Science, Service, Stewardship

Incorporating Ecosystem Considerations into ACLs

Pat Livingston, Kerim Aydin, Kristan Blackhart, Phil Levin, Jason Link, Tom Minello, Tom Noji, et al.

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Outline

- ***Overview: How do ecosystem considerations fit into a stock assessment/ACL framework?***

- ***What are current efforts in incorporating ecosystem considerations into ACLs?***
  - ***National Programs and Plans***
  - ***Regional activities and issues***

- ***Future research and management direction***

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Multi-species, Multi-fishery, Multi-Sector, Multi-Objective Management

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National Programs and Plans

- ***Stock Assessment Program (ESA)***
  - ***Stock Assessment Improvement Plan: Tier 3 Next Generation Assessments explicitly incorporate ecosystem considerations: multispecies interactions, environmental effects, fisheries oceanography, spatial and seasonal analyses***

- ***Fisheries and the Environment (FATE)***
  - ***Development, evaluation, and distribution of leading ecological and performance indicators to be used to advance an ecosystem approach to management by improving fishery stock assessments and integrated ecosystem assessments.***

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National Programs and Plans

- ***Integrated Ecosystem Assessments (IEAs)***
  - Provide MSEs and advice through comprehensive synthesis and quantitative analysis of information on relevant physical, chemical, ecological and human processes *in relation to specified ecosystem management objectives*

- ***Habitat Science and Assessment***
  - Habitat Assessment Improvement Plan (HAIP): Improve EFH, HAPC information and impacts assessment in the context of MSRA, stock assessments, IEAs and CMSP

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Methods of Using Ecosystem Information in an ACL context

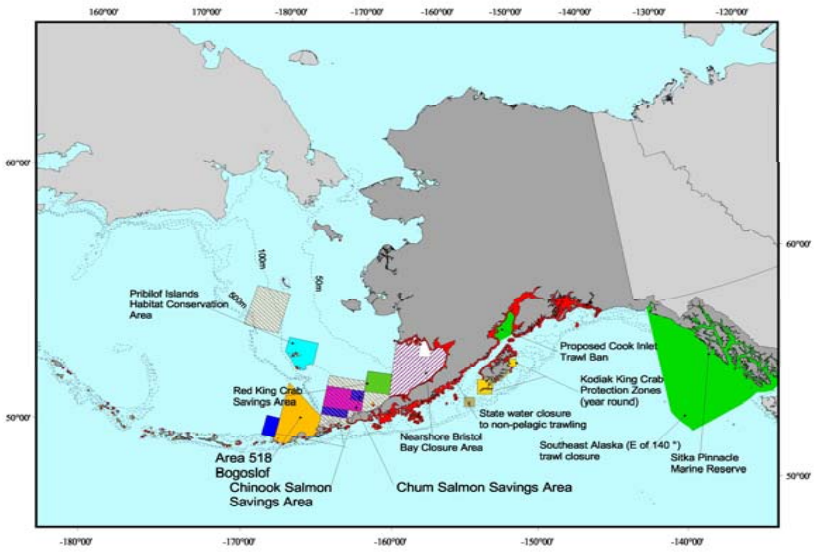
- ***Tactical***
  - — Quantitative incorporation into a single species assessment model: M2, environmental or habitat variable
  - —Qualitative evaluation of ecosystem factors in annual ACL process: suites of variables that may impact production

- ***Strategic***
  - — Management strategy evaluations (MSEs) to examine robustness of harvest strategies
  - —Quantitative suites of ecosystem indicators and aggregate indices

Examples of Ecosystem-based Management Actions

- **OY cap on total groundfish yield**
- **No target fisheries on forage – designation of ecosystem component stocks**
- **Minimum biomass threshold in harvest control rule for sea lion prey species**
- **Trawl closures, bottom trawling restrictions**
- **Single species FMPs converted to place based or multispecies based FMPs or FEPs**

CAP on TOTAL TARGET CATCH
Total yield < 2 million tonnes



Regional Examples: Tactical

Table 15.14. Ecosystem effects

Ecosystem effects on Atka mackerel			
Indicator	Observation	Interpretation	Evaluation
Prey availability or abundance trends			
Zooplankton	Stomach contents, ichthyoplankton surveys	None	Unknown
Predator population trends			
Marine mammals	Fur seals declining, Steller sea lions increasing slightly	Possibly lower mortality on Atka mackerel	No concern
Birds	Stable, some increasing some decreasing	Affects young-of-year mortality	No concern
Fish (Pacific cod, arrowtooth flounder)	Pacific cod and arrowtooth abundance trends are stable	None	No concern
Changes in habitat quality			
Temperature regime	2006 AI summer bottom temperature slightly below average (excl. 2000)	Could possibly affect fish distribution	Unknown
***The Atka mackerel* effects on ecosystem**			
Indicator	Observation	Interpretation	Evaluation
Fishery contribution to bycatch			
Prohibited species	Stable, heavily monitored	Likely to be a minor contribution to mortality	Unknown
Forage (including herring, Atka mackerel, cod, and pollock)	Stable, heavily monitored	Bycatch levels small relative to forage biomass	Unknown
HAPC biota (seapens/whips, corals, sponges, anemones)	Low bycatch levels of seapens/whips, sponge and coral catches are variable	Unknown	Possible concern for sponges and corals
Marine mammals and birds	Very minor direct-take	Likely to be very minor contribution to mortality	No concern
Sensitive non-target species	Skate catches are variable and have averaged 87 t from 2003-2005, which is about 14% of the AI skate catch over this time period	Data limited, need species-specific catch information	Possible concern
Other non-target species	Sculpin catch is variable, large increase in bycatch in 2004	Unknown	Unknown
Fishery concentration in space and time	Steller sea lion protection measures spread out Atka mackerel catches in time and space. Fishery has expanded and concentrates in other areas outside of critical habitat	Mixed potent vs Steller sea of critical hab experiencing rates.	
Fishery effects on amount of large size target fish	Depends on highly variable year-class strength	Natural fluctu	
Fishery contribution to discards and offal production	Offal production unknown The Atka mackerel fishery contributes an average of 690 (58%), and 6,100 t of the total AI trawl non-target and Atka mackerel discards, respectively.	The Atka mac of the few tra in the AI. Nu should be int context.	
Fishery effects on age-at-maturity and fecundity	Unknown	Unknown	

September 2010 Plan Team Draft — Ecosystem Considerations

APPENDIX C

Ecosystem Considerations for 2011

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September 20, 2010
North Pacific Fishery Management Council
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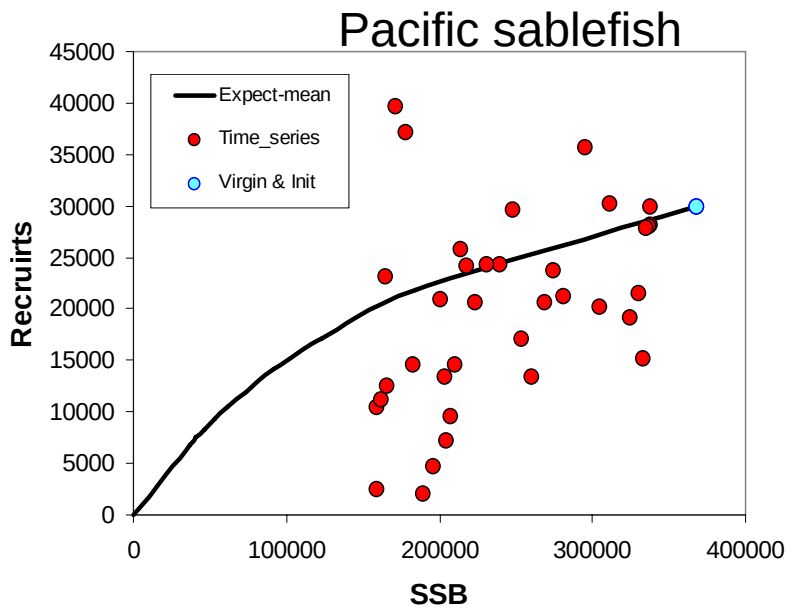
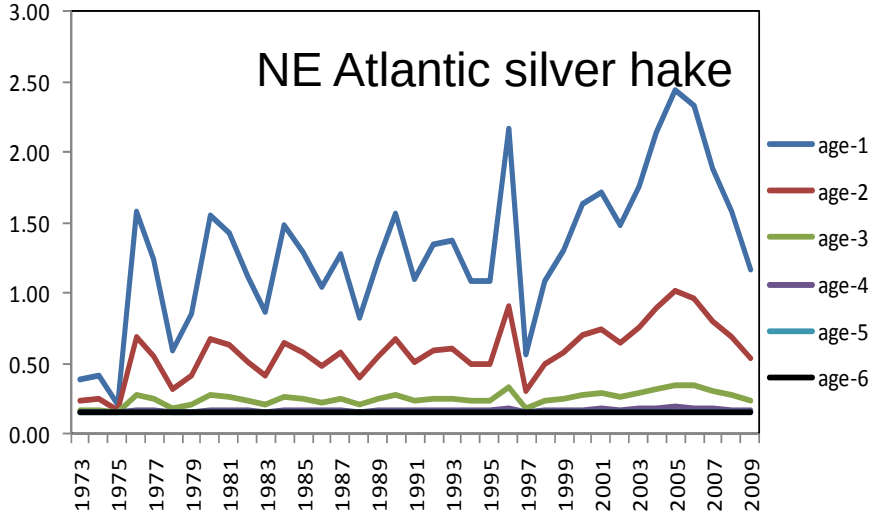
	Juvenile migration year				Forecast of adult returns	
	2005	2006	2007	2008	Coho 2009	Chinook 2010
Large-scale ocean and atmospheric indicators						
PDO (May–Sep)	■	■	■	■	●	●
MEI (annual)	■	■	■	■	●	●
Local and regional physical indicators						
Sea surface temperature anomalies	■	■	■	■	●	●
Coastal upwelling	■	■	■	■	●	●
Physical spring transition	■	■	■	■	●	●
Deep water temperature and salinity	■	■	■	■	●	●
Local biological indicators						
Copepod biodiversity	■	■	■	■	●	●
Northern copepod anomalies	■	■	■	■	●	●
Biological spring transition	■	■	■	■	●	●
June spring Chinook	■	■	■	■	--	●
September Coho	■	■	■	■	●	--

Key
- ■ good conditions for salmon
- ■ intermediate conditions for salmon
- ■ poor conditions for salmon
- ● good returns expected
- — no data
- ● poor returns expected

Regional Examples: Tactical

- Environmental covariate in Pacific sablefish stock recruitment relationship
- M2 considerations in the Atlantic: herring, silver hake, red hake, mackerel, butterfish, Loligo, northern shrimp, and menhaden
- EBS yellowfin sole temperature dependent survey Q
- GOA walleye pollock B20 threshold for Steller sea lions





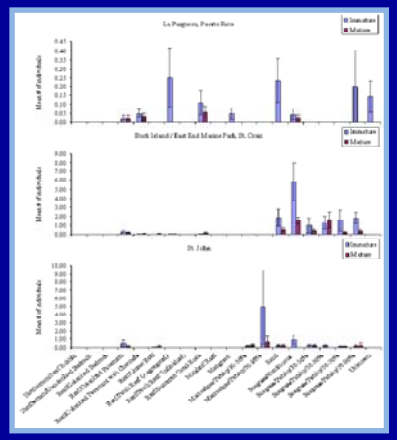
Caribbean Queen Conch Population Extrapolation (Fishery-Independent Surveys + Habitat mapping)

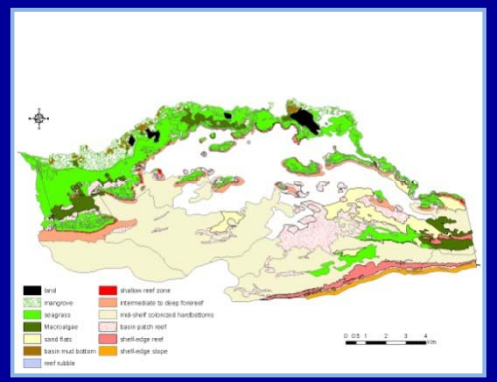
Surveys Stratified by Habitat

& size Adult/Juveniles by Habitat

+

Areal Extent of Habitats





Density and Abundance Adults/Juvenile

Convert Shell Length to Meat Weight

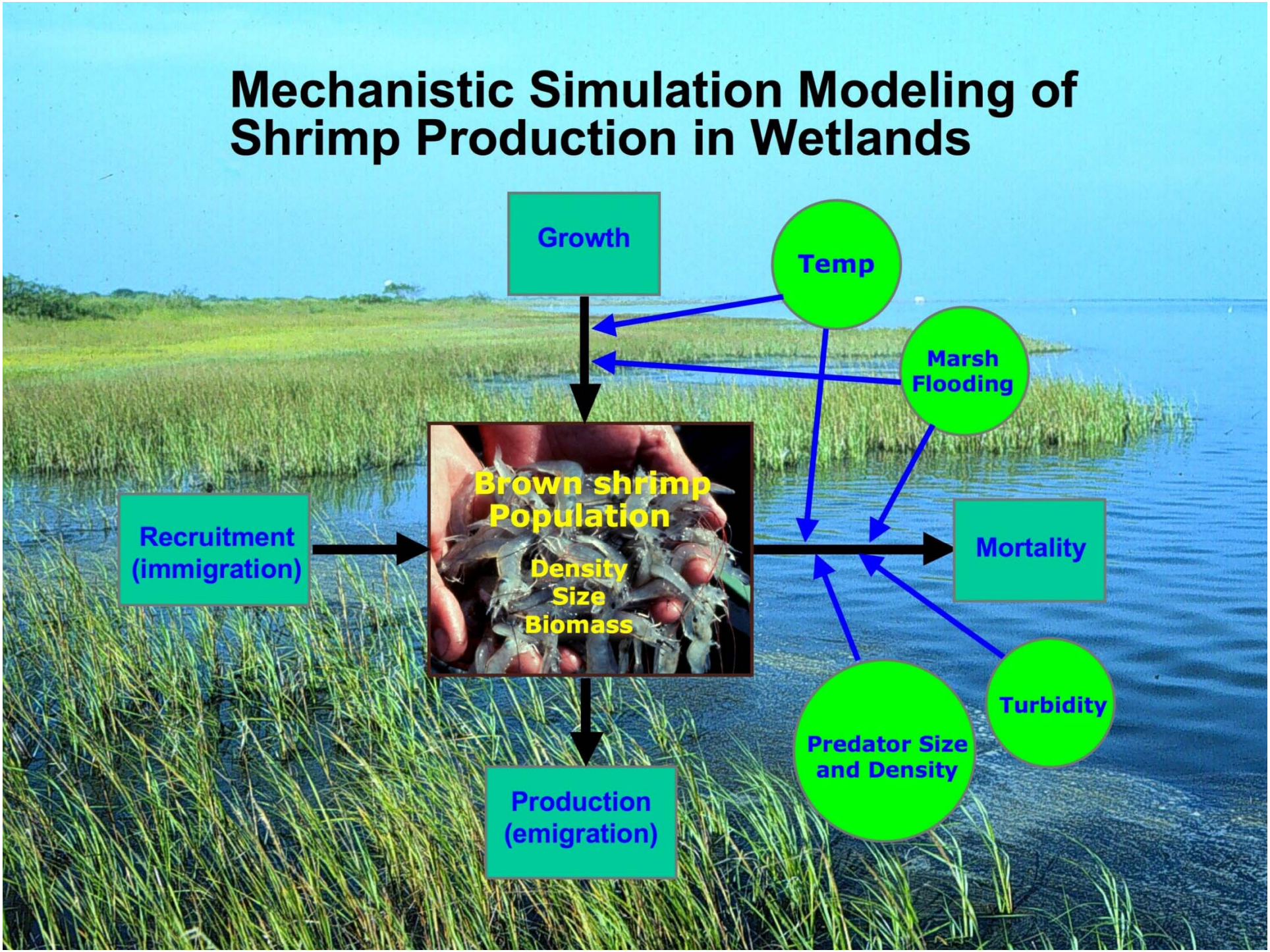
vs Healthy Stocks

Estimate of Standing Stock

vs Reported Landings

Can habitat-based densities predict stock status in a heavily fished Caribbean gastropod? *by* R.L. Hill, K.J. McCarthy, R.S. Appeldoorn, J.C. Doerr, C.F.G. Jeffrey, S. Gordon *for* 2010 Joint NSAW-NHAW Meeting, May 2010

Mechanistic Simulation Modeling of Shrimp Production in Wetlands



IOOS Informed Habitat Science Supporting Marine Ecosystem Management

Goal: Ecosystem resilience

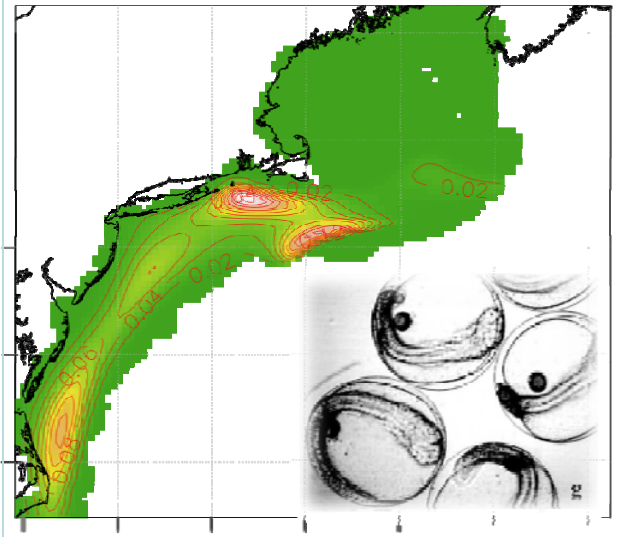
Capacity to absorb disturbance & reorganize without moving into less desirable state.

Approach:

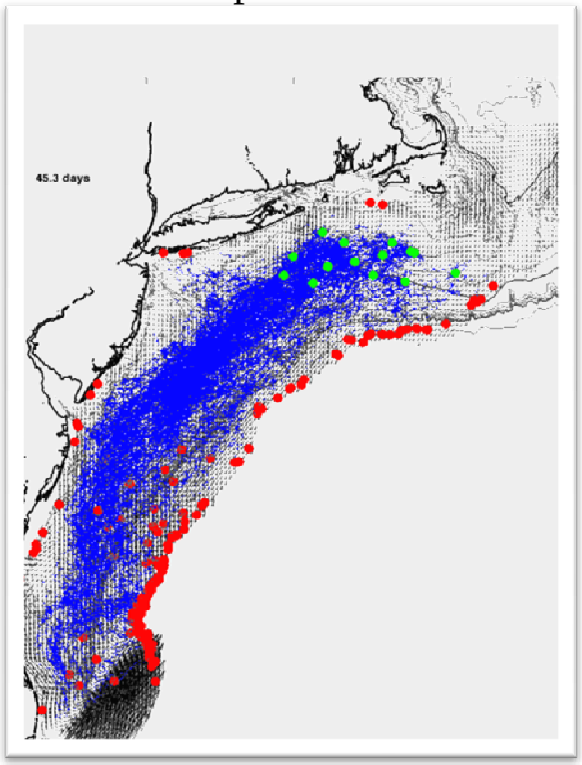
Identify habitats supporting keystone species across LME to maintain response diversity.

Adaptive Process Studies & Modeling of Coupled Ontogenic Habitats

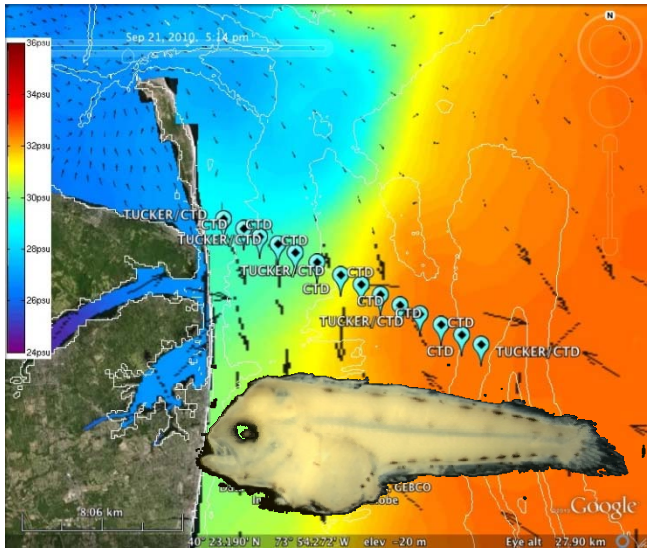
Spawning habitat models



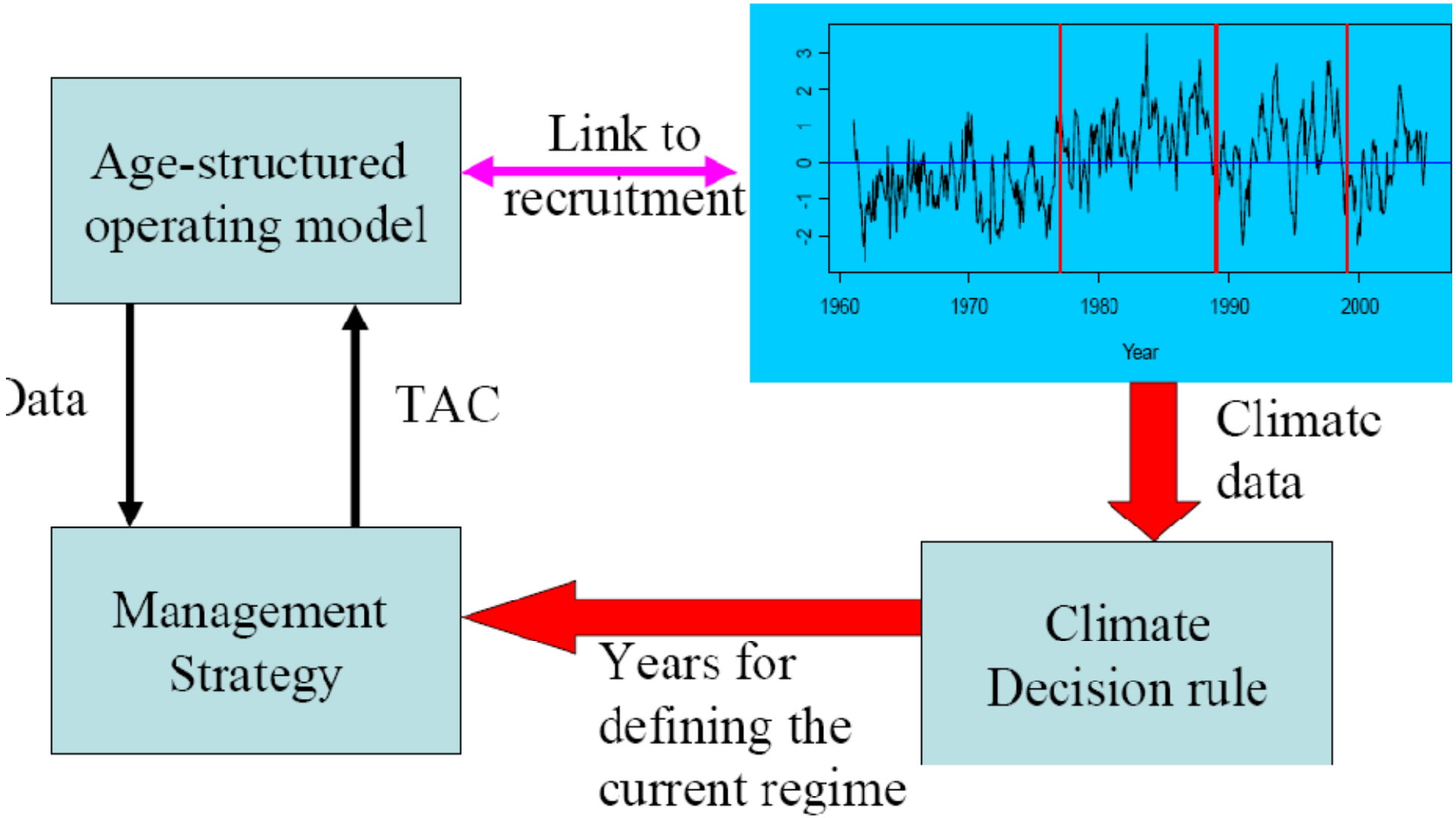
Transport models



Adaptive studies & models
of connectivity to nursery grounds

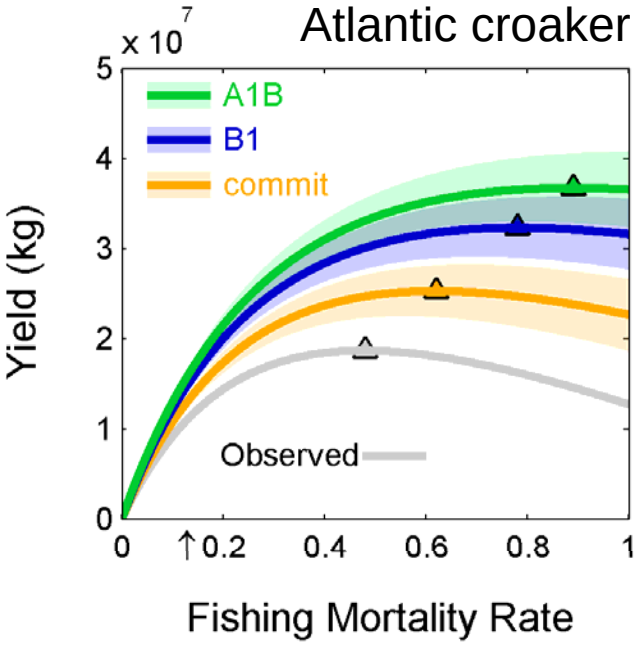


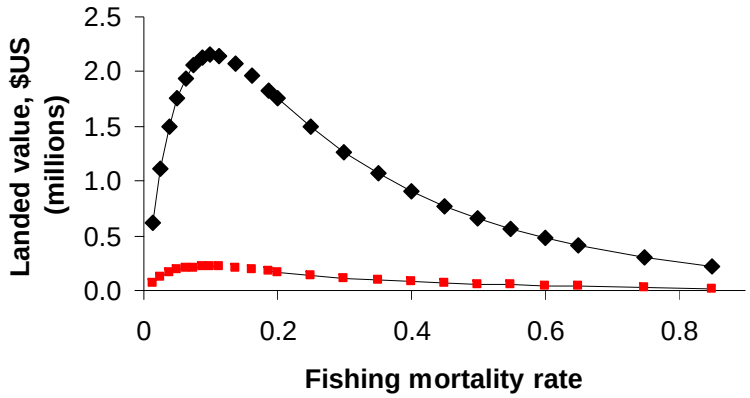
Management Strategy Evaluation: Climate Impacts on Productivity



Regional Examples: Strategic - MSEs

- Atlantic croaker and climate change scenarios
- GOA walleye pollock MSE: Climate Impacts Productivity

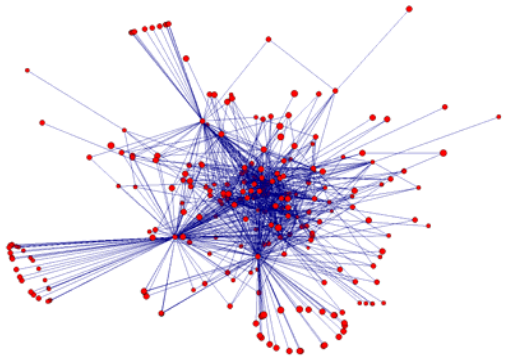




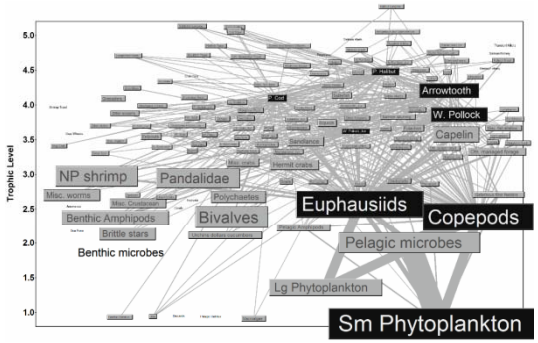
English sole maximum sustainable yield ($/yr) under current climate (top) vs. ocean acidification with strong declines in shelled benthos (bottom)

The Ecosystem Assessment: Tracking and modeling the effects of fishing and climate on ecosystem structure and function on multiple scales

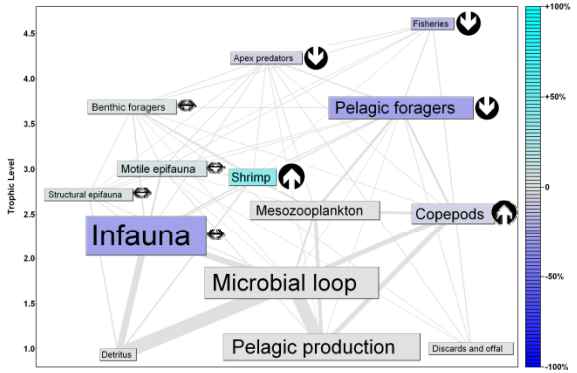
- Preserving nodal species within a complex network
  - 300+ species



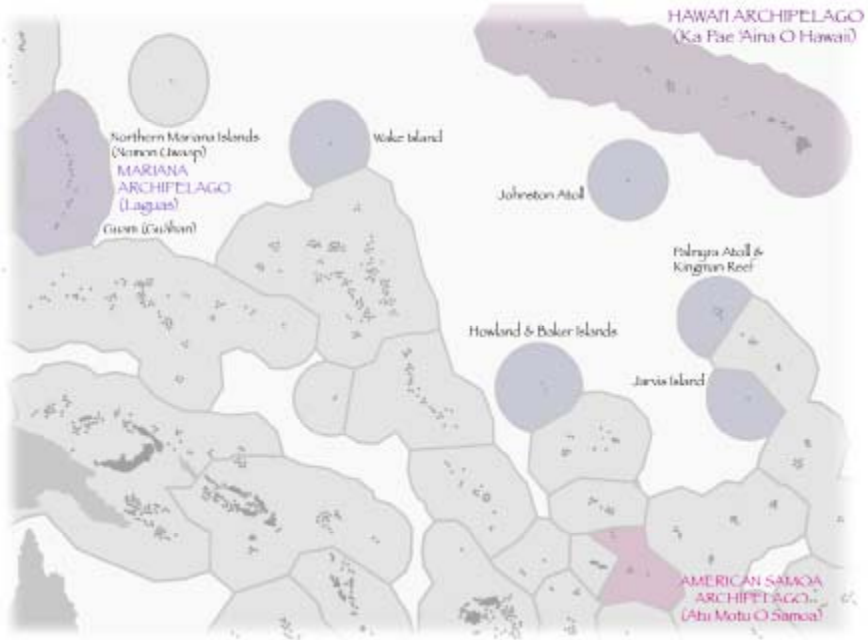
- Measuring direct and indirect effects of fishing and climate within a food web
  - 100+ groups including multiple fisheries



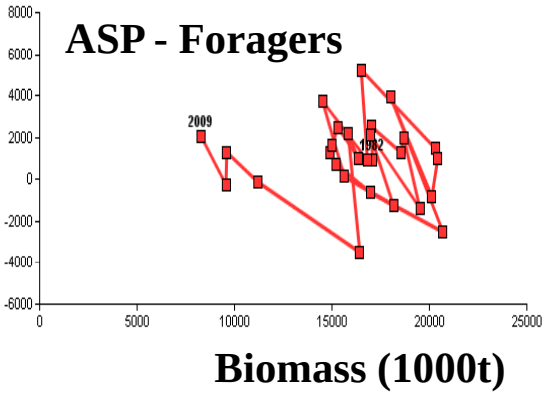
- Tracking status and shifts in production between major functional groups.
  - 14 major groups



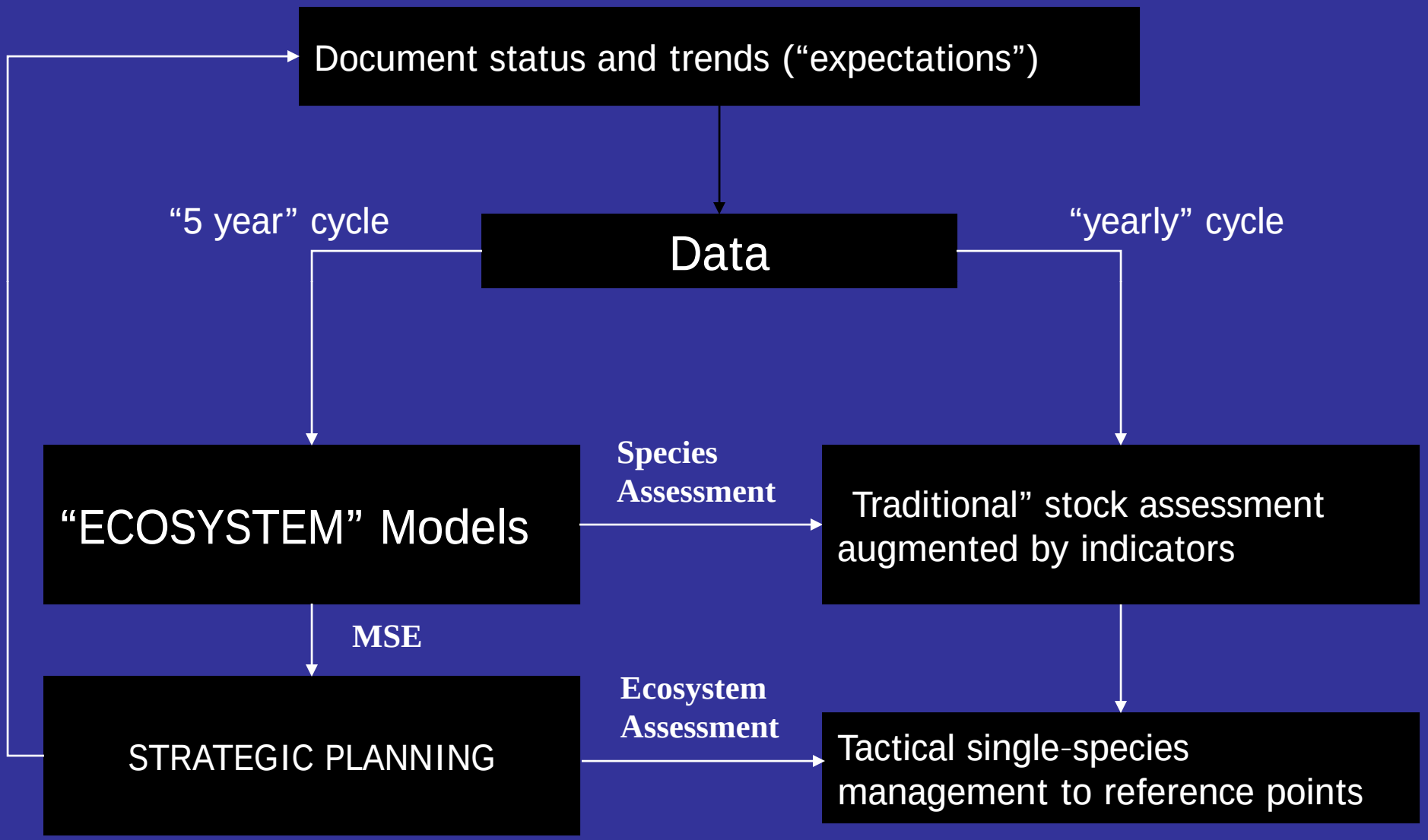
Regional Examples: Strategic – Integrated Management and Indicators



- Ecological Unit Based FMPs/FEPs
- Regional Integrated Ecosystem Assessments
- Total Groundfish or Aggregate MSY



Ecosystem Information in Species and Ecosystem Assessments



Short Term Objectives for Improvement

- ***Continue to address ecosystem terms of reference in stock assessments (M2, environmental drivers of recruitment and growth, habitat covariates)***
  - ***Develop regionally specific priorities for species and processes to be considered***
- ***Continue development of integrated ecosystem assessment frameworks***
  - ***Estimate and implement system level thresholds***
  - ***Improve modeling capabilities (multispecies, ecosystem)***
  - ***Improve integration of environmental data***
- ***More explicit rules or processes for defining where ecosystem considerations should play into ACL decisions for information not already captured in the current management process***
  - ***Work with Councils/SSCs/Regions and stock assessment review panels to develop structured process for considering ecosystem factors***
  - ***Develop processes within Science Centers to bring scientists doing stock assessment, habitat science and ecosystem research together (improve data access)***
- ***Continued and enhanced funding for National programs that focus on ecosystem data collection and integration (FATE, IEA, Habitat, ESA)***
  - ***Improve ecosystem data collection***
  - ***Continue integration into single species models***
  - ***Improve integrated assessments at the regional level***