Blue Economy II: Supporting Fisheries Management

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Main themes

- Fisheries has interrelated objectives that all include environmental considerations
- Case studies that include modeling, ocean observing, and engaging stakeholders.
- Coastal ocean use can change quickly. What are the opportunities and risks and what do we need to manage them?

Interrelated objectives

- Sustainable fisheries and communities
- Protected resources
- Aquaculture

- Ecosystem Based Fisheries Management
- Climate and environmental variability

Magnuson-Stevens Fishery Conservation and Management Act, Endangered Species Act, Marine Mammal Protection Act, National Aquaculture Act

Environment can enter any assessment in multiple places

How to include environmental factors is key…

1.Landings

2. Indices/surveys

3. Discards

4. Biology Growth, mortality, reproduction

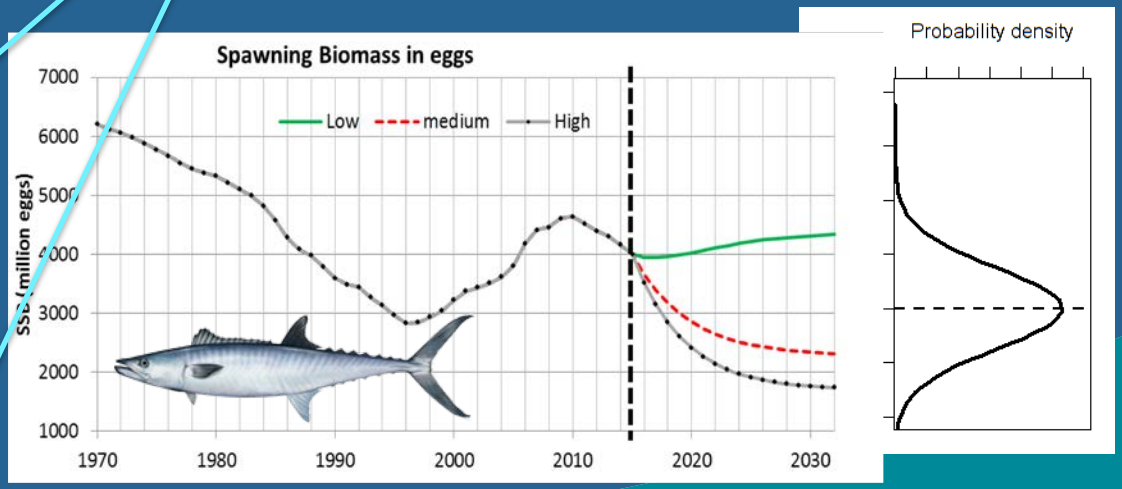
5. Length/age comp

Assessment model (past history)

Future projections

OFL/ABC advice

Allowable catch can be buffered if environment isn't accounted for

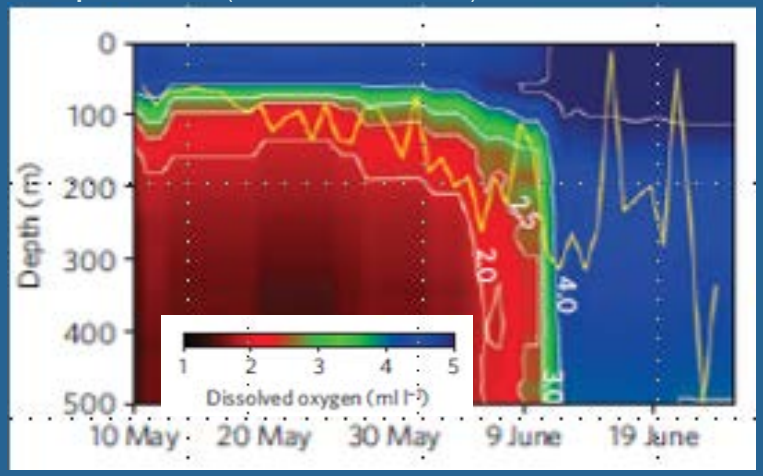


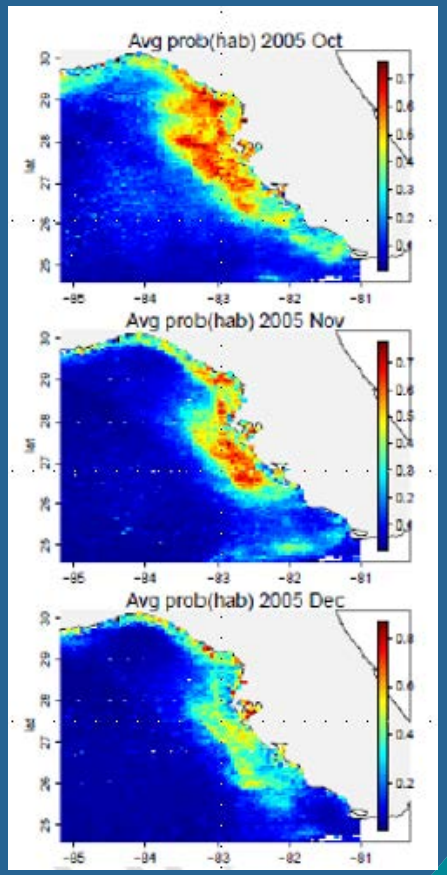
John Walter (SEFSC)

Case studies

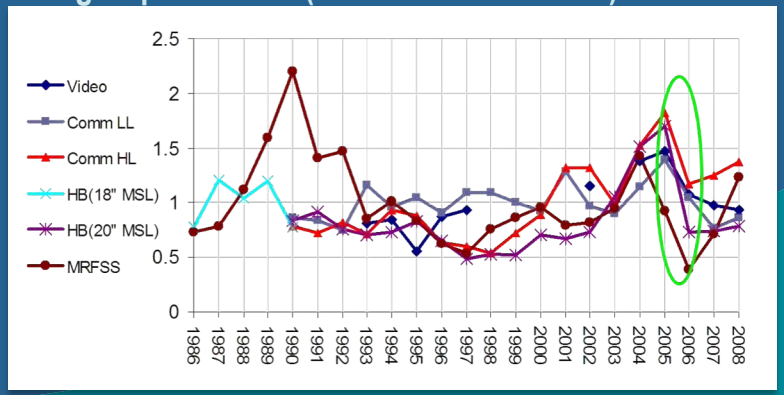
Interpreting catchability and indices

Habitat reduced by oxygen minimum zone expansion (Stramma et al. 2008)





Red grouper indices (~50% decline in 2006)

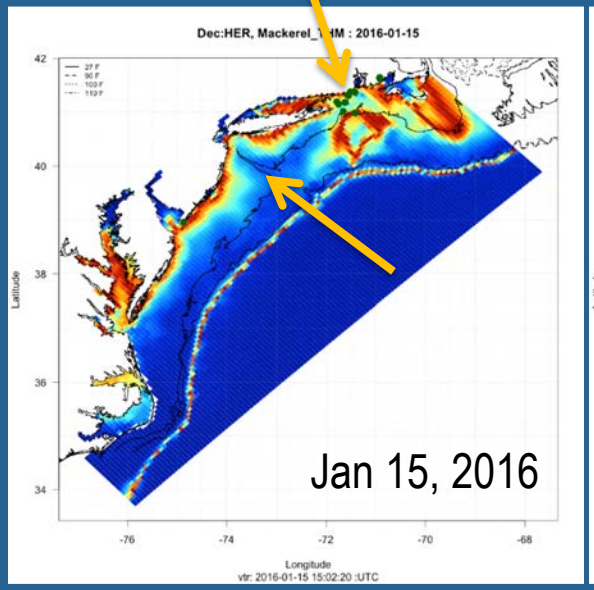


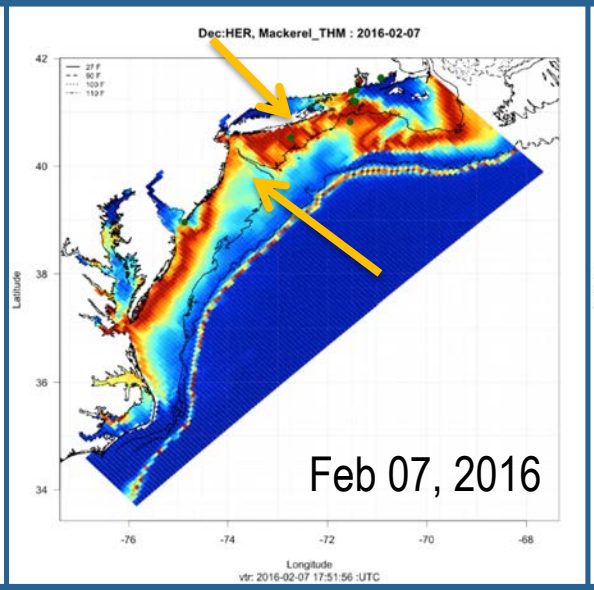
Stramma, Prince, Orbesen, Luo, Walter, Schirrippa (Multi-Institution w/NEFSC)

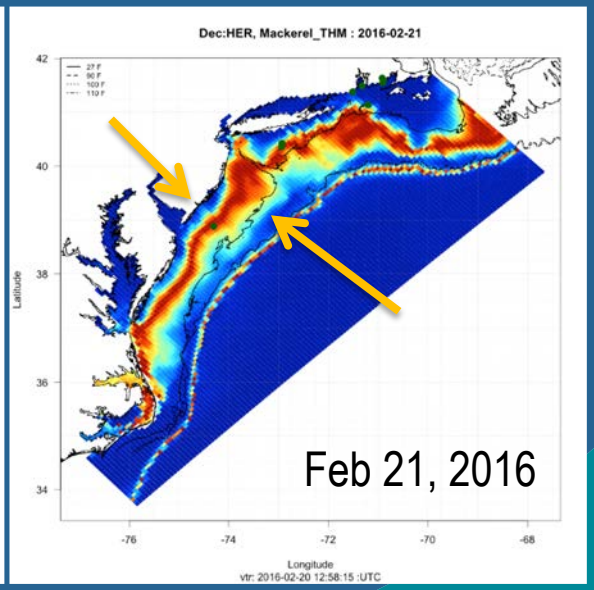
Habitat connectivity and dynamic oceanography

Mackerel were not caught in preferred thermal habitat unless it had been connected to suitable habitat to the northeast along the fall and winter migration route connecting the mid-Atlantic Bight to summer feeding habitats in the Gulf of Maine.

RED is good habitat, GREEN dots are fishing vessels







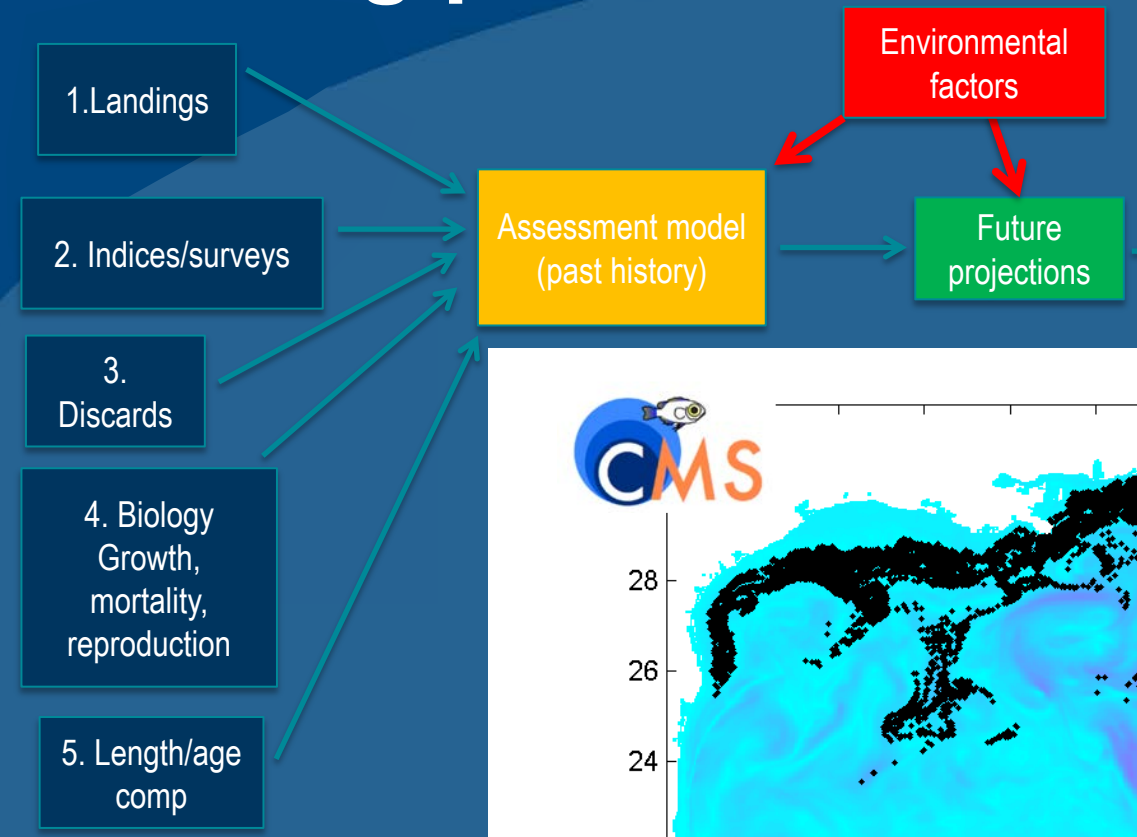
- Mackerel Fishery.
- Habitat model based on fisher knowledge and assimilative circulation model

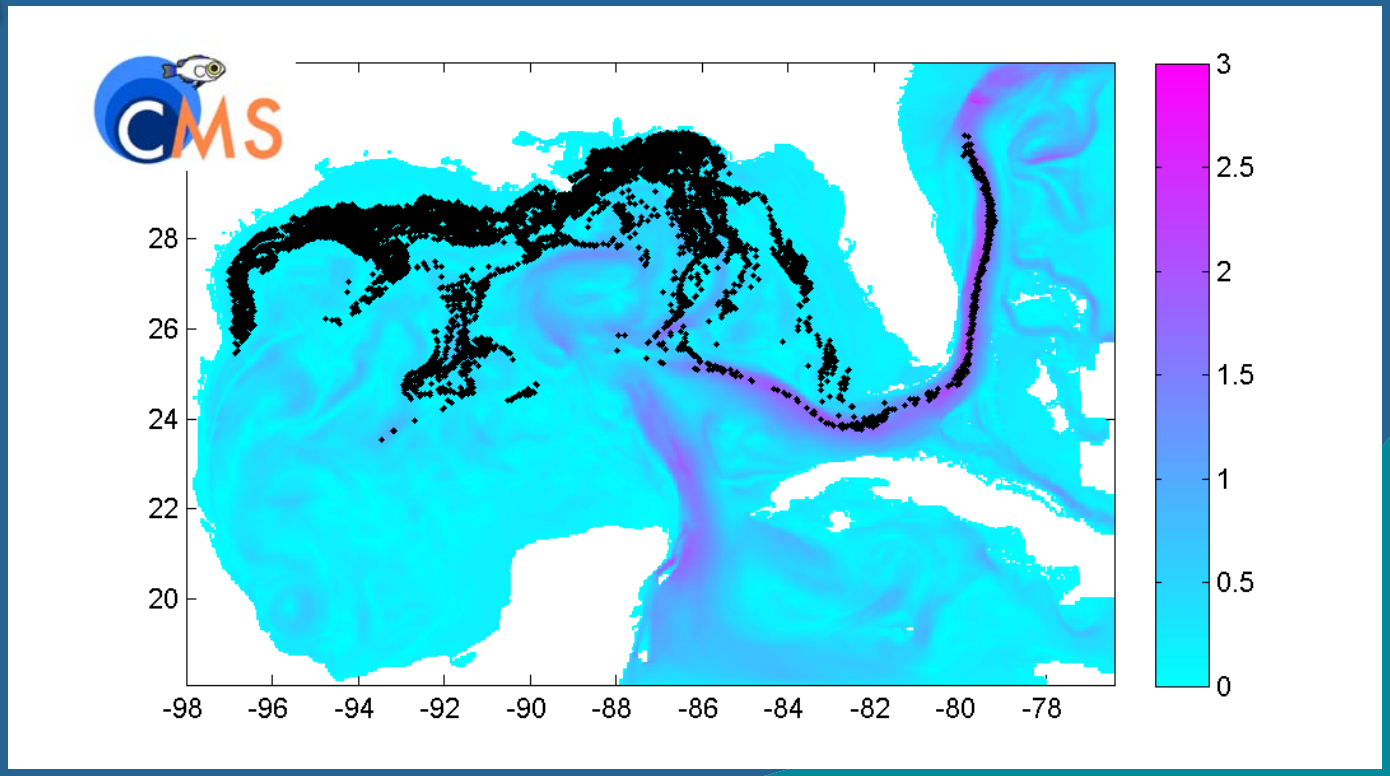
- Characterize of habitat connectivity
- Source of interannual variability
- Assess survey coverage and develop alternative survey strategies

DiDominco, Bright, Moore, Roffer, Manderson, Kohut, Pressutti (Multi-Institution w/NEFSC)

Informing past and future recruit strength

- Red snapper
- Larval transport modeling
- Interannual retention





Paris, Karnauskas, Walter (Multi-Institution w/SEFSC)

Moored echosounders: Index of Abundance at reduced costs?

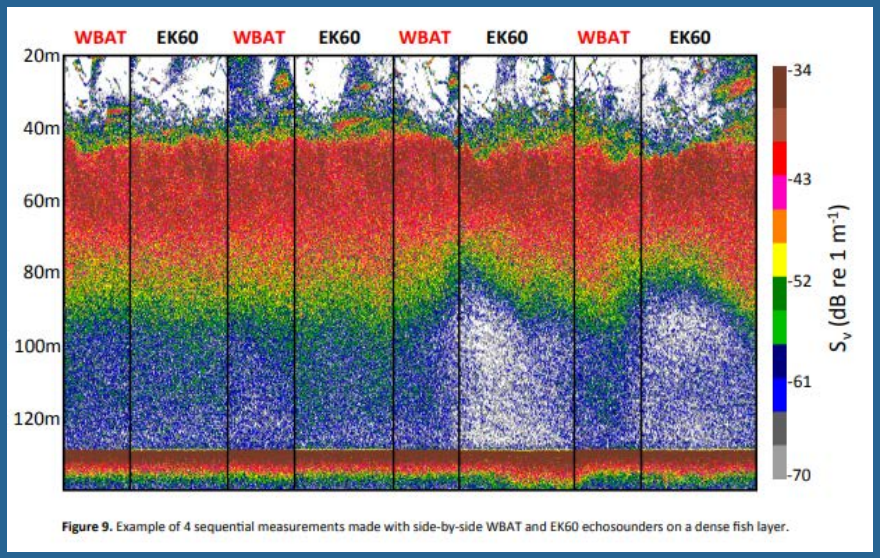


Figure 9. Example of 4 sequential measurements made with side-by-side WBAT and EK60 echosounders on a dense fish layer.

I. Can a few moorings measure abundance?

Analysis of 20 years of annual survey data of spawning walleye pollock in Alaska (**Fig. 1**) indicate that backscatter from as few as three moored echosounders may provide an index of pollock abundance comparable to that produced by a 5600 nmi^2 survey.(**Fig. 2**).

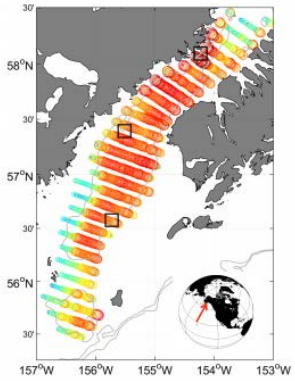


Figure 1. Best-fitting mooring locations (black boxes) based on the 20-yr retrospective analysis of survey data. Pollock biomass are shown from the 2014 survey . The color and size of the circles at each location are proportional to $\log_{10}$ biomass.

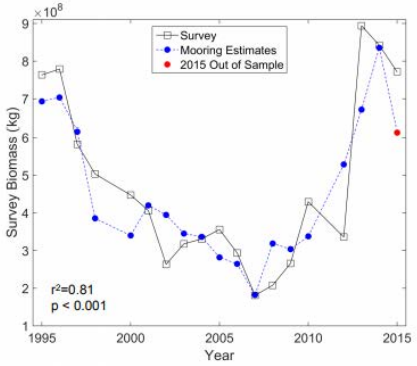


Figure 2. Retrospective analysis of pollock biomass (i.e., kg of pollock in the survey area) estimated from an annual Acoustic-trawl (AT) survey (black line), and a mooring index (blue line) derived by averaging ~ 7 nmi of shipboard acoustic measurements in the squares shown in Fig 1. The red point represents the 2015 survey, which was not used to develop the conversion between the simulated moorings and the survey.

II. Mooring design and deployment

We constructed 3 trawl-resistant moorings containing autonomous echosounders **(Fig. 5)**.

The moorings were deployed on the seafloor at ~270 m for the duration of the pollock spawning season (February to May 2015).

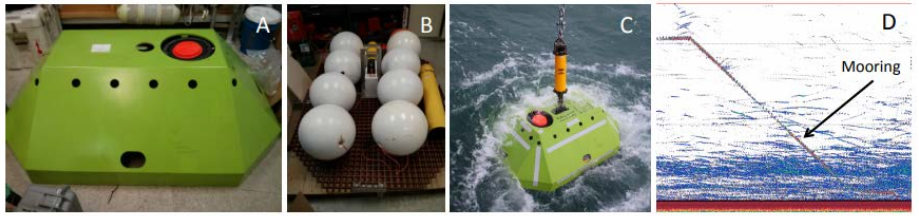
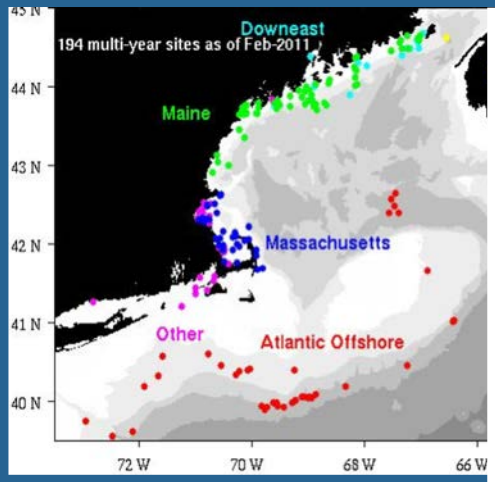


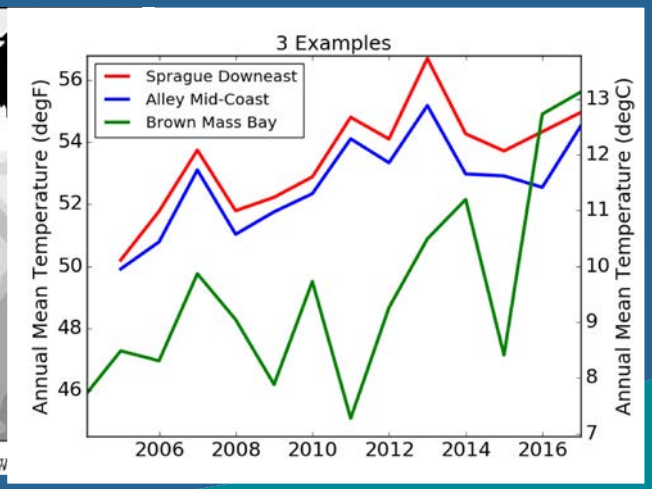
Figure 5. Trawl-resistant bottom mooring. Panel A: Trawl-resistant mooring with gimbaled transducer (orange). Panel B: interior layout with flotation, acoustic release in center, and echosounder pressure case to the right. Panel C: mooring deployment using an acoustic release to lower the system. Panel D: echogram of the mooring deployment at 18 kHz, showing the system being lowered and released..

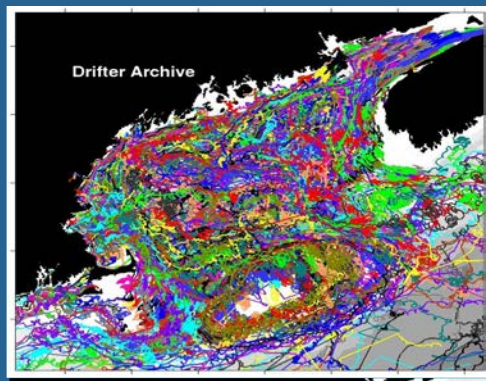
DeRobertis, Levine, Wilson, Furnish, and Wangen (AFSC, SIMRAD)

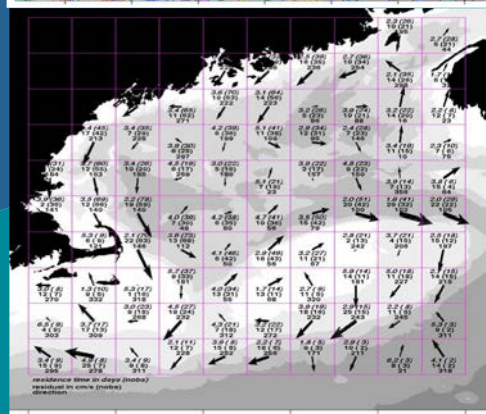
eMOLT: fishers, students, oceanographers

- 2001- Lobster traps (>6M hourly bottom temperature records)
- 2003 – Surface drifters and unmanned sailboats (surface currents) – Atlantic crossing
- 2014 – Trawlers (weather, temperature) rates
- Catch Analyses
- Assimilative models





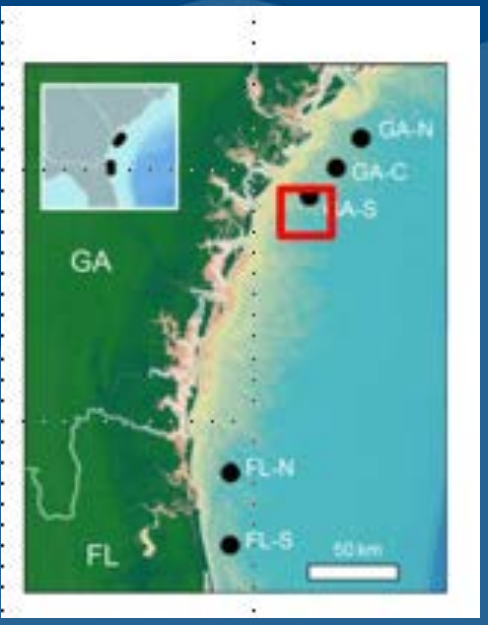


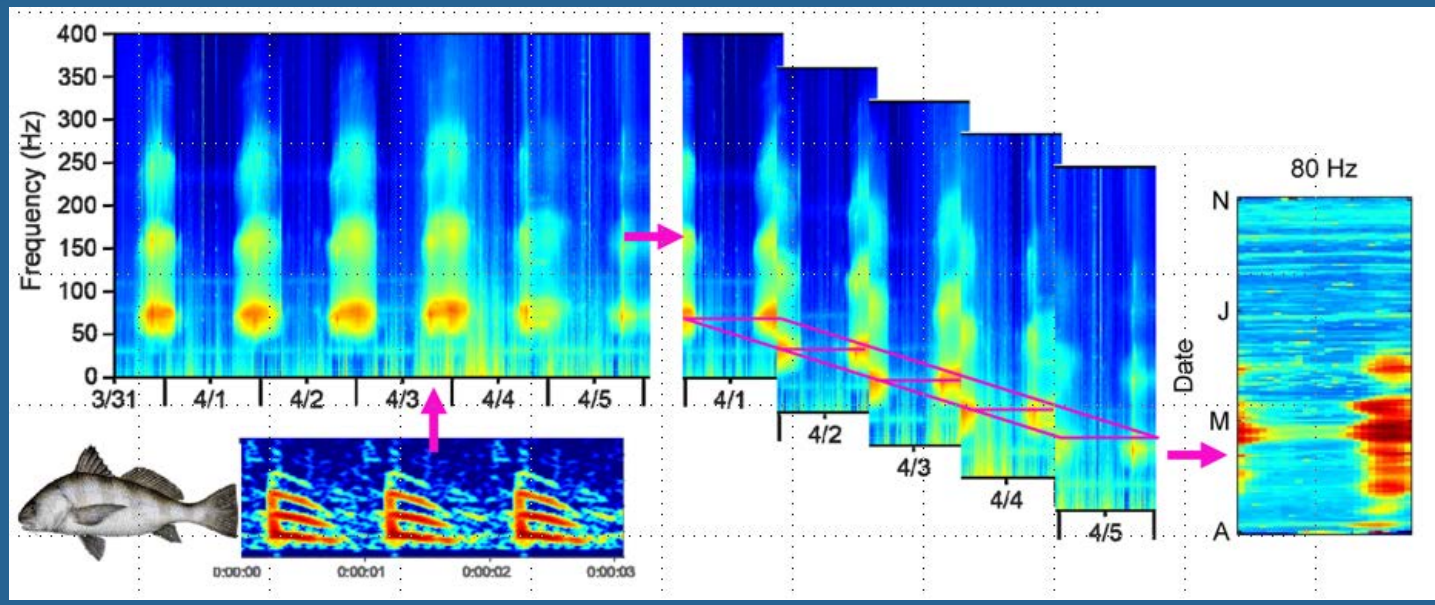


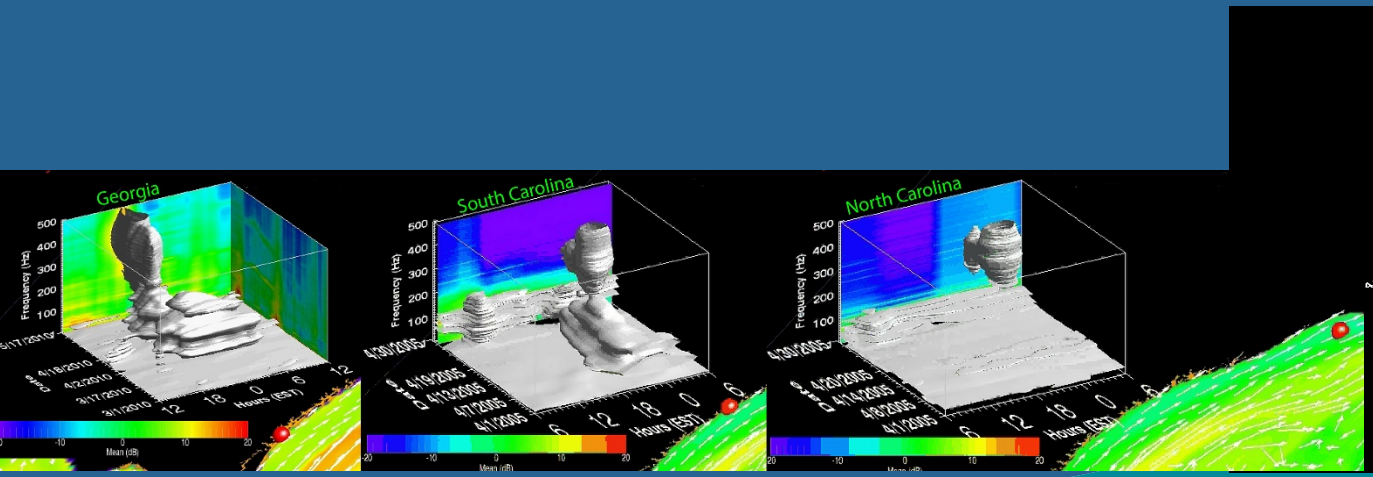
Jim Manning (NEFSC)

Hydrophone arrays as a fisheries survey technique

Analysis/software to link to environmental data



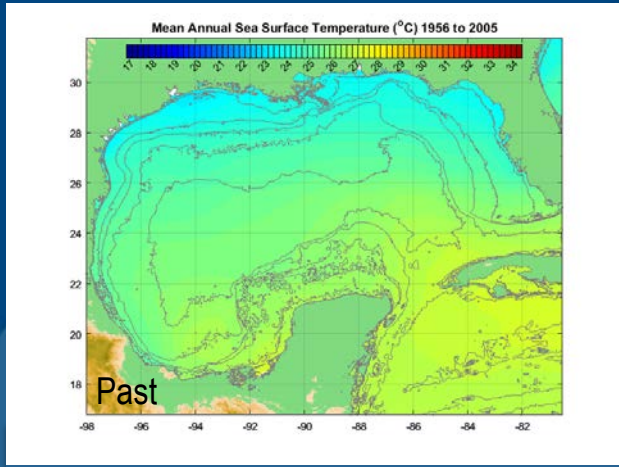


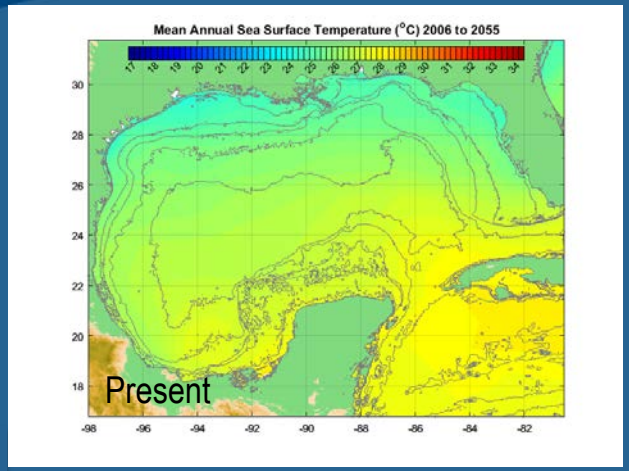


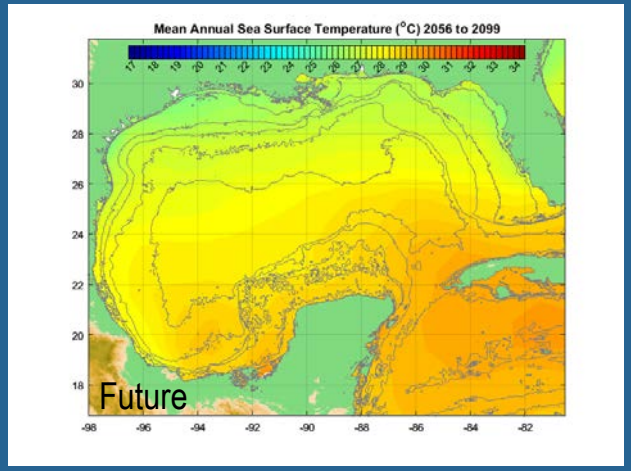
Soldevilla, Rice, Luo, Quinlan (Multiinstitutional w/SEFSC)

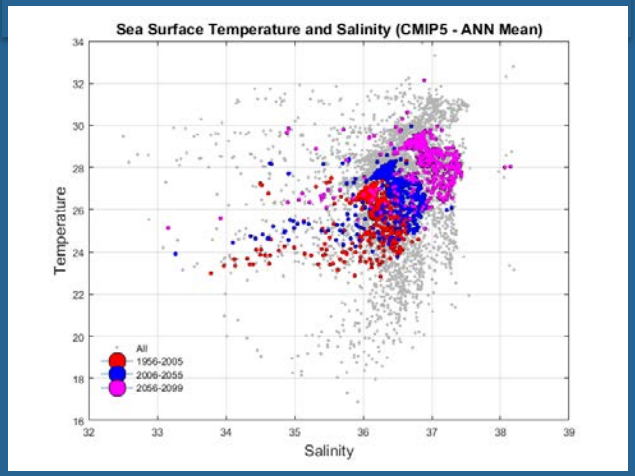
Tracking/assessing environmental shifts

CMIP5 SST

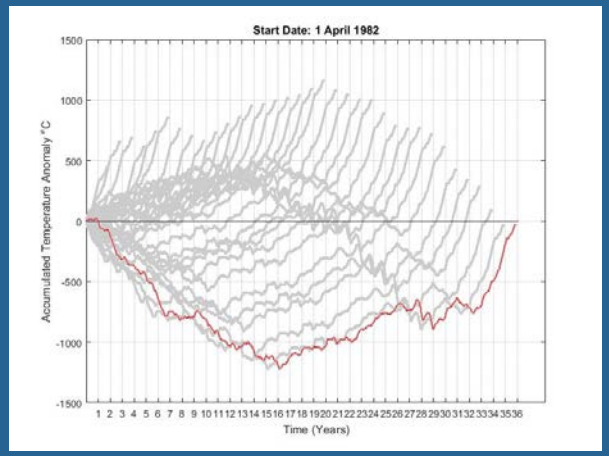




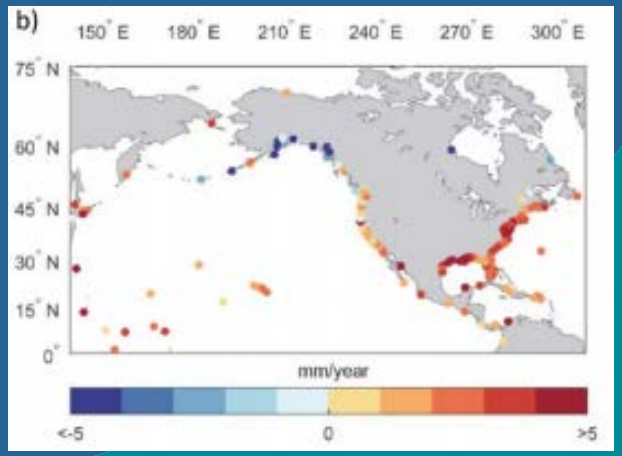




T,S-offset



SST trends



SLR trends

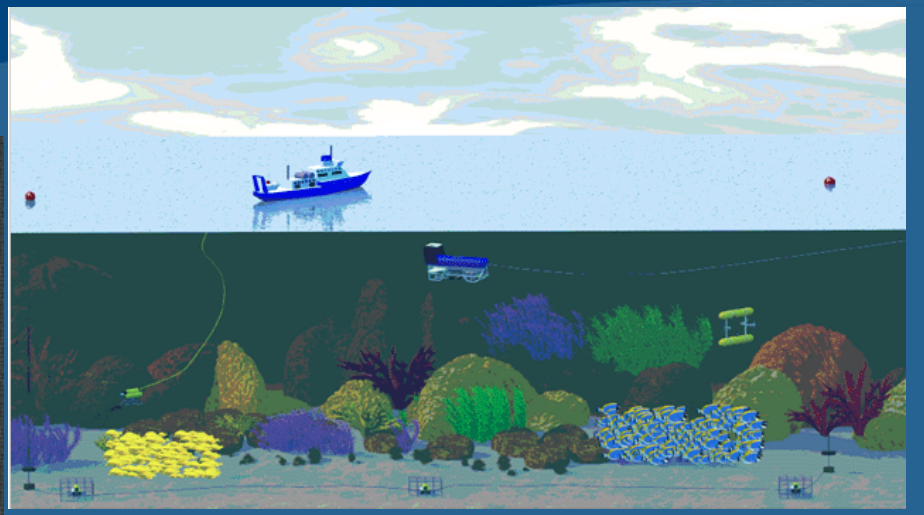
Other areas

NOAA FISHERIES STRATEGIC INITIATIVE ON AUTOMATED IMAGE ANALYSIS

BREAKING NEWS

VIAME Open source software

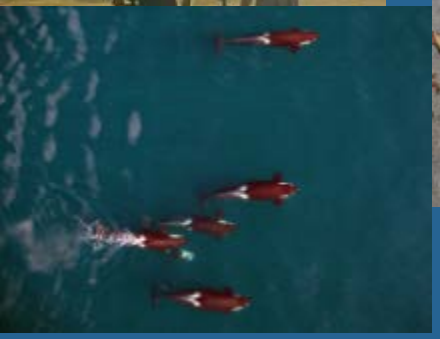
•NOAA Fisheries AIASI announces VIAME: An Open Source Framework for Underwater Image Processing



Untrawlable Habitat Strategic Initiative

Spatial distribution of environmental DNA in a nearshore marine habitat

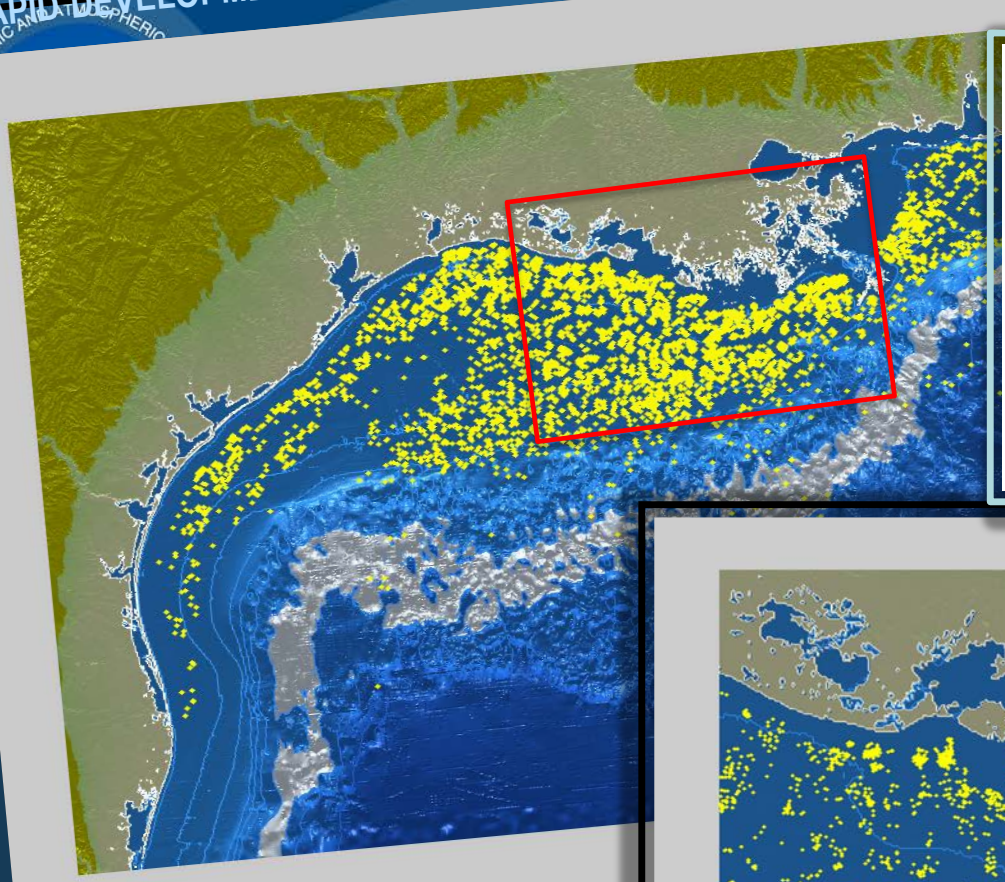
James L. O'Donnell[1], Ryan P. Kelly[1], Andrew Olaf Shelton[2], Jameal F. Samhouri[3], Natalie C. Lowell[1,4] and Gregory D. Williams[5]

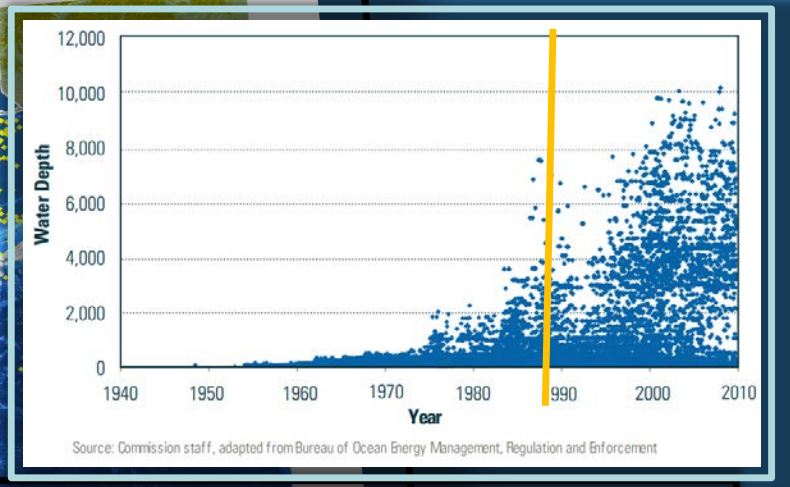


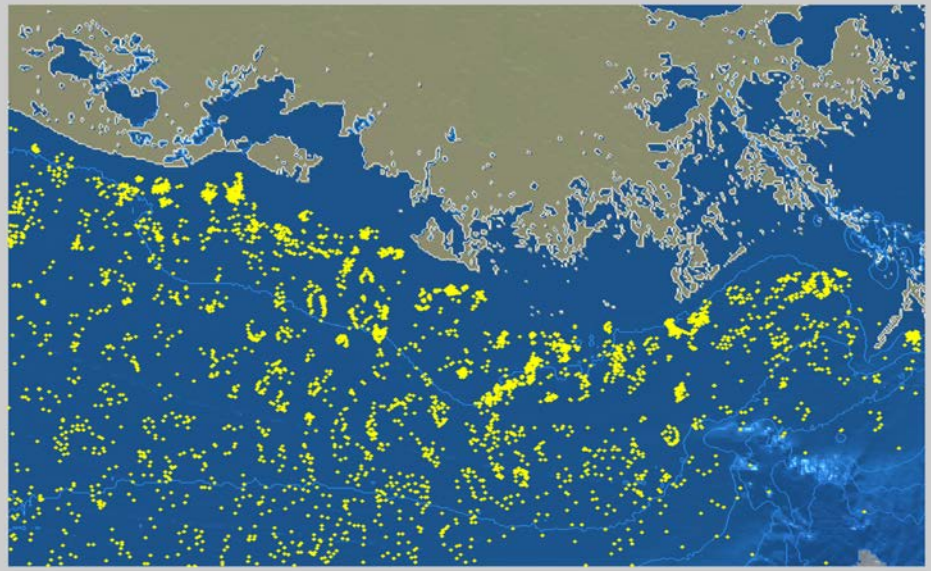
Several drone projects

Use changes…

Rapid development of at-sea industry (est. 1948)







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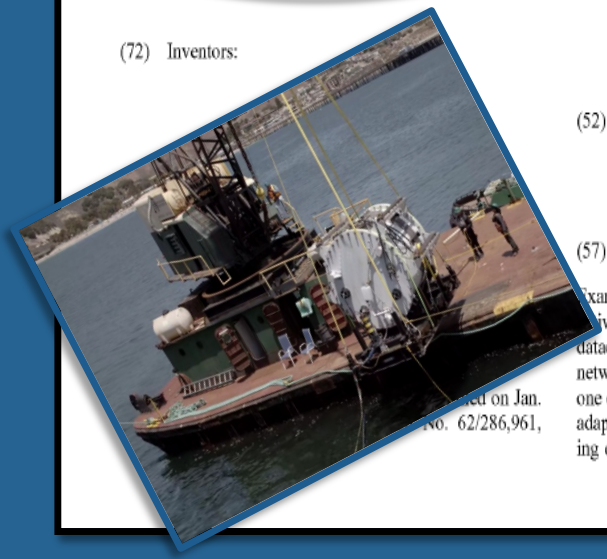
(54) **ARTIFICIAL REEF DATACENTER**

(71) Applicant:

(72) Inventors:



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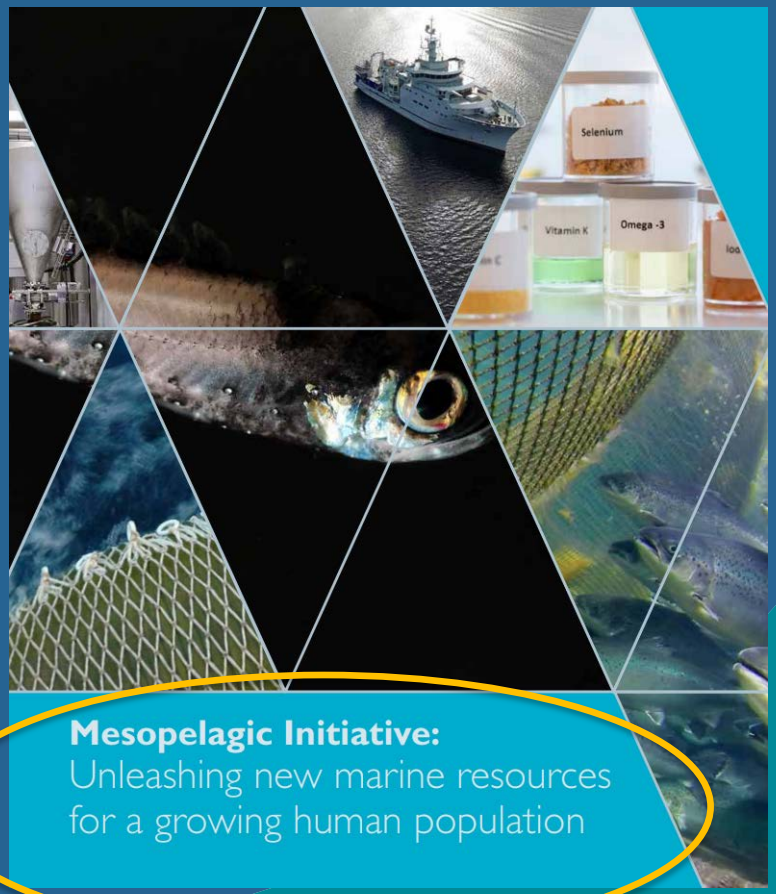
H05K 7/14	(2006.01)
A01K 29/00	(2006.01)

(52) **U.S. Cl.**

CPC ***H05K 7/20709*** (2013.01); ***H05K 7/1497*** (2013.01); ***A01K 29/005*** (2013.01); ***A01K 67/033*** (2013.01); ***A01K 61/006*** (2013.01)

(57) **ABSTRACT**

Examples of the disclosure provide for an apparatus for actively promoting marine life. The apparatus includes a datacenter implemented in a body of water and coupled to a network, a pressure vessel that houses the datacenter, and one or more components coupled to the pressure vessel and adapted to actively promote reef life and sustain a surrounding ecosystem.



Mesopelagic Initiative:
Unleashing new marine resources for a growing human population

Blue Economy
Ocean Gross Domestic Product

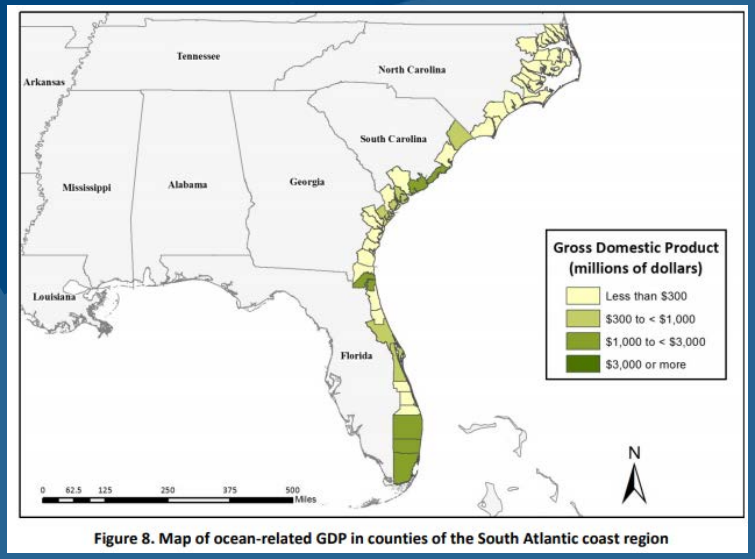


Figure 8. Map of ocean-related GDP in counties of the South Atlantic coast region

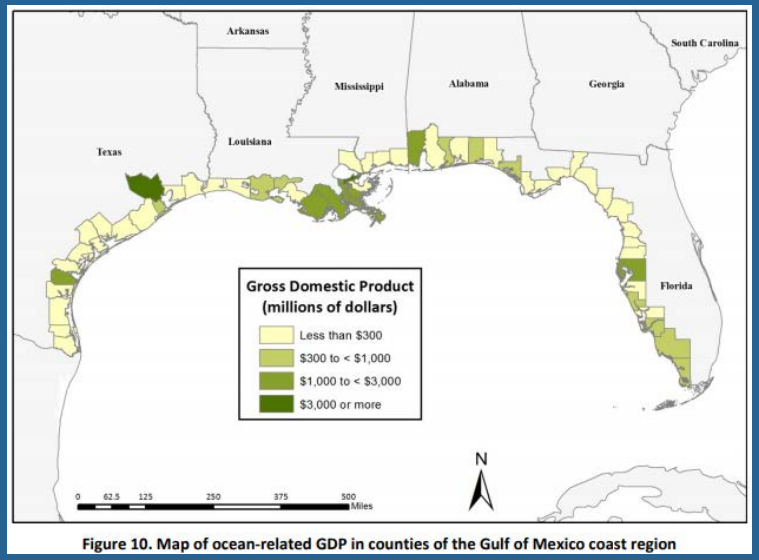
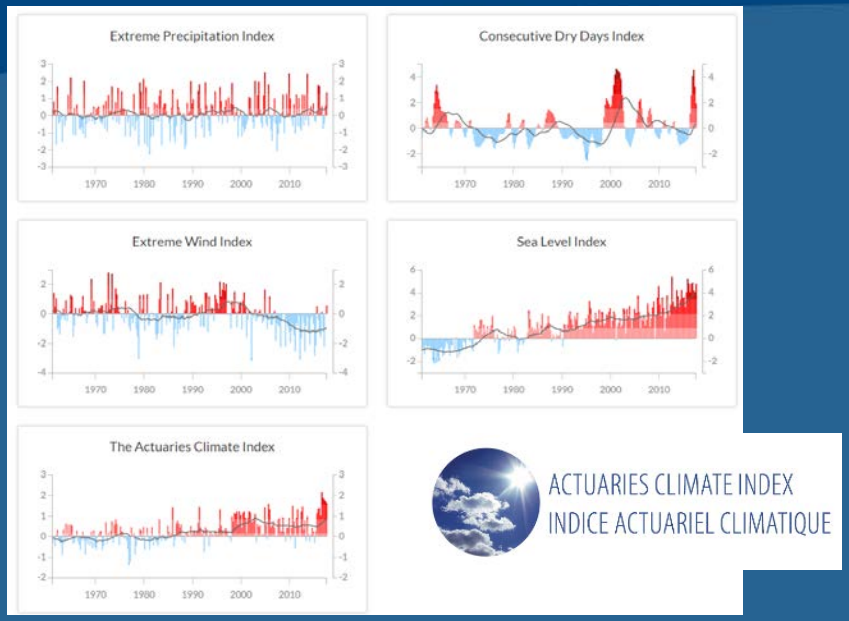


Figure 10. Map of ocean-related GDP in counties of the Gulf of Mexico coast region



Actuaries climate index includes temperature (hi/low), rainfall, drought, wind, sea level.

Which ocean ecosystem services support the economy and where are they?

Sustainability could be about improving services and assessing hazard

ANTICIPATE CHALLENGES

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Next Generation Environmental Intelligence….

- Conduct field/lab work required to support ecosystem models, effective restorations, understanding of system material flows
- Find technological solutions throughout (molecular biology, advanced survey design/analyses, imaging, acoustics, machine learning, UxS, IOOS)
- Invest in building infrastructure that we will want – given anticipated challenges – 10 to 20 years from now
- Revisit all of this iteratively to adjust

CALCOFI • MARMAP • ECOMON • SEAMAP • ECOFOCI • RREAS • NPHL

Some NMFS legacy in

Ecosystem (and Climate) Studies

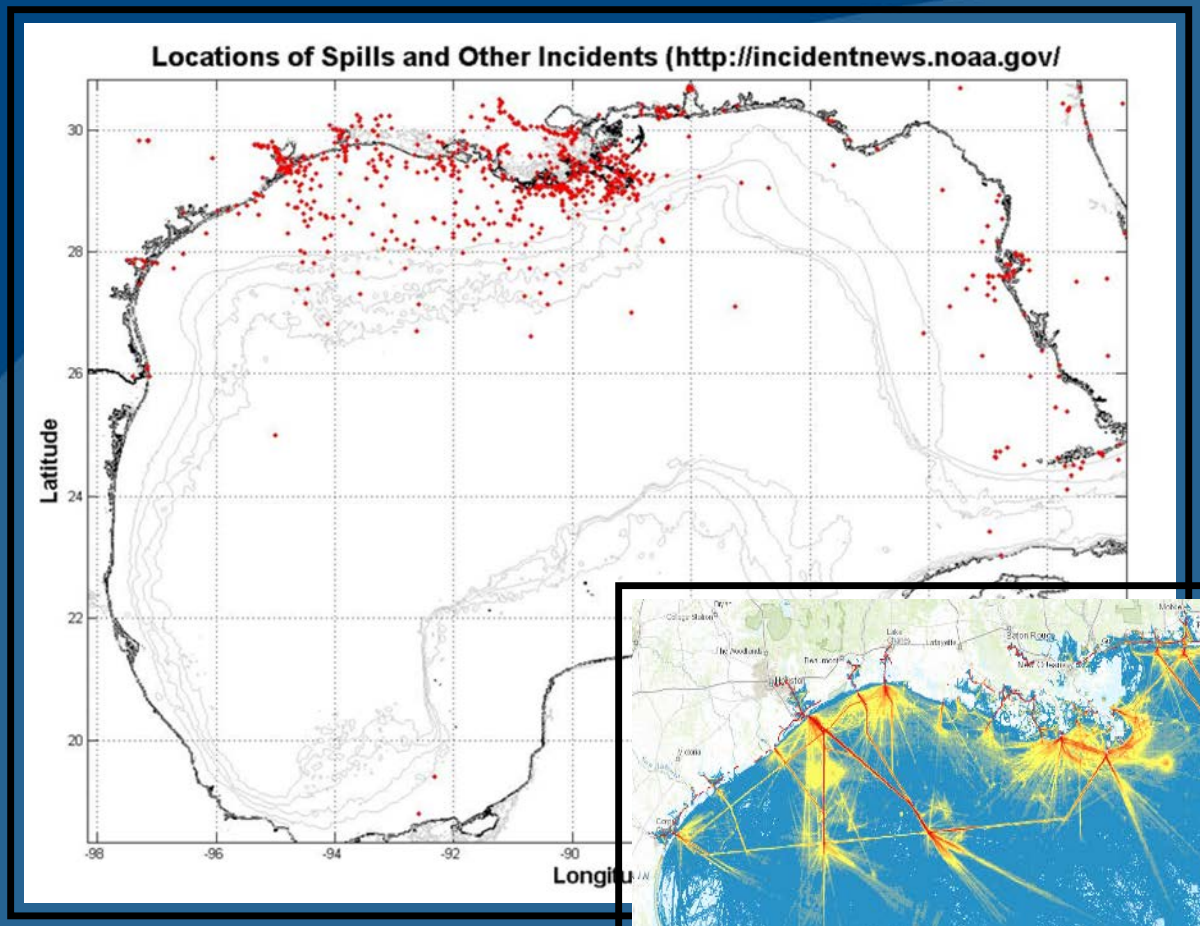
South
Atlantic
Bight
Recruitment
Experiment

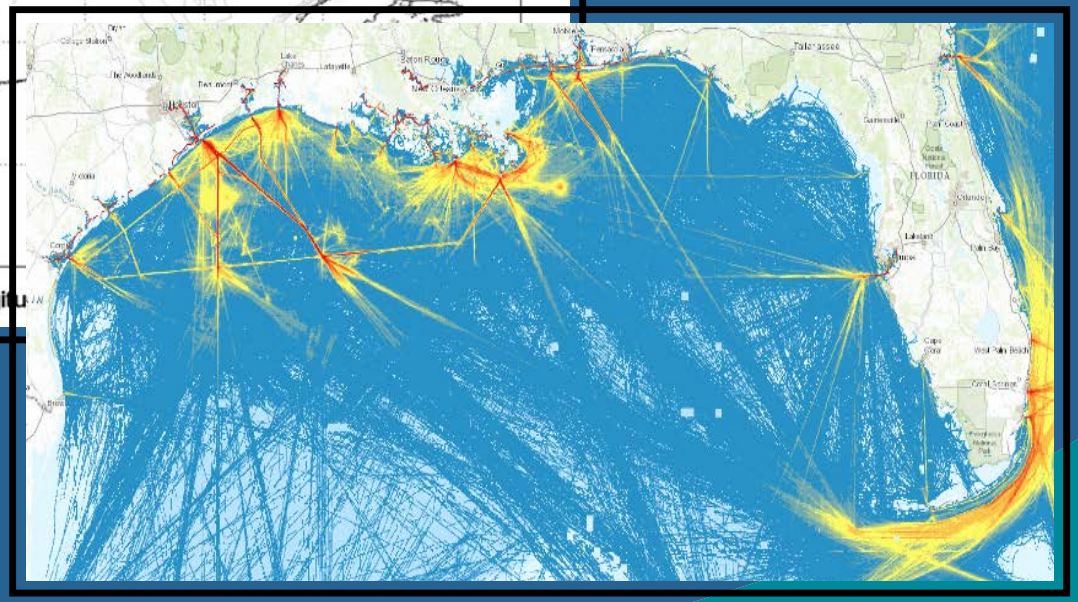
Well-planned ecosystem science via government-academic partnerships helped develop broadscale and process surveys, biophysical modeling, advanced tech, etc.

Maintaining effective scientific capacity

- Anticipate regional challenges?
- Who and what is at risk?
- What historical/current data are available? Are those data accessible and appropriate?
- What equipment/technology can/could be deployed?
- Has appropriate expertise been developed?
- Does capacity exist to handle the program and the material it generates?

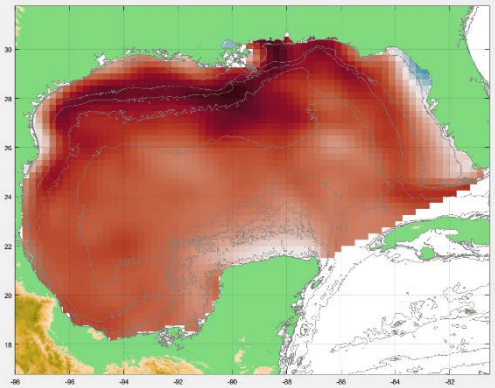
Does a process exist to learn from the experience and adapt?





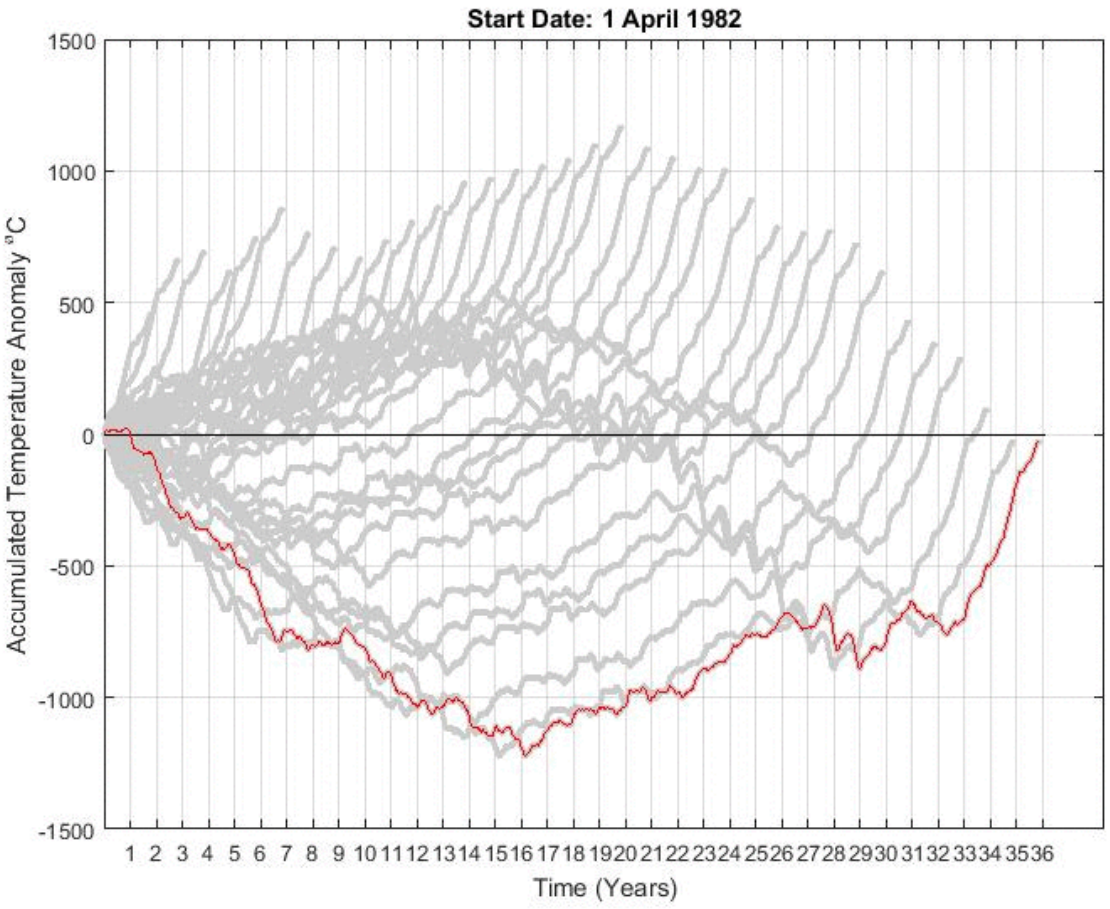
Shipping...

Larger ships, Panama Canal expansions



THERMAL HISTORIES OF ANNUAL COHORTS?

Accumulated degree days wrt mean daily temperature for GoMex LME



There were 170 storms (TS to H5) in the Western Atlantic between 2000 and 2014.

46% (79) traversed the Gulf of Mexico.

(Average is 5.6 per year)