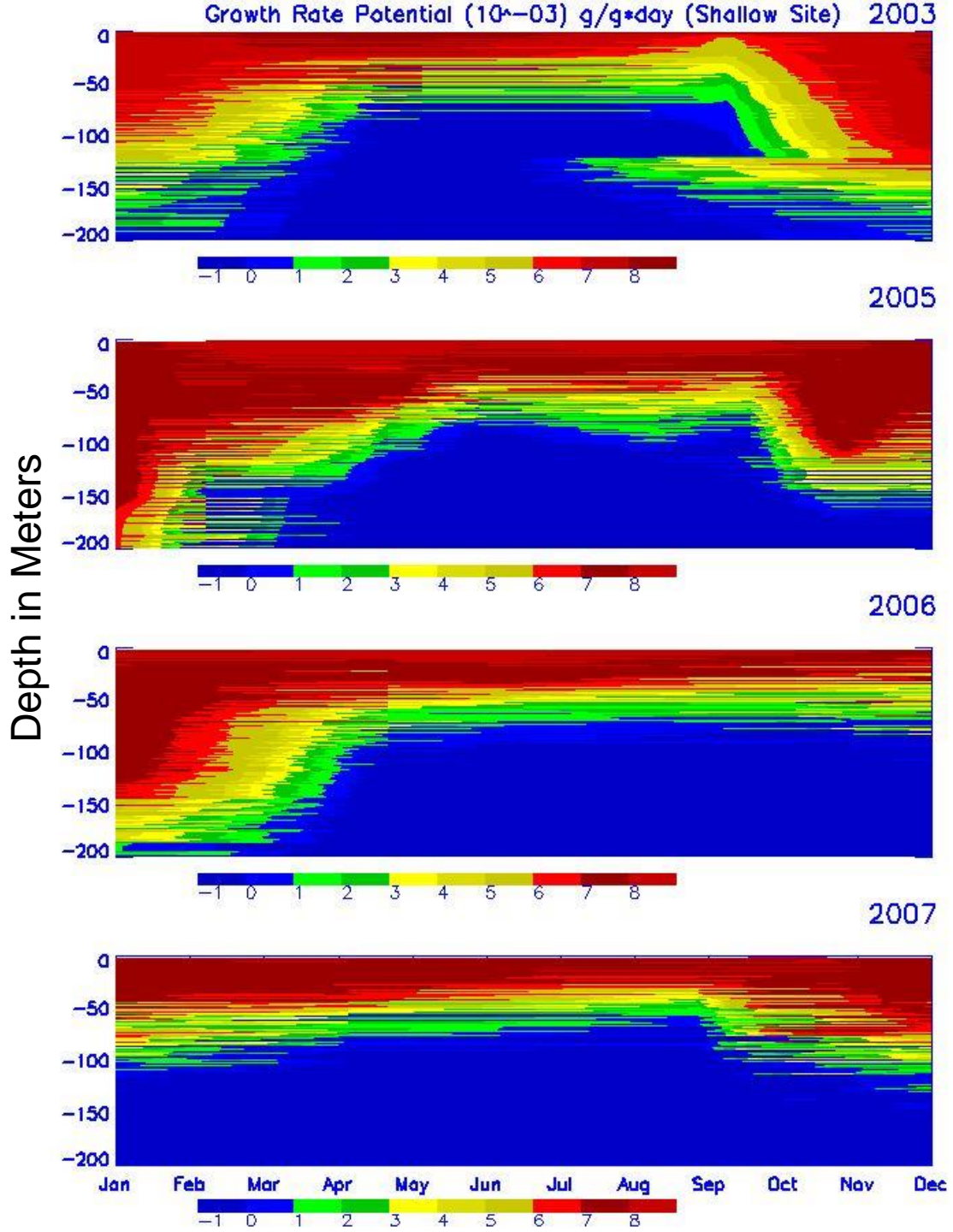
Links to Production: Chinook Salmon

Data base =
37,838 CTD, XBT
casts for years
spanning
1929 - 2013

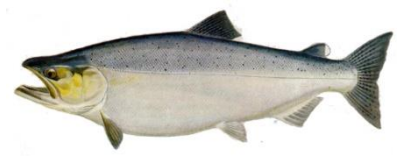


Shallow Site --2005

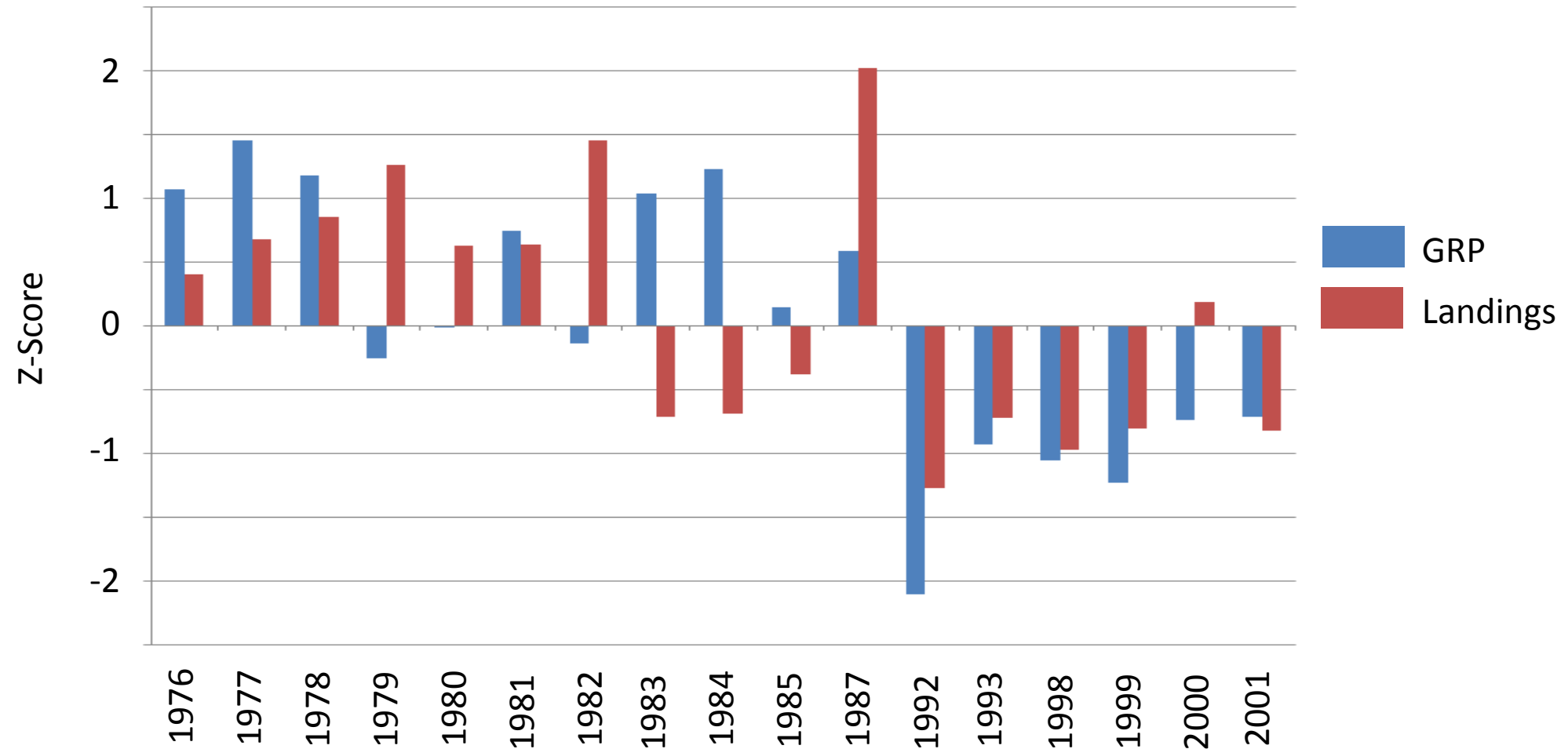




Chinook Salmon
Growth Rate Potential
Across Different
Years



GRP as an Index for Production



Drivers

Products

Observations

- Cruise data
- Observing systems
- Satellites

Models

- Hydrodynamics
- Water quality
- Food web

GRP Models



Temporal Scale

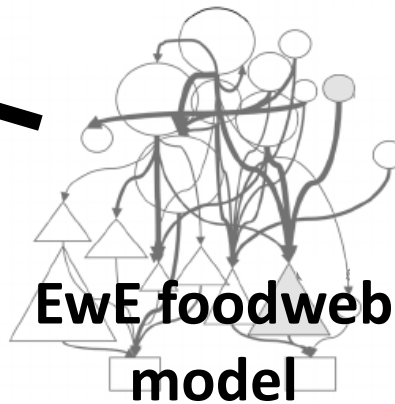
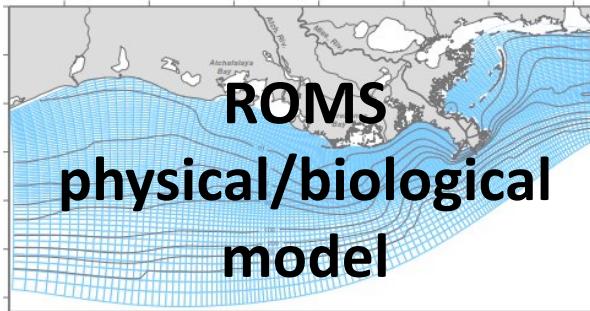
- Daily
- Seasonal
- Yearly

Spatial Scale

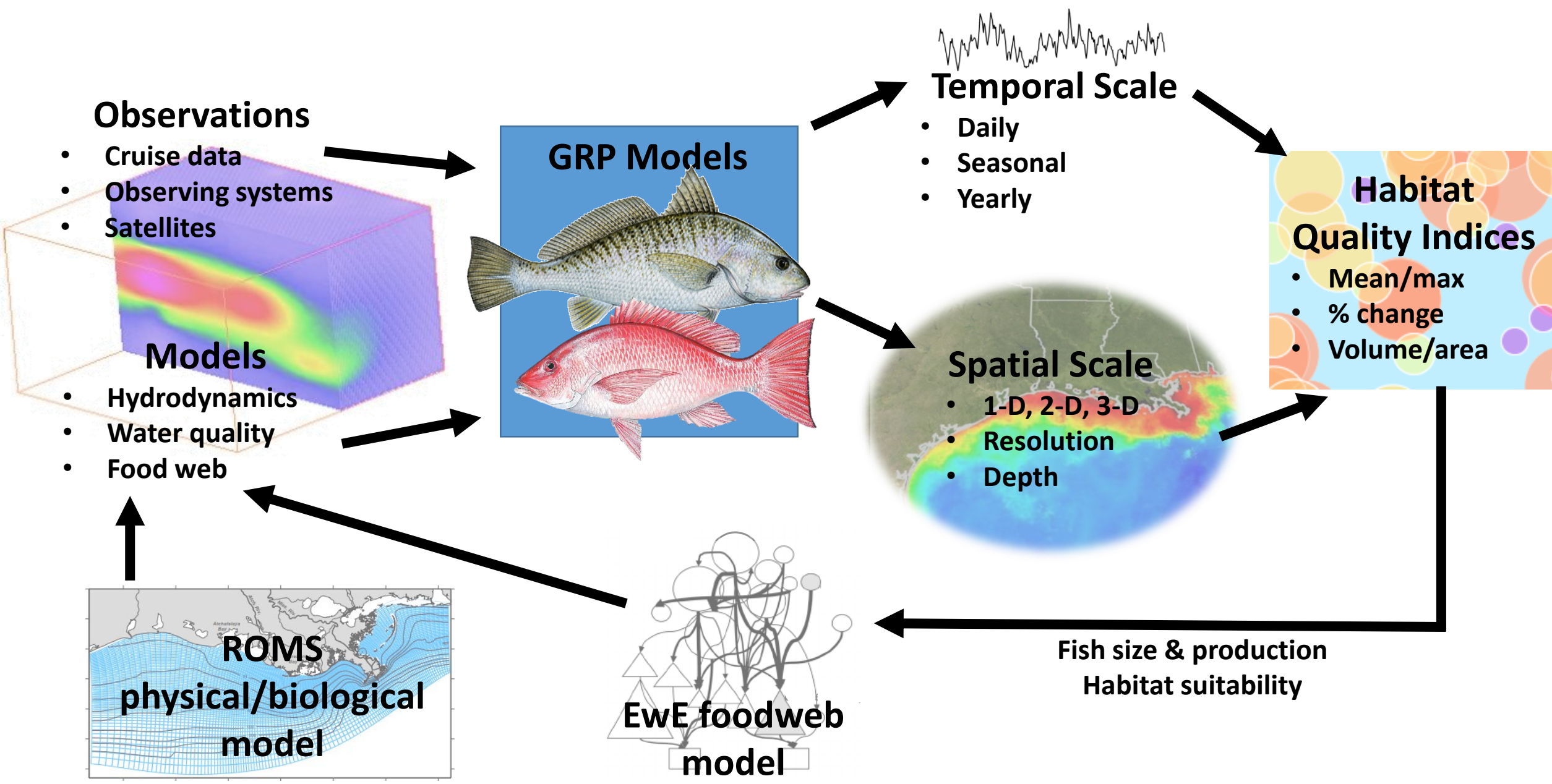
- 1-D, 2-D, 3-D
- Resolution
- Depth

Habitat Quality Indices

- Mean/max
- % change
- Volume/area

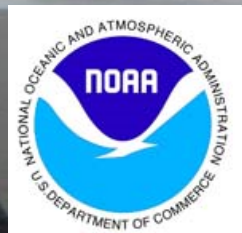


Fish size & production
Habitat suitability

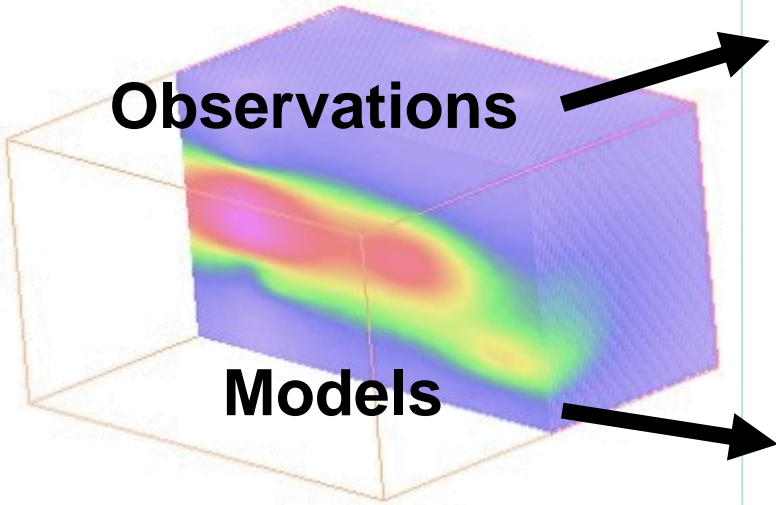


Questions?

Support from;
NOAA-CSCOR NGOMEX
NSF Rapid Response
National Academy of Sciences



Drivers

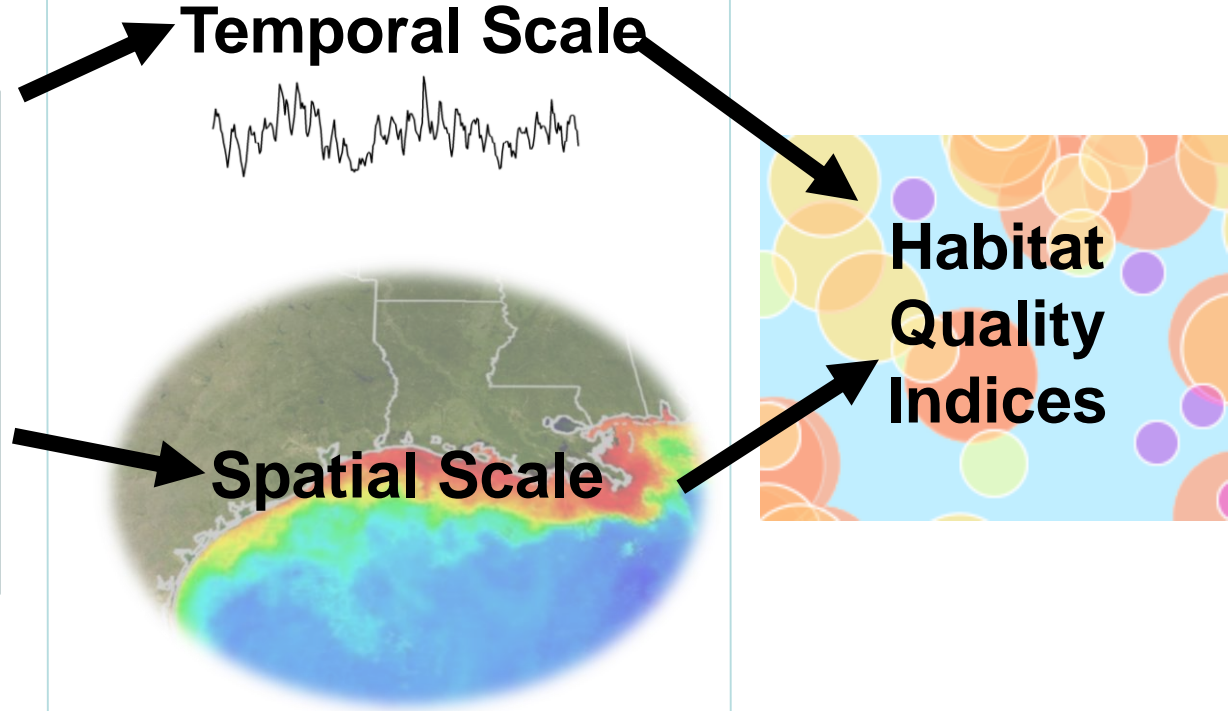


Models

GRP Models

- Menhaden
- Bay anchovy
- Bluefish

Products



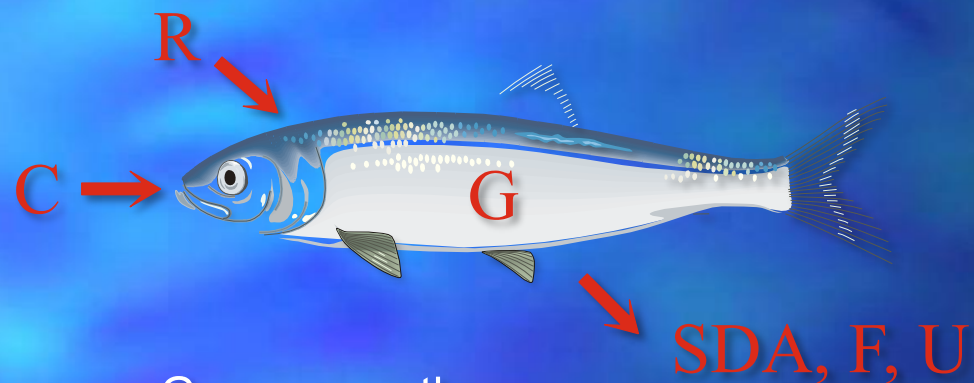
Decision Options

1. Information about additional data sources
 - Historic / real time
 - Landings/survey data for validation

2. Fish species
 - Red snapper*
 - Atlantic croaker*
 - Brown shrimp*
 - White shrimp
 - Atlantic bumper

3. Temporal scale
 - Daily
 - Seasonal
 - Yearly
 - Other
4. Spatial scale
 - 1-D, 2-D, 3-D
 - 1 km, 10 km
 - Depth

5. Summary statistic
 - Mean/max
 - % change
 - % suitable habitat
 - Volume
 - Area



- G = growth
- C = consumption
- R = respiration
- SDA = standard dynamic action
- F = egestion
- U = excretion

Consumption = Growth + Respiration + Wastes

Preliminary Results: Red Snapper

