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FISHERY MANAGEMENT COUNCIL

MAFMC Ecosystem Approach to Fishery Management Update

ASMFC Management and Science Committee

May 21, 2013

MAFMC Ecosystem Considerations

- Council formed Ecosystem Subcommittee of the SSC to assist the Council in the development of ecosystem approaches to fishery management
- Council developed TORs to guide the work of the ESC to address short and long term ecosystem related issues

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MAFMC Ecosystem Management Goal Statement

- To allow for ecologically sustainable utilization of living marine resources while maintaining ecosystem productivity, structure, and function.

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MAFMC hosted National SSC IV

- First opportunity for national discussion by eight SSCs about how each Council is incorporating ecosystem considerations into stock assessments and FMPs
- Assessment and management of forage stocks one of three focus topics discussed at SSC IV

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National SSC IV Unresolved Forage issues

- Generic definition of forage species
- What special assessment and management considerations for forage species are appropriate?
- Workshop participants agreed that additional work/discussion necessary to provide national guidance/advice on these questions

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MAFMC Ecosystem Activities since SSC IV

- Council voted to develop an Ecosystem Approach to Fishery Management Guidance Document (PFMC approach)
- A non-regulatory umbrella document intended to guide Council policy with respect to ecosystem considerations across existing FMPs

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Ecosystem Guidance Document Development

- Council formed EAFM working group to develop guidance document and background information necessary to inform the process
- Current member expertise in areas of ecosystem level assessment modelling, habitat, social/economics and fishery management

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EAFM Guidance Document Focus

1. Forage/low trophic level species considerations
2. Species interactions (predation, competition) and their effects on sustainable harvest policy
3. Incorporation of social and economic considerations in OY specifications/EAFM

EAFM Guidance Document Focus (cont.)

4. Effects of systematic changes in oceanographic conditions on abundance and distribution of fish stocks; ramifications for existing management approaches/programs

5. Incorporation of habitat conservation and management objectives in the current management process (including water quality issues)

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Ecosystem Workshops Purpose

- Bring together technical experts, managers and stakeholders to evaluate science and policy aspects of each issue
- Develop recommendations for best practices to be incorporated into Council's EAFM operational guide

Forage Workshop
April 11, 2013

- Panel of experts discussed the role of forage species within ecosystems and best practices with respect to the harvest of forage species, taking their role(s) within ecosystems into account.

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Forage Panel Discussion

April 11, 2013

- Focus on science related to assessment and management of forage species
- Discuss where in the process these issues should be handled including stock assessments, ABC control rules, OY specification
- Discussion will inform EAFM Guidance Document development

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Forage Workshop Purpose

- Recent scientific findings suggest that forage stocks may warrant special management consideration, especially with respect to achieving ecosystem level management goals and objectives

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Forage Workshop Purpose

- National Standard 1 (NS1) guidelines recommend that consideration should be given to managing forage stocks for higher biomass than traditional MSY based reference points ($B_{msy)}$ to enhance and protect the marine ecosystem

Forage Workshop Panel

- Ellen Pikitch (Stony Brook/Lenfest)
- Ed Houde (UMD-CBL/SSC)
- Rob Latour (VIMS/SSC)
- Sarah Gaichas (NEFSC/EAFM WG)
- Presentations and discussion guided by trigger questions (see MAFMC.org)

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Forage Workshop
Ellen Pikitch

- Forage species (FS) definition possible based on LTL, life history and vulnerability to F (MAFMC has one)
- Summarized LENFEST/MSC findings

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LENFEST Findings

- Focus on predators (dependency)
- Consider temporal and spatial mgt.
- Cut forage fishing in half and leave twice as much fish in the ocean compared to MSA reference points
- Tailor mgt. to available information (less info=more precaution)

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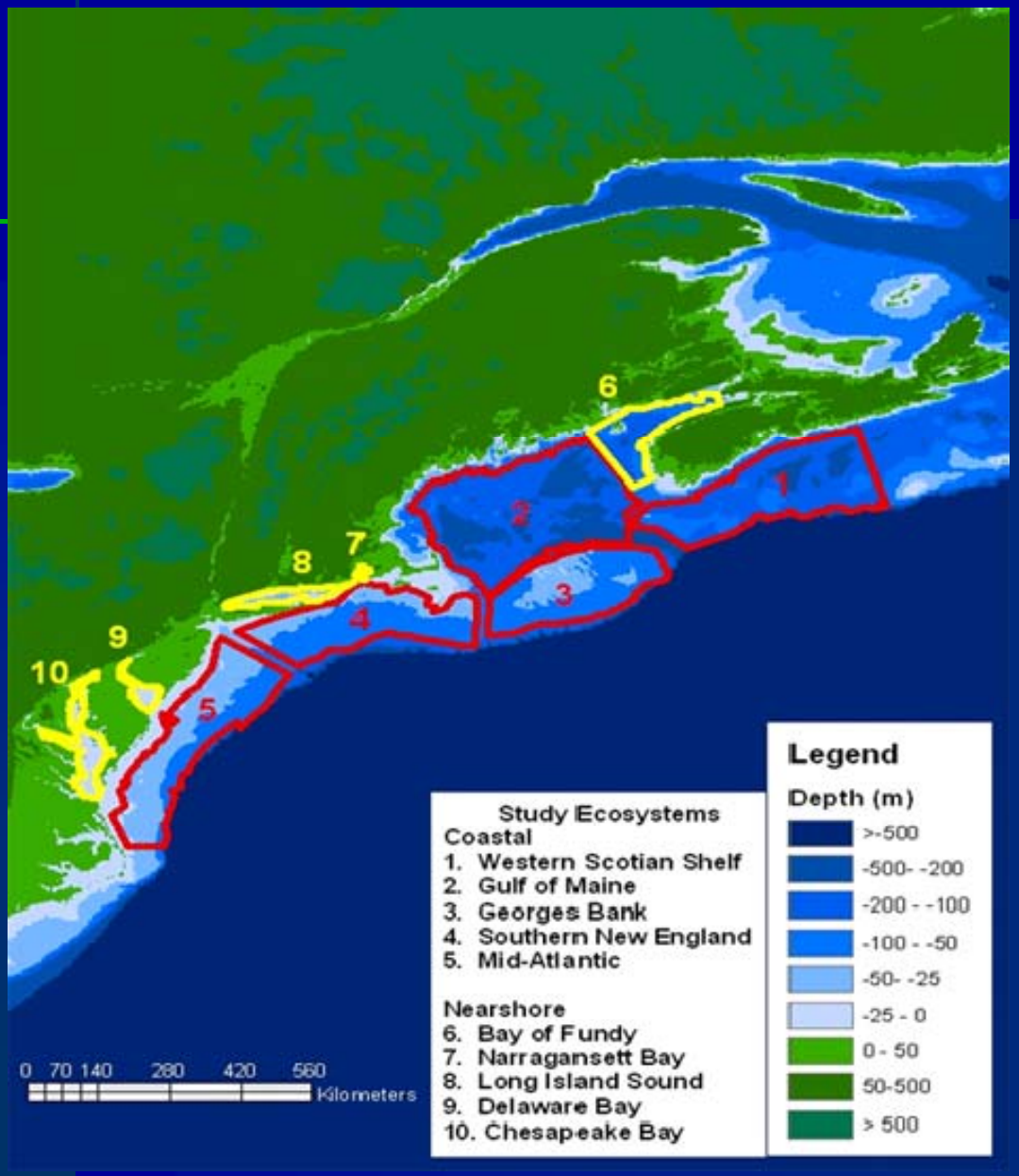
Houde

- Definition of forage species (FS) possible
- Summarized LENFEST/MSC findings
- FS should be managed conservatively with biomass targets higher than B_{msy} and exploitation rates about half of traditional MSY reference points (similar conclusion reached by MSC)

Northwest Atlantic Coastal and Shelf Ecosystems



- Productive Coastal Zone
- Major Productive Estuaries
- Connected to Southern New England and Georges Bank
- Connected to South Atlantic shelf ecosystems
- Bounded by the Gulf Stream
- Strongly seasonal

Candidate MA Forage Species

Species	Fished	Retained Bycatch	Discarded Bycatch
Butterfish	yes	yes	yes
Atl. mackerel	yes	no	yes
Longfin squid	yes	yes	yes
Illex squid	yes	yes	yes
Atl. herring	yes	?	yes
Atl. Menhaden	yes	no	yes
River herrings	no	no ?	yes
Sand lance	no	no	no
Round herring	no	no	yes
Sardines	no	no	?
Anchovies	no	no	?

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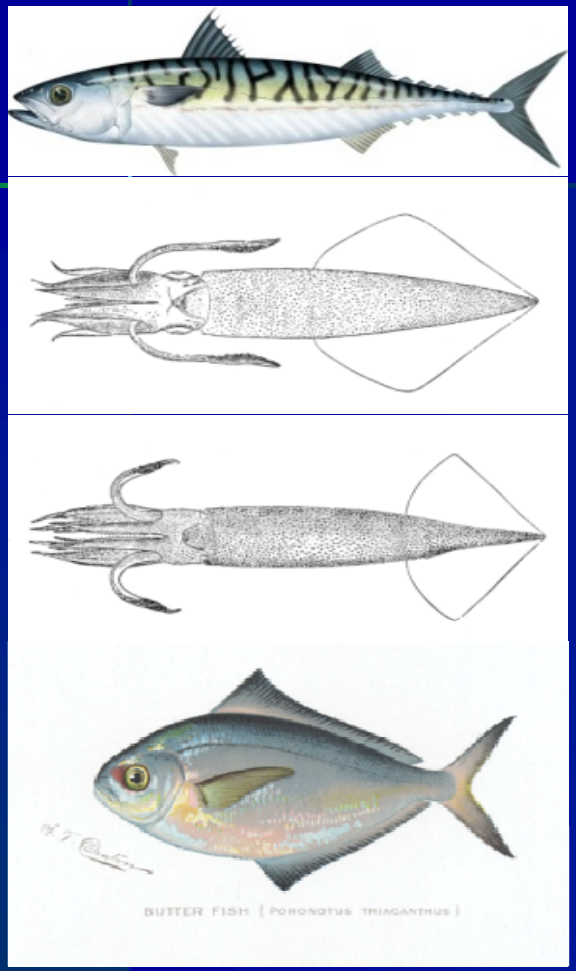
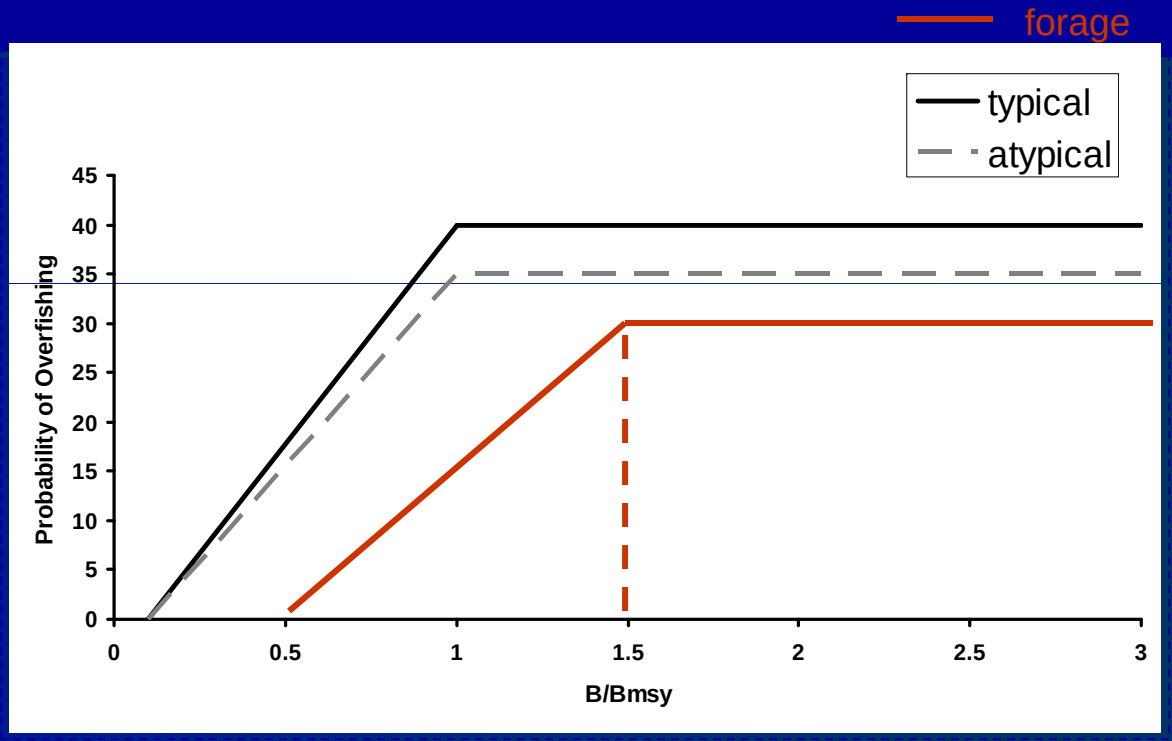
Managed Forage Species



Modified Council Risk Policy



Can the MAFMC Develop a Forage Policy?

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For consideration

- Indicators and reference points
- Are there any rules of thumb, e.g., $F < M$, Biomass threshold, hockey-stick (Restrepo, Lenfest) rules, appropriate *F* and *B* levels.
- Can predator demand be indexed from stock assessments of predators?
- What indices of ecosystem state are available that are indicative of predator demand and prey availability?
- Can energetics modeling be useful to estimate demand?
- What about ecosystem modeling? Strategic or tactical?
- What decisions and regulations could be

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Latour

- How natural mortality (m) is handled in stock assessments
- Options for incorporating forage species assessment and management into current process at assessment and ABC control rule/risk policy levels

Data/modeling strategies

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Analytical gradient

Largely single-species BRPs

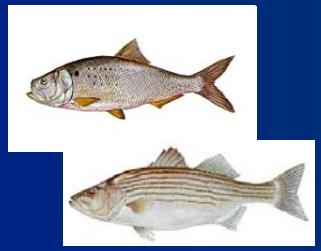
Group/guild BRPs

Pure single-species assessment

Multiple coordinated single-species assessments

Single-species assessments with explicit M_2 or climate

Multispecies assessments



Aggregated biomass analyses

Entire ecosystem model

Predatory fishes

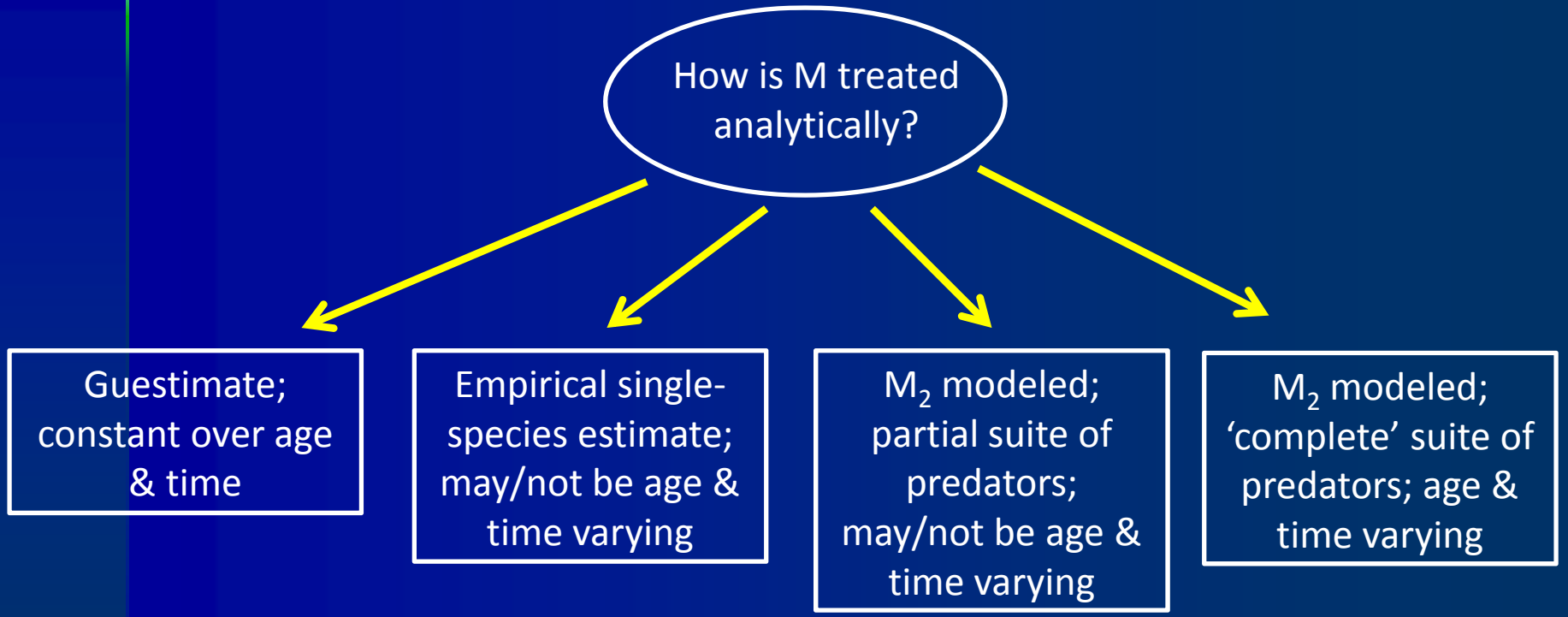
Pelagic forage fishes

Benthic forage fishes

Link 2010

Natural mortality (M)

- Forage stocks: more attention focused on natural mortality



Where do we want to go?

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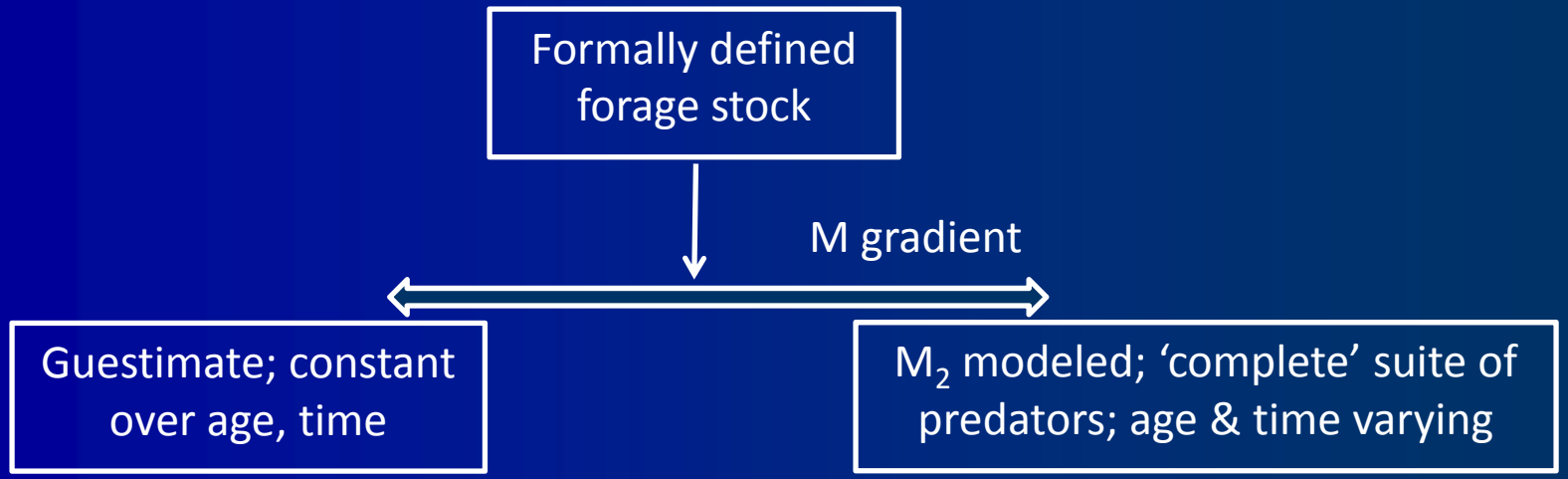
- *Possible* future management objectives
  - Compliance with Magnuson-Stevens Act, avoid overfishing: EAFM, effects of fisheries on each other and ecosystem
- *Required* future assessment objectives
  - Coordinated single-species assessments, efforts to formally include M_2 and/or climate drivers, multispecies models

- Can management/assessment 'harmony' evolve together?
  - Degree of 'harmony' will modulate scientific uncertainty
  - Are the Terms of Reference (TORs) the portal?
  - Likely have single-species BRPs for a while

ABC control rule/Council risk policy

- Option, link P* to treatment of M in assessment
- ABC based on P* = P*-*f*(M gradient)

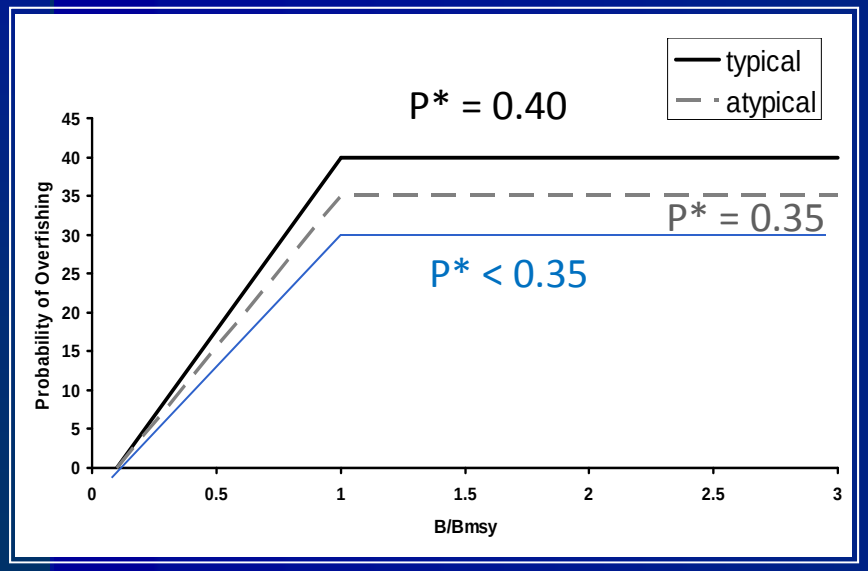


- Potentially plausible for Level 1, 2, 3* assessments

  * when SSC elects to define OFL distribution

ABC control rule/Council risk policy

- ABC based on P* = P*- *f*(M gradient)
- Atypical life history:
  - results in greater vulnerability to exploitation, and life history has not been fully addressed through the stock assessment and BRP development process.



Accounting versus managing

- Enhanced treatment of M within assessments serves to describe historical predation demand
- 'Better' M modeling = better accounting
- Ecosystem structure and functioning goes well beyond better accounting
  - EAFM necessitates making choices/tradeoffs

$$\Sigma MSY_{SS} > MSY_{System}$$

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Gaichas

- Current state of ecosystem models and data
- Bridges from single species → multispecies
- Other approaches (e.g. functional groups)
- Changes in the ecosystem
- Information needs for forage species

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Current state of ecosystem models and data

Able to support an ecosystem approach to management, and specifically forage management policy

An intermediate-complexity tactical ecosystem assessment tool combines:

Standard stock assessment

- Structured population dynamics
- Statistical parameter estimation using multiple data sources
- Biological reference points and stock status for management

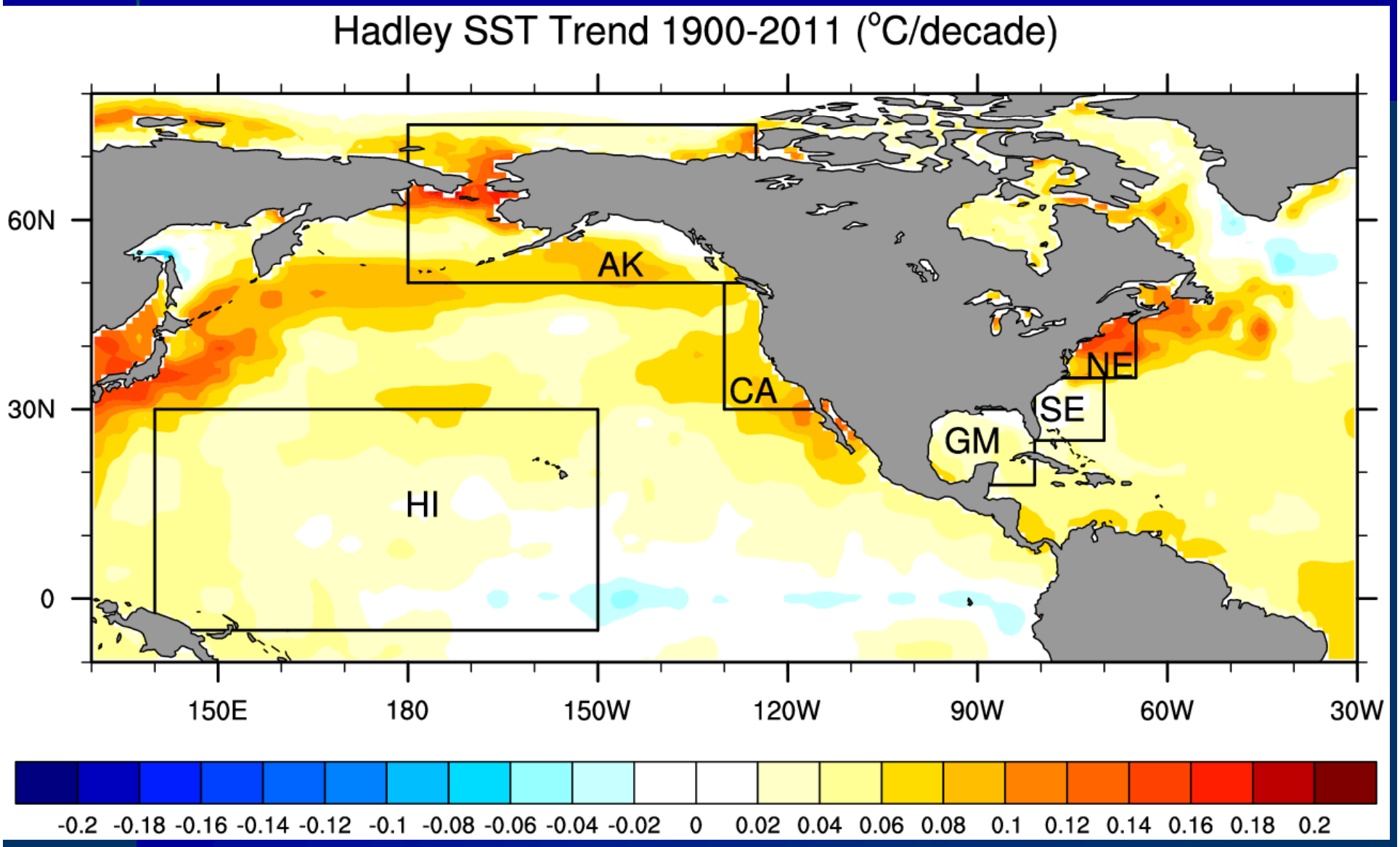
Ecosystem considerations

- Species interactions and tradeoffs
- Environmental effects on key population processes
- Populations and fisheries in space

... WITHOUT requiring time machines, expensive new surveys, or supercomputers

Courtesy Michael Alexander (NOAA/ESRL/PSD), Jamie Scott (CIRES), and Antonietta Capotondi (CIRES)

Observed sea surface temperature trend



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Information needs for forage species

And two main questions to address

List of data and analyses needed

- Improved consumption information
  - Quantification of uncertainty: standardize methods
  - Diet for upper trophic level predators (mammals, birds, HMS)
- Parameterize existing models for specific mid-Atlantic issues, species, and regional environments
- Alternative management objectives/strategies for testing
- Risk analysis to determine where highest priority gaps remain

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Two main questions

How to include predation in forage fish management?

- Within single species assessments
- Using multispecies assessments
- As an adjustment to policy (OFL, buffers, etc.)

How to account for tradeoffs in predator consumption requirements when managing forage fish?

- Possible with current data, multispecies models
- Managing tradeoffs a new level of policy

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Forage Fish Exploitation Policy- Next steps

- EAFM WG to examine workshop results
- Develop a framework for forage fish management (options) to fit within existing Council ABC control rule and risk policy
- Management Strategy Evaluation
- EAFM Guidance Document to inform Council's forage exploitation policy

The proposed framework for forage species would work as follows:

1. OFL determined based on MSA defined F_{msy} (or OFL Proxy)
2. SSC specifies ABC based on current risk policy with respect to "atypical" species (p*=0.35) if M2 not included in stock assessment, else P*=0.4.
3. Based on ecological/social/economic evaluation, Council could add additional ecosystem consideration buffer when specifying OY (aka "ecological set-aside") for forage stocks. The bounds for the ABC/OFL ratio under proposed OY framework for forage stocks become:

0.25-0.5 > ABC/OFL > 0.81 if M2 is adequately incorporated into stock assessment, else
0.25-0.5 > ABC/OFL > 0.726 (i.e., M2 not adequately addressed). The Council could add additional buffers during specification of OY, but lower bound would be 0.5.