



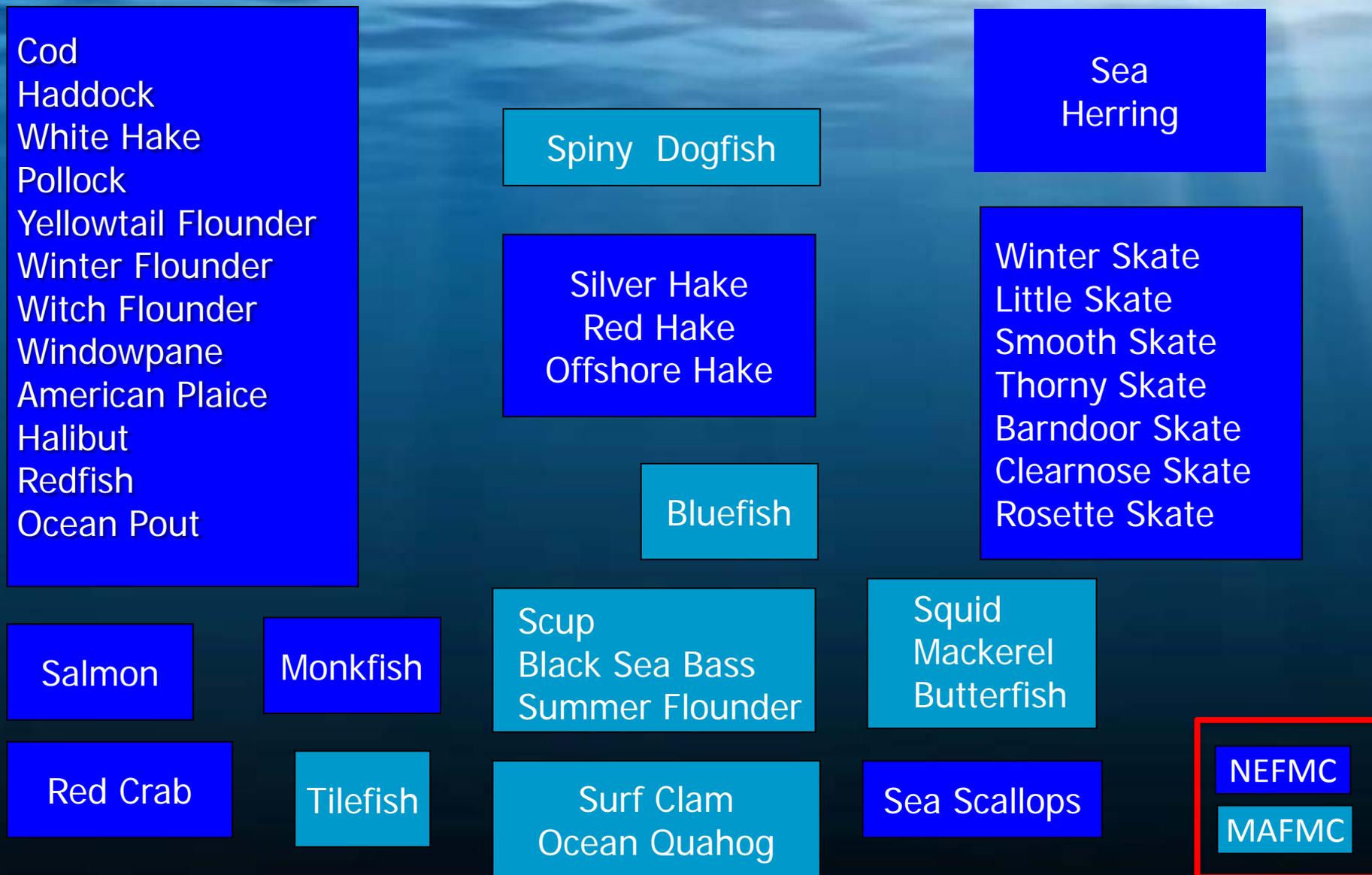
**NOAA
FISHERIES**

Northeast
Fisheries
Science Center

Making EBM/EBFM Operational

Michael J. Fogarty &
Sarah Gaichas

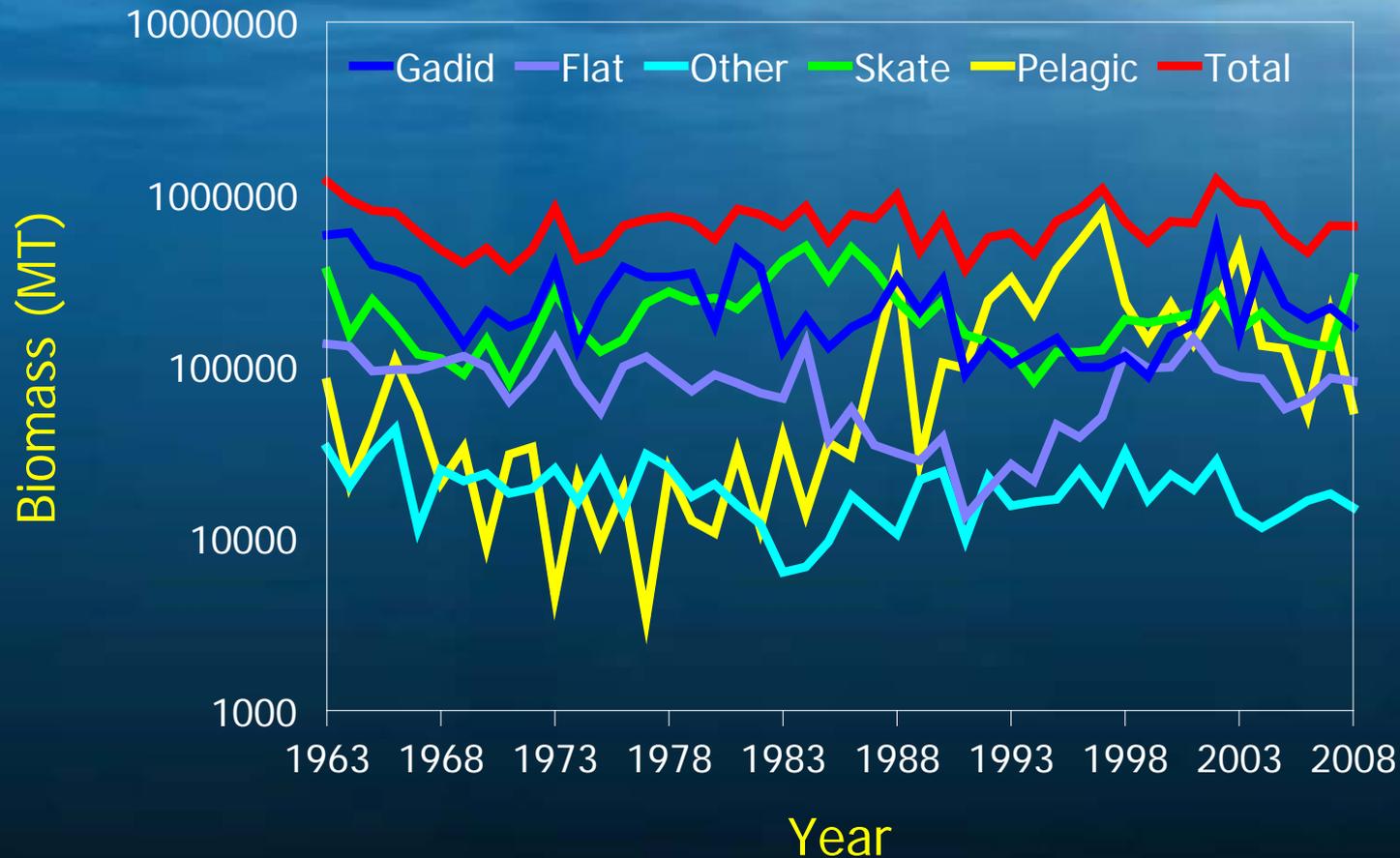
Management Setting: NEFMC and MAFMC FMPs



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Can We Simplify by Taking Advantage of Emergent Ecosystem Properties?

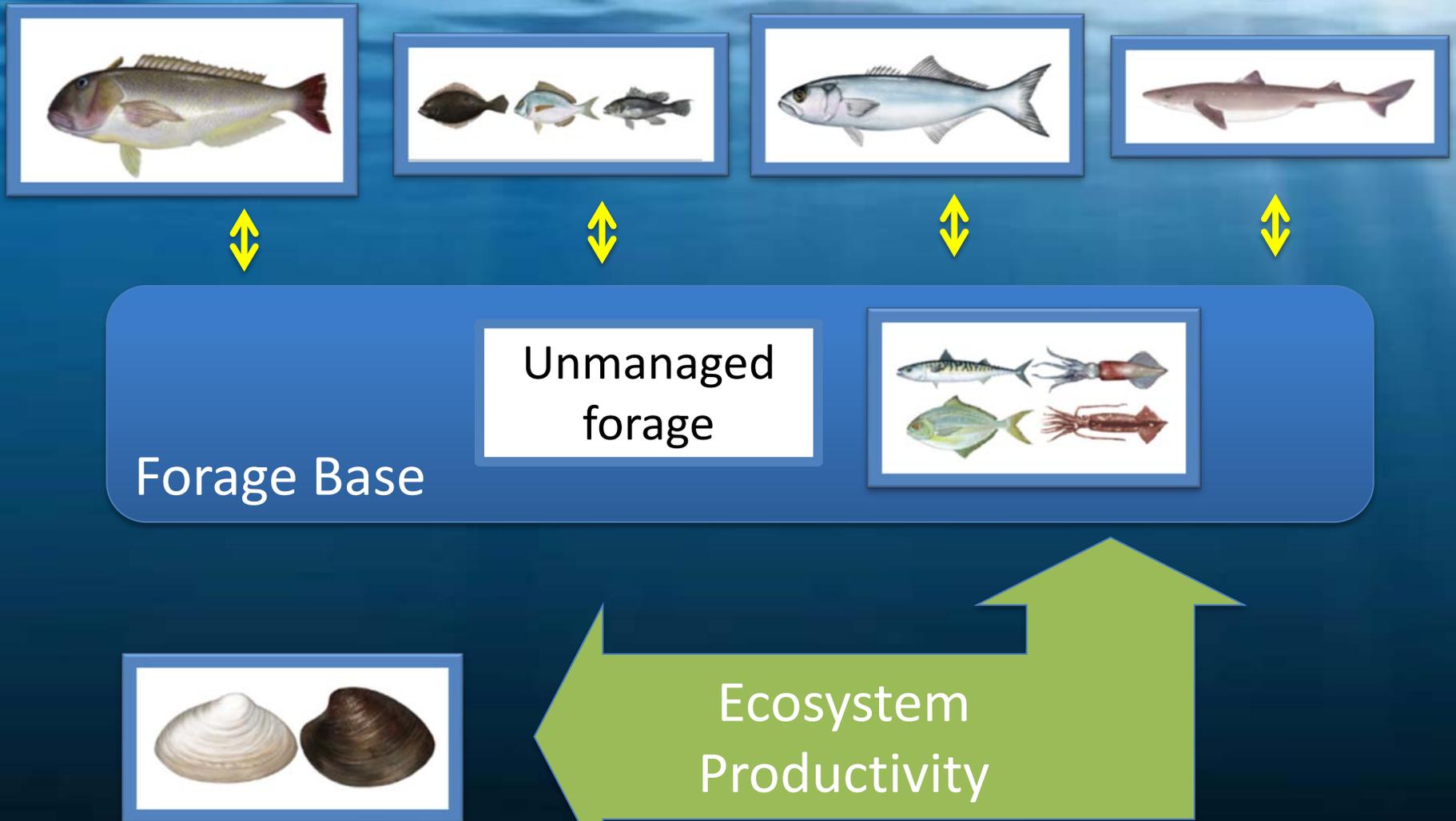


MAFMC Strategic Plan

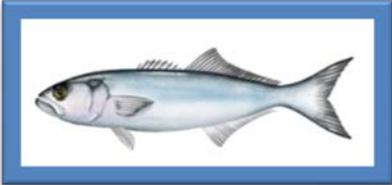
- Complete and implement the ‘Ecosystem Approach to Fisheries Management Guidance Document’
- Incorporate consideration of species interactions into fishery management plans and coordinate these considerations across appropriate management plans
- Determine and incorporate the relationship between essential fish habitat and productivity of marine resources into management



Interactions Between FMPs: Food Web Interactions



Across FMPs: Habitat Interactions



Pelagic habitat



Demersal Habitat



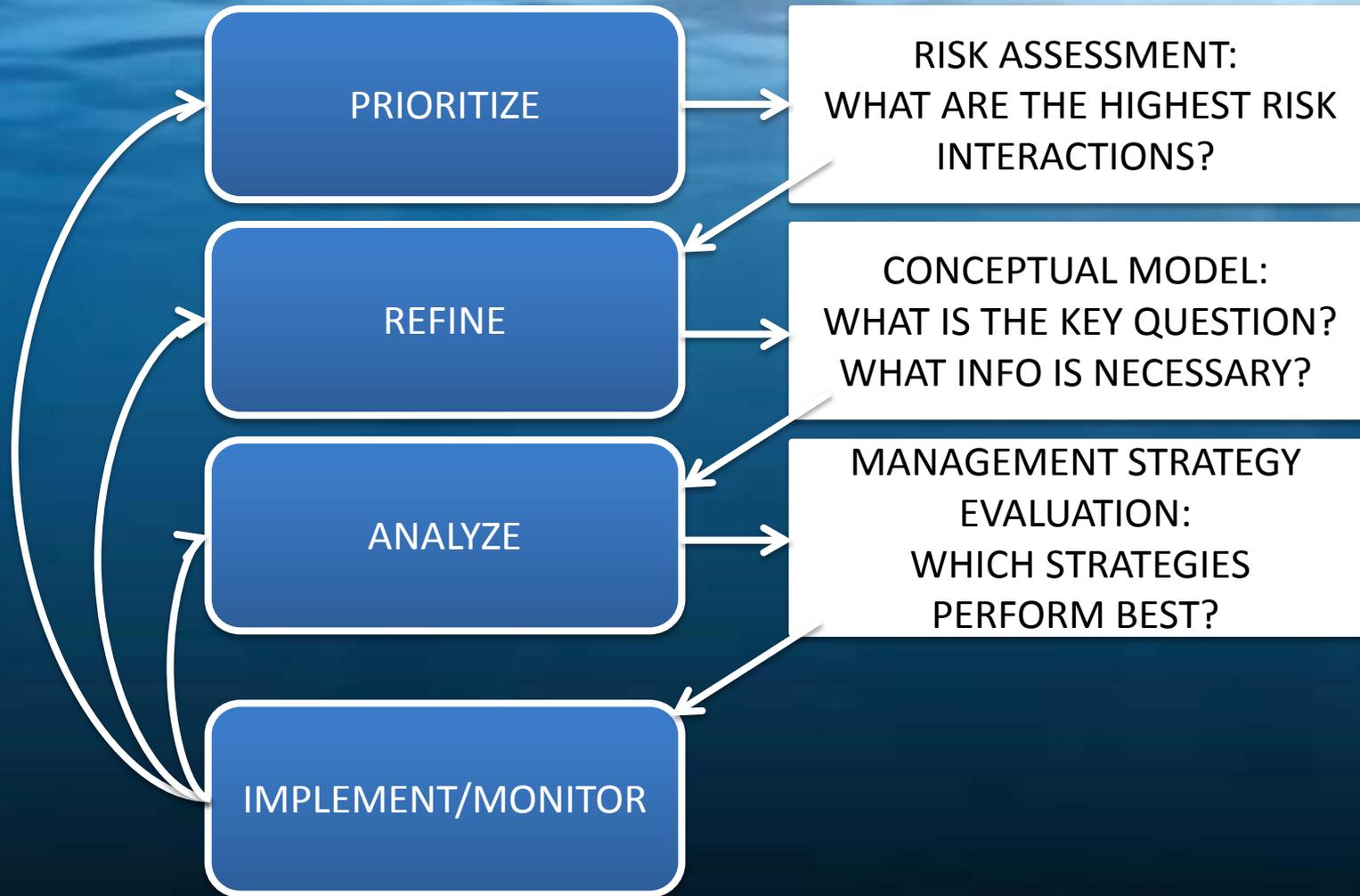
Seafloor habitat



Climate,
land use,
fishing,
other
effects on
habitat
quantity
and
quality



Framework for addressing interactions



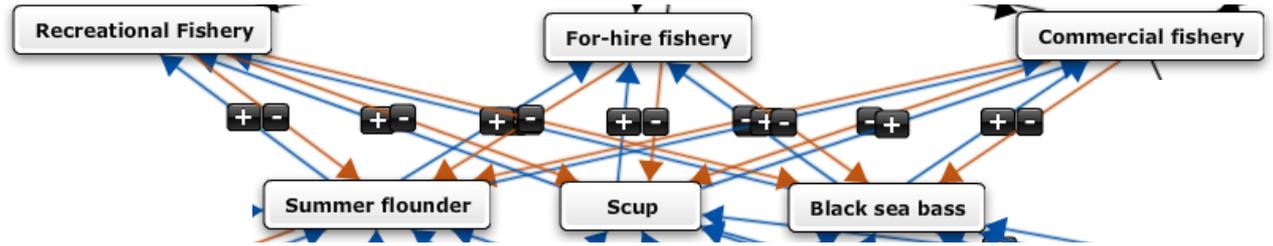
Example cross-FMP risk assessment

	F status	B status	assess type	discards	food web	climate	dist shifts	alloca- tion	habitat
	F<Fmsy	B>Bmsy		low	low		high	n	n
	F<Fmsy	B>Bmsy	SCAA	low	low	high	high	n	n
			SCAA				high		
	F<Fmsy	B>Bmsy	SCAA		low		high		
	F<Fmsy	B>Bmsy			low	high	high		
	Unknown	Unknown		n	high		high		n
	F<Fmsy	B>Bmsy	SCAA		high	low		n	n
	F Unknown	B>Bmsy			high	low	high	n	n
	Unknown	Unknown		n	high	low		n	n
	F<Fmsy	B>Bmsy		n	low	high	low	n	n
	Unknown	Unknown		n	low	high	low		n
	F<Fmsy		SCAA	n		low	high		
	F<Fmsy		length ba			low		n	n

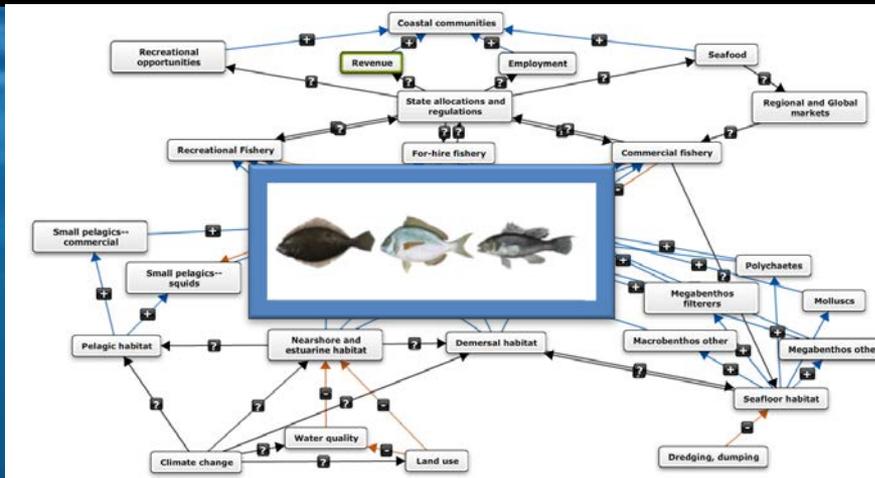




Example conceptual model



Example MSE setup



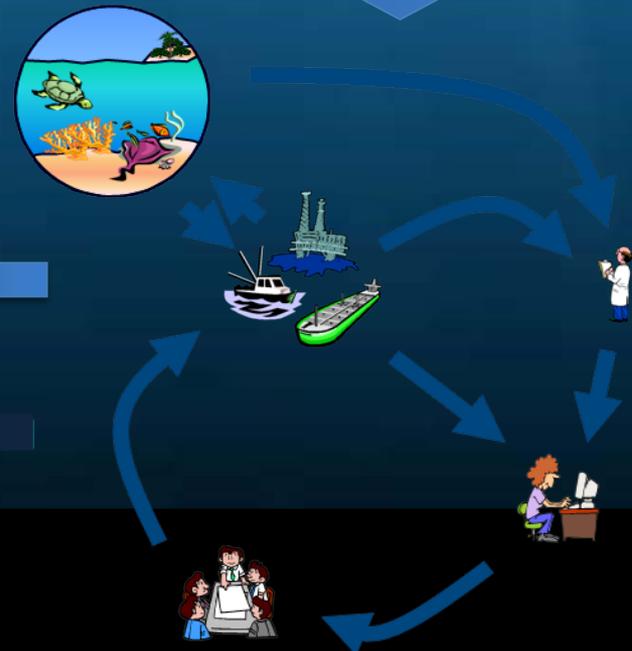
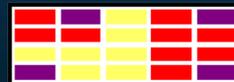
Council/stakeholder process
Specifies MSE objectives,
Performance measures,
Range of strategies

Scientists
develop tools

Council Decision Support:

- **Tradeoffs** between objectives
- Potential management strategy **performance** considering
 - key interactions
 - risks
 - uncertainties

Performance measures



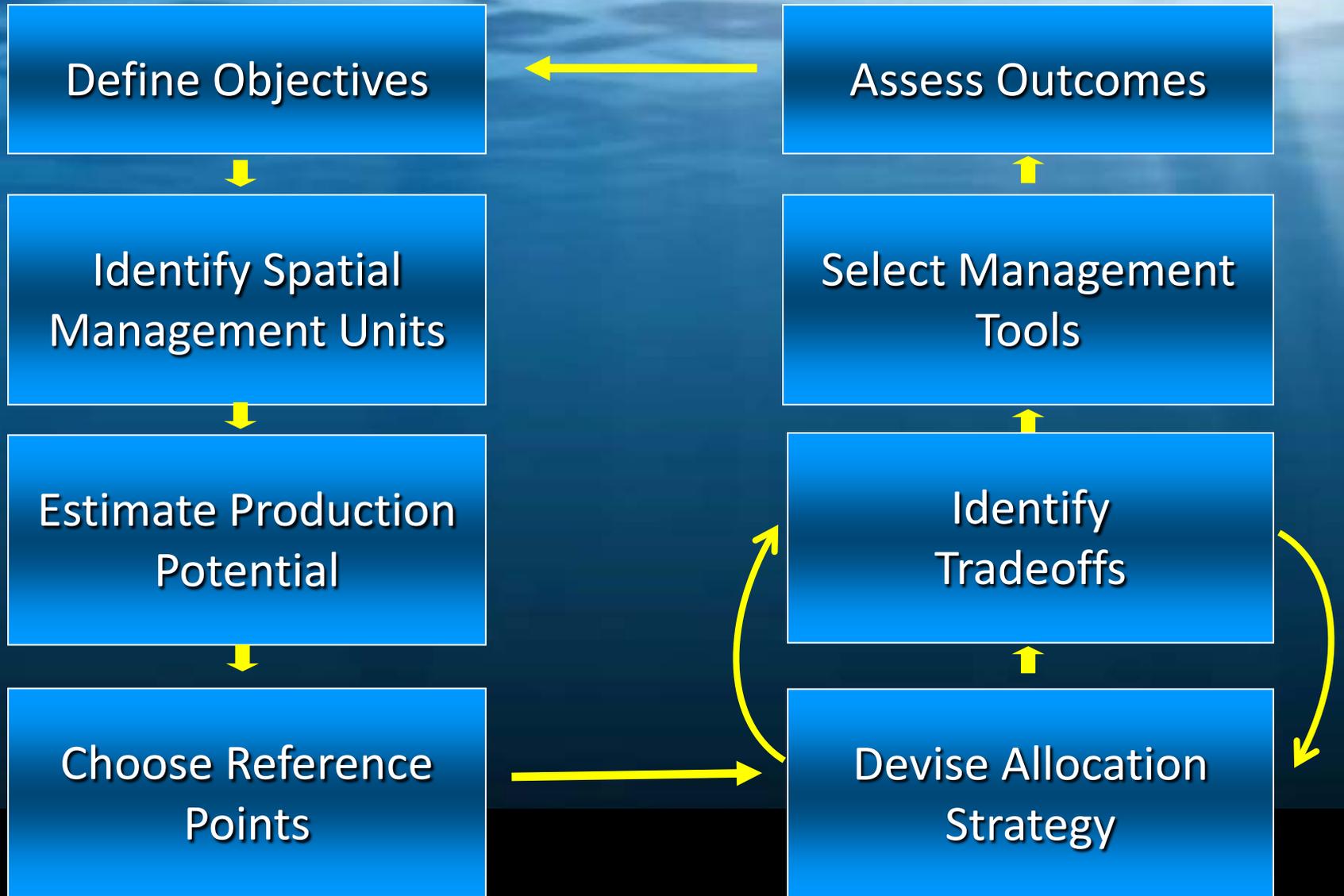
NEFMC EBFM Resolution (April 2015)

Provide:

‘An example of a fishery ecosystem plan that is based on fundamental properties of ecosystem (e.g., energy flow and predator/prey interactions) as well as being realistic enough and with enough specification such that it could be implemented. The example should not be unduly constrained by current perceptions about legal restrictions or policies.’

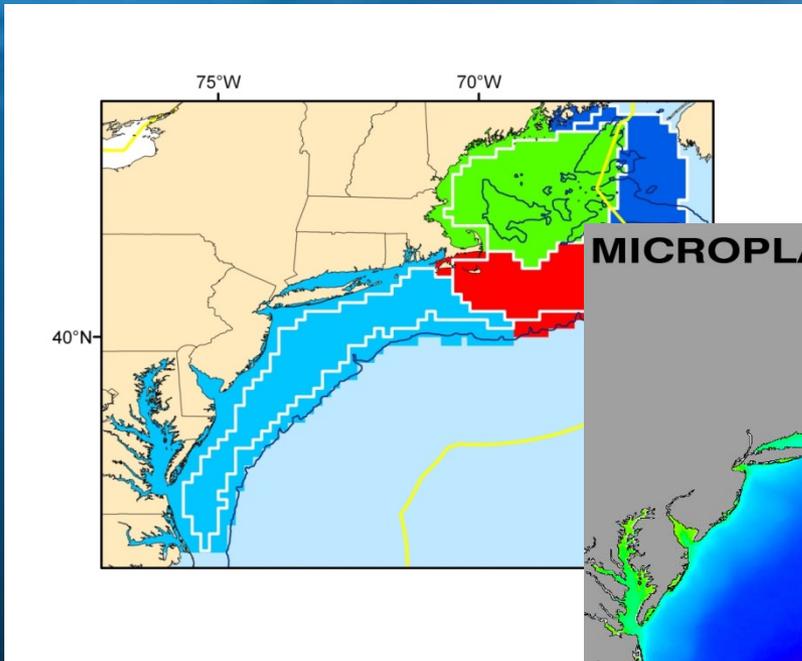


EBFM Road Map

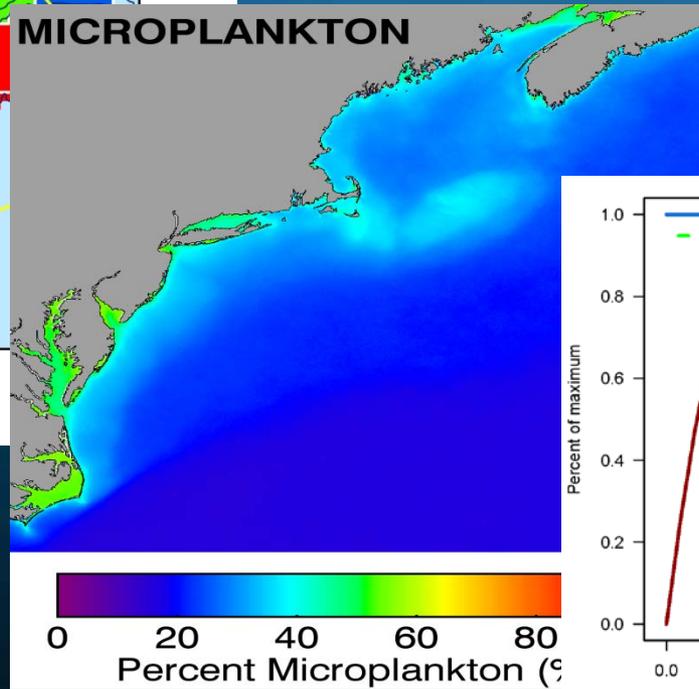


Fitting the Pieces Together

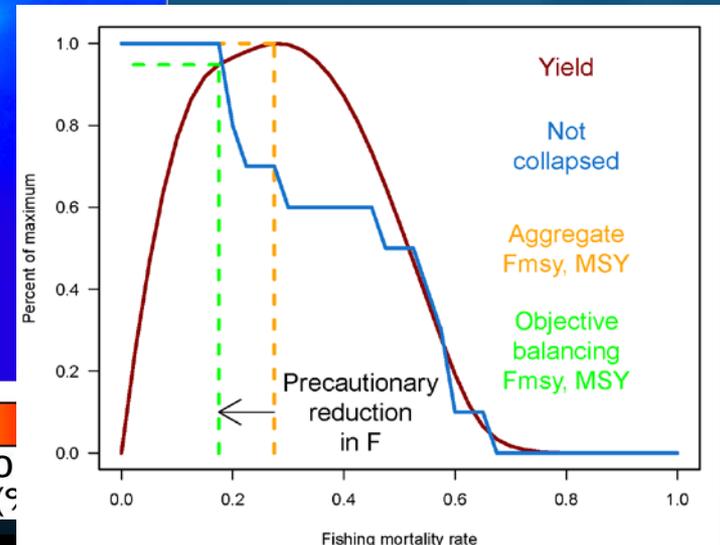
Define Spatial Units



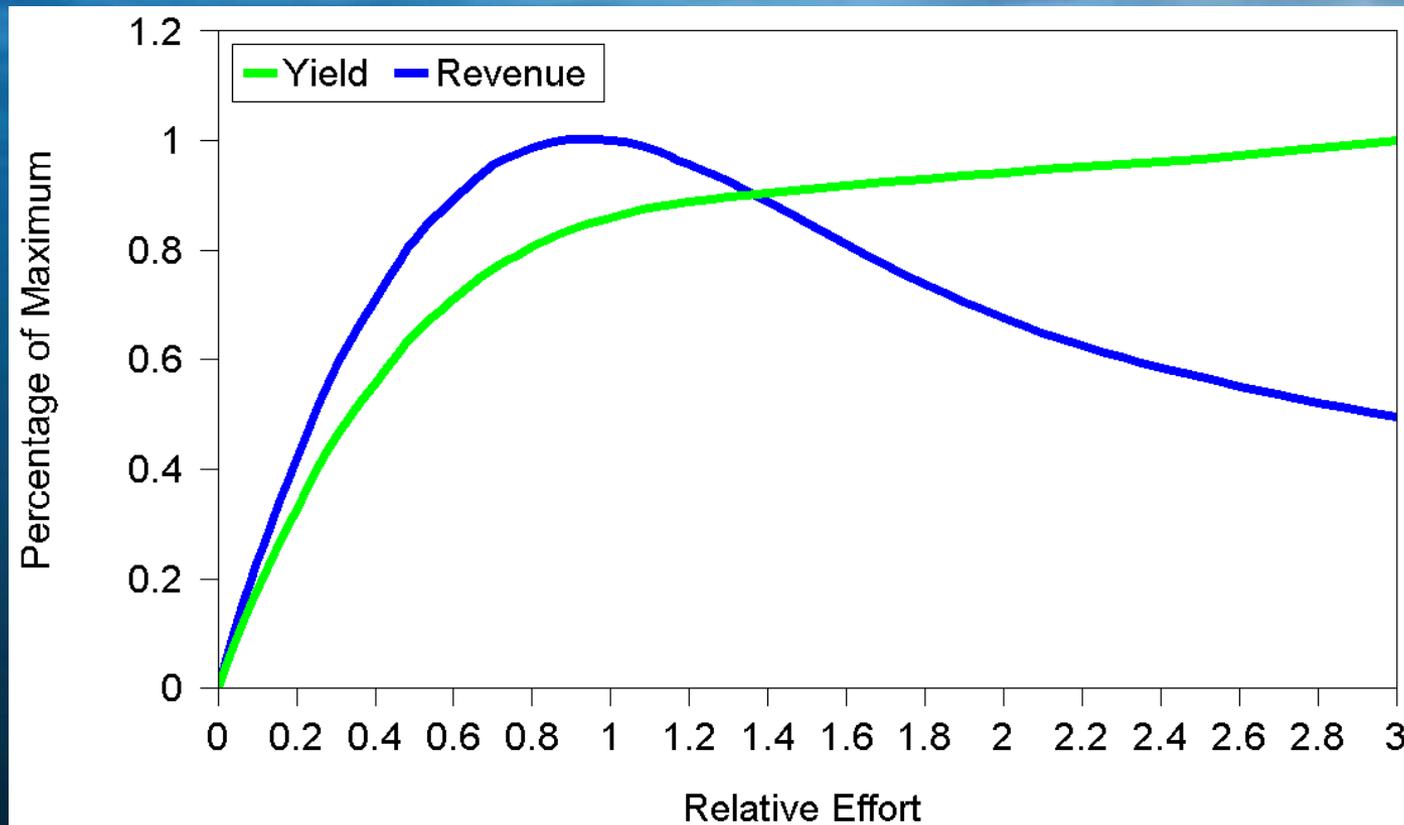
Production Potential



Reference Points

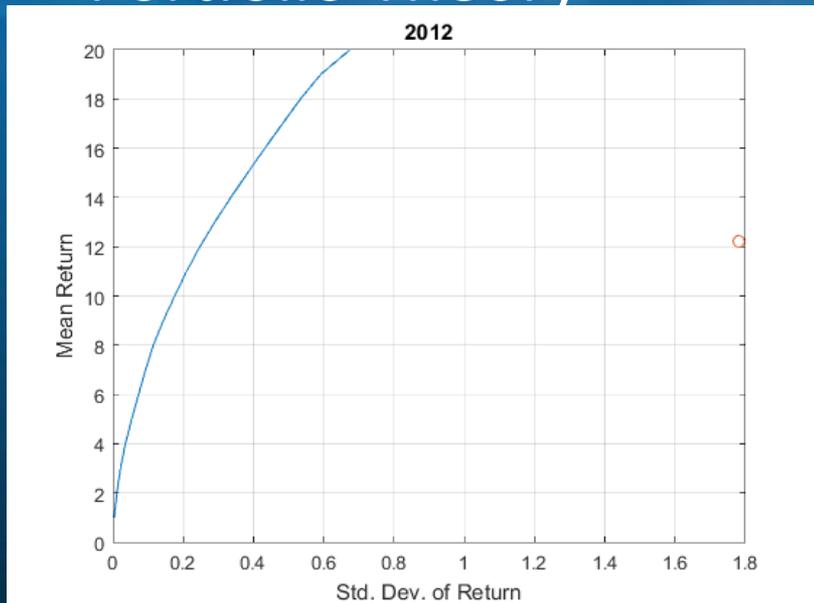


Management Strategies Depend Strongly on Objectives: Yield or Revenue?

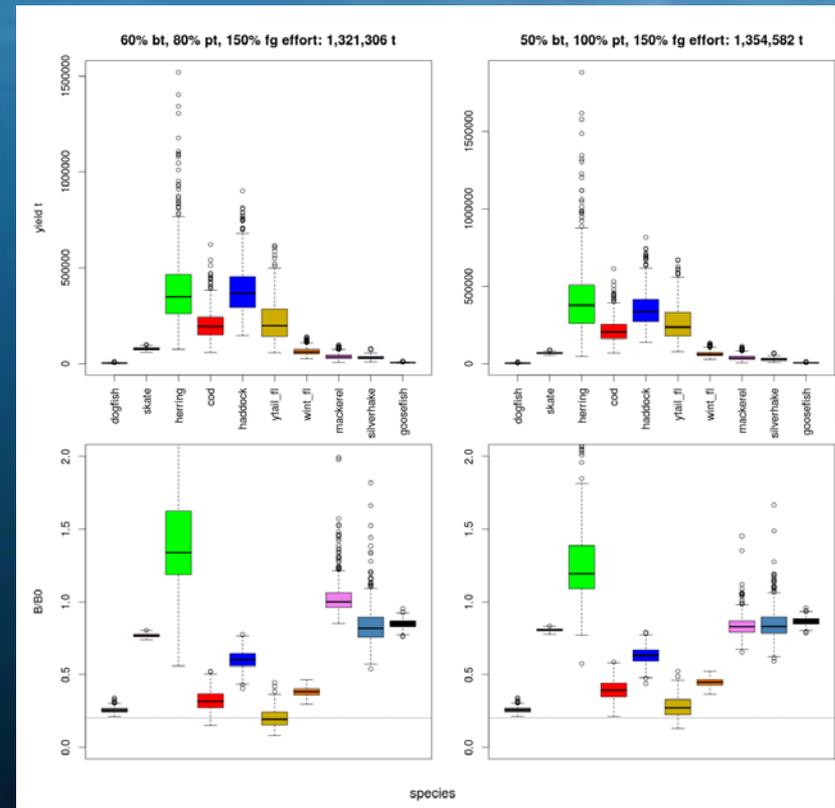


Fitting the Pieces Together

Allocation Strategy: Portfolio Theory



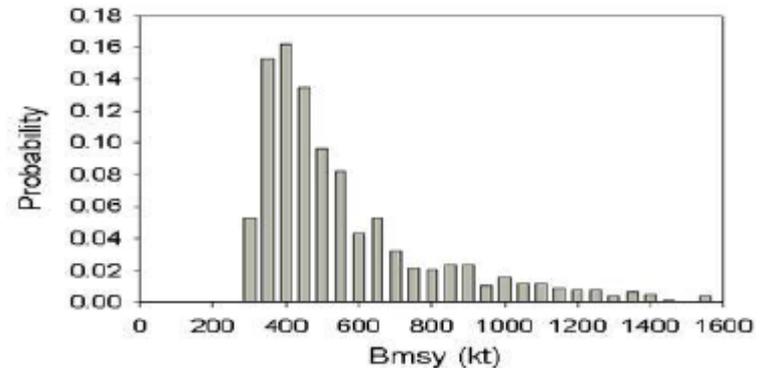
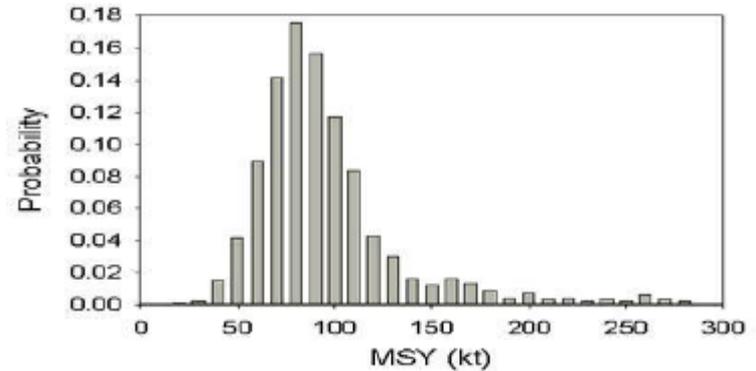
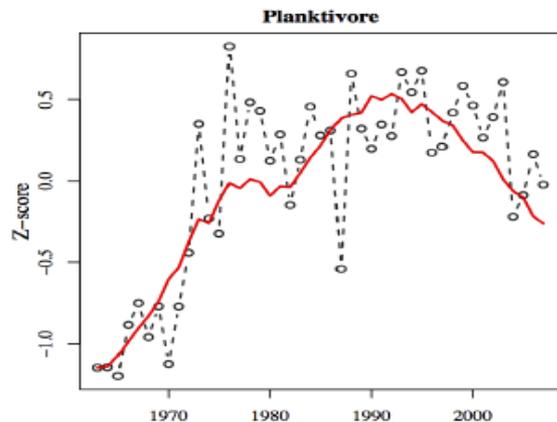
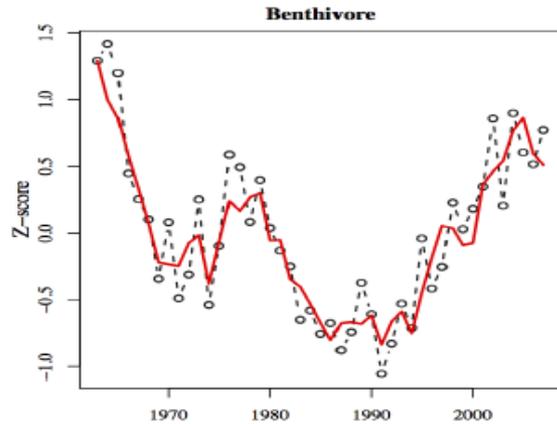
Identify Tradeoffs



Fitting the Pieces Together: Real World Applications

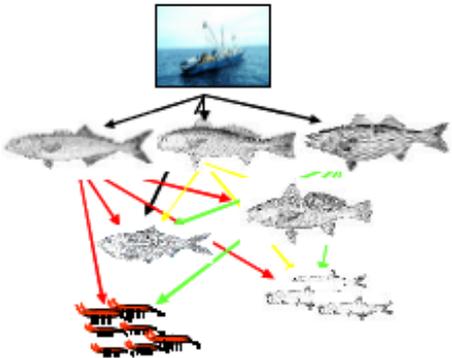
State-Space Model Fits

Reference Points



ASMFC, NEFMC and MAFMC Forage Fish Initiatives

An Expanded Multispecies Virtual Population Analysis Approach (MSVPA- X) to Evaluate Predator-Prey Interactions in Exploited Fish Ecosystems



VERSION 1.1
Users Manual and Model Description
17 April 2004

Atlantic States Marine Fisheries Commission

Dr. Lance Garrison
Garrison Environmental Analysis and Research

Dr. Jason Link
NOAA Fisheries – Northeast Fisheries Science Center

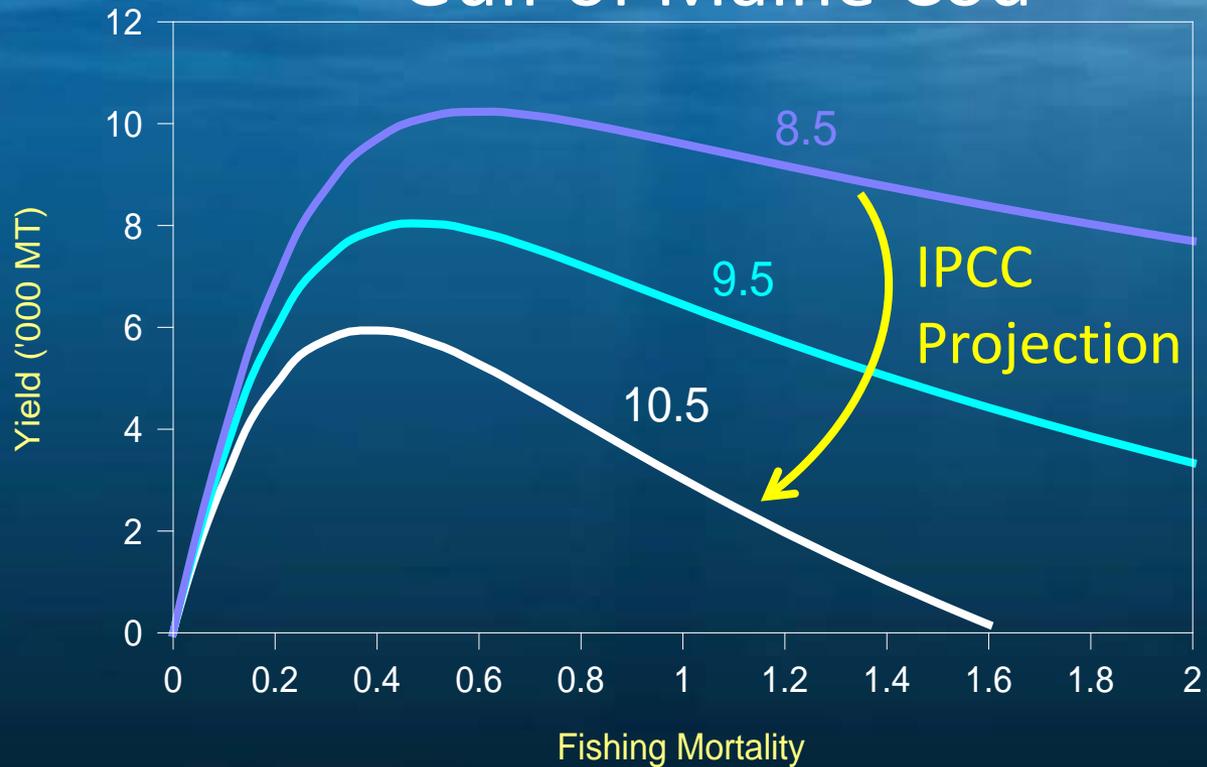
Forage Considerations

- ASMFC
 - Focus on Menhaden
- NEFMC
 - Focus on Atlantic Herring
- MAFMC
 - Proposed Ban on Harvest
Of Un-managed Forage
Fish



Climate Change, Productivity, & Reference Points

Gulf of Maine Cod

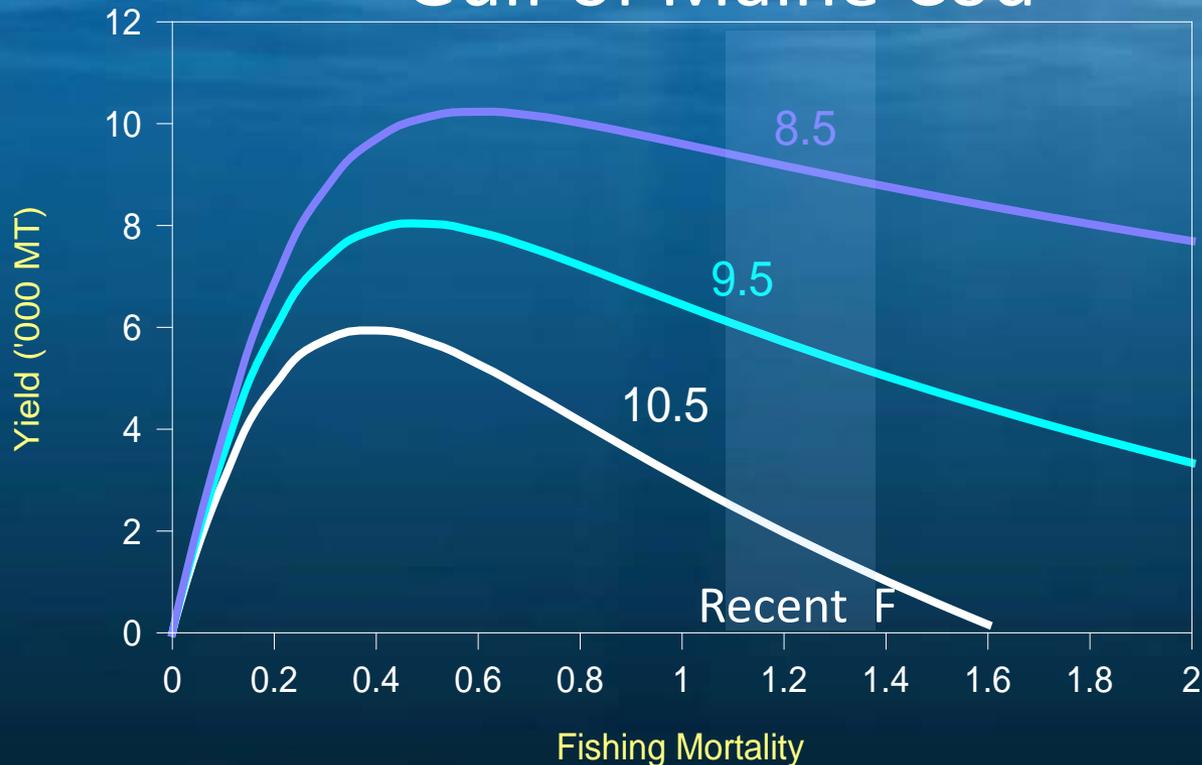


Interaction Between Temperature and Fishing Pressure Alters Production Dynamics and Biological Reference Points



Climate Change, Productivity, & Reference Points

Gulf of Maine Cod



Interaction Between Temperature and Fishing Pressure Alters Production Dynamics and Biological Reference Points



Marine Life Data & Analysis Team

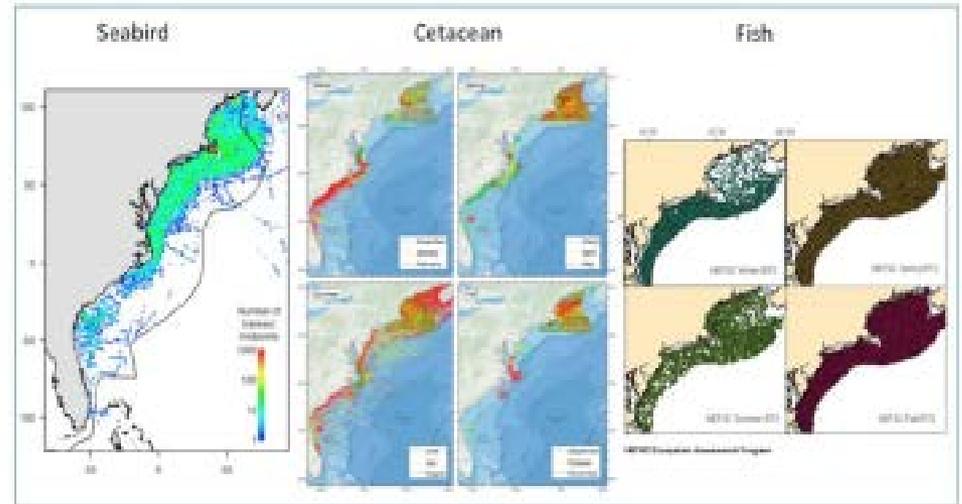
Marine-life Data & Analysis



NRPB
Important Ecological
Areas



NC



MARPB
Ecologically
Rich Areas

Modeling and Analysis
Management



Strengths and Challenges

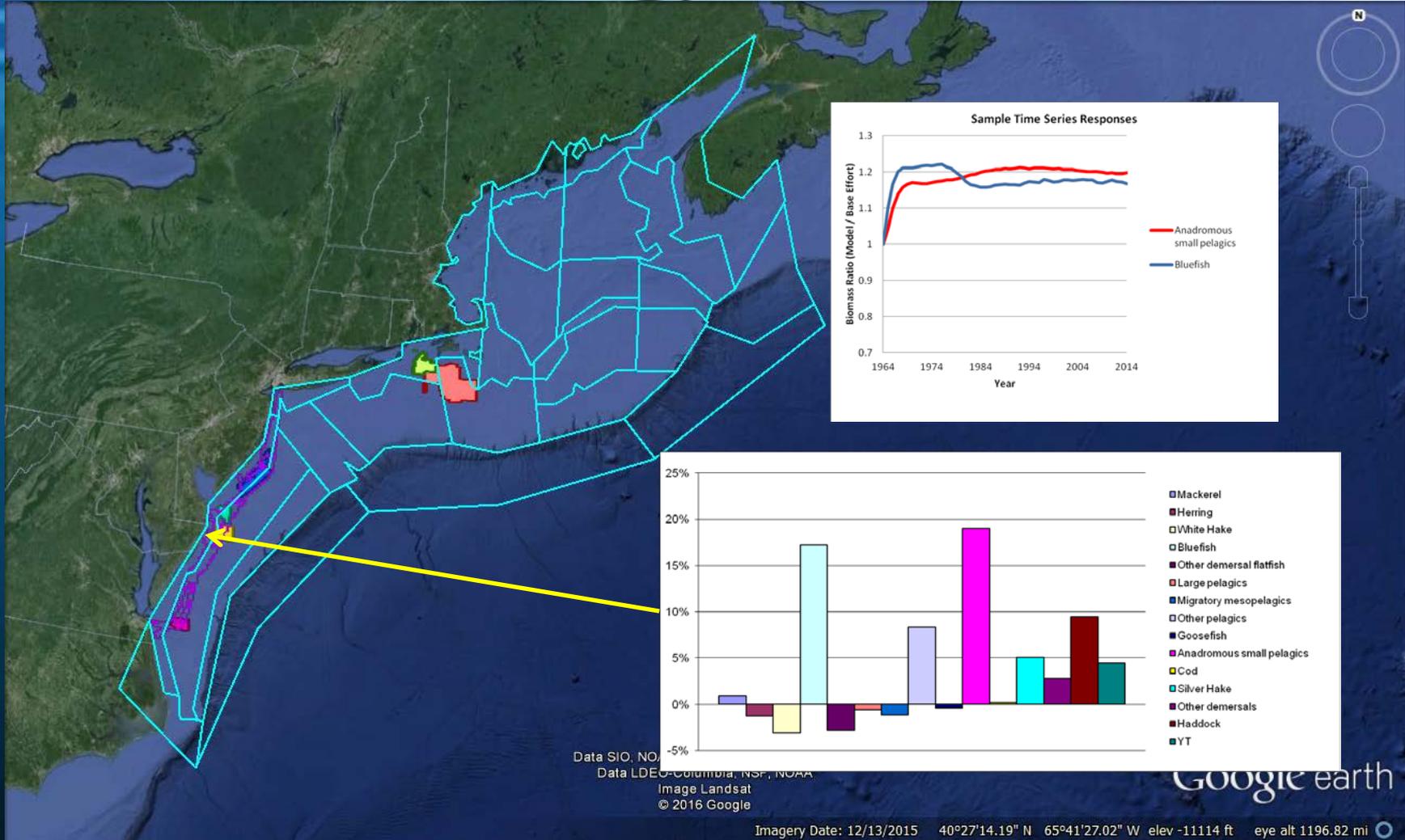
- Well developed outreach effort to stakeholders for EBM/EBFM
- Suite of analytical tools have been developed to explore options for tactical ecosystem management advice
- NEFSC staff positioned to contribute directly to management efforts through advisory panels and committees
- Different pathways toward EBM/EBFM by management authorities in the Northeast are tailored to different needs and objectives but can be reconciled
- Rapid rate of change in response to climate forcing highlights the need for strong commitment to monitoring
- Strong commitment to expanded ecosystem modeling and analysis essential
- Send money, guns and lawyers



Extra Slides



Multisectoral Management: Wind Energy & Fisheries

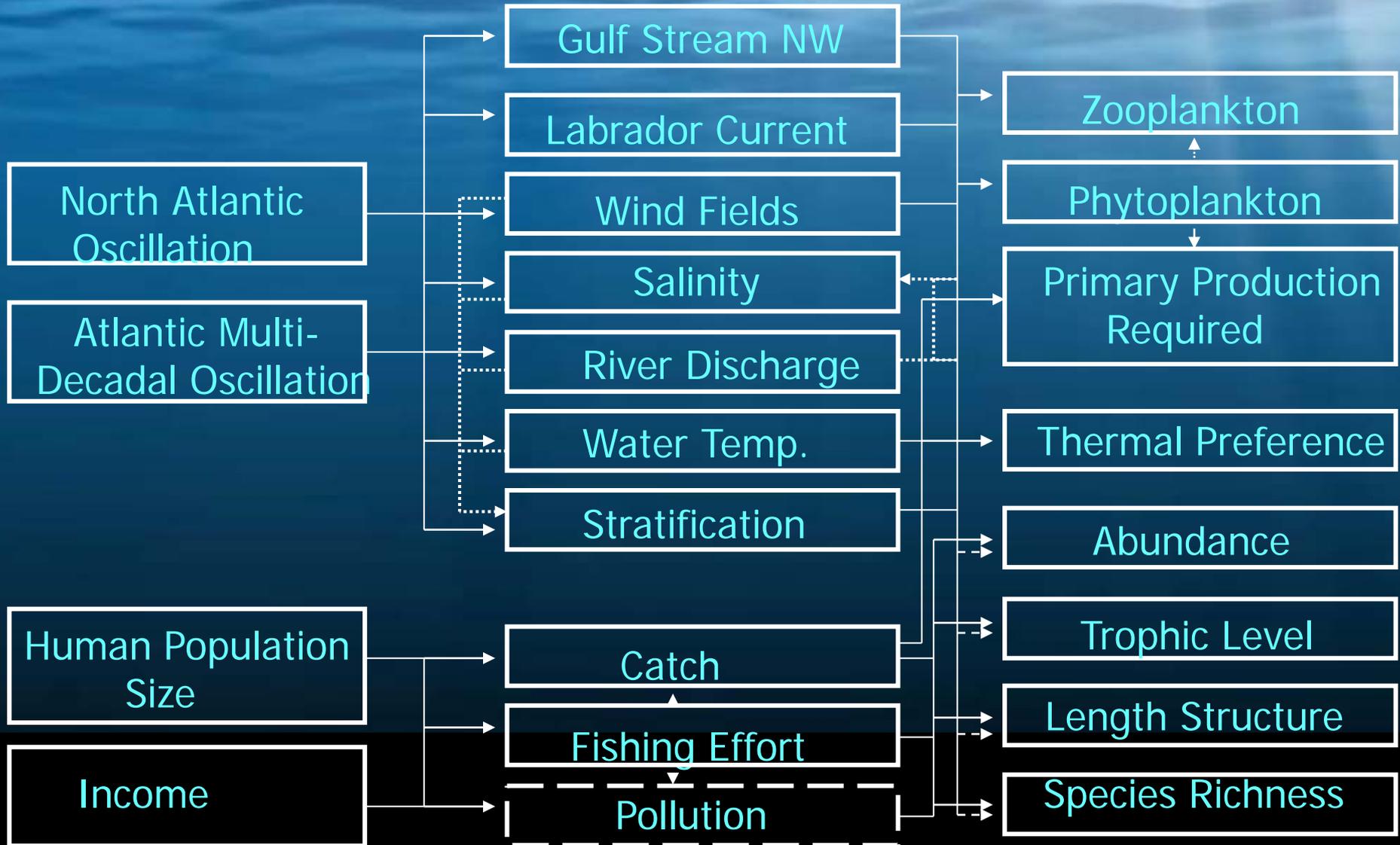


Integrated Ecosystem Assessments: Driver-Pressure-State Framework

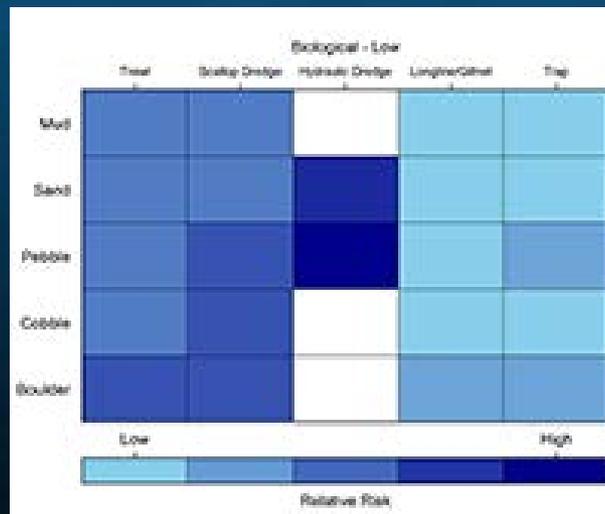
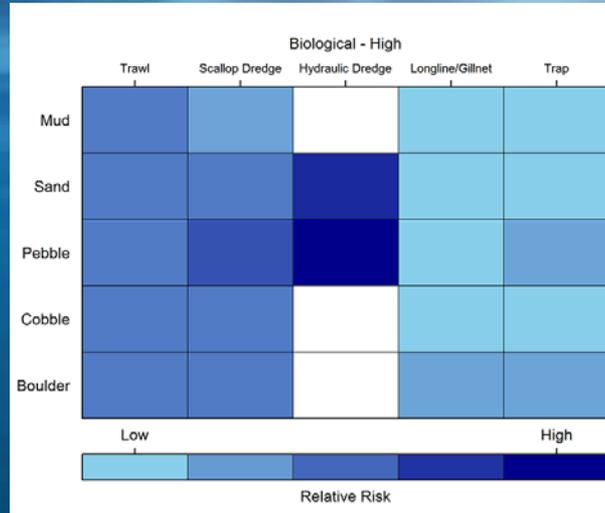
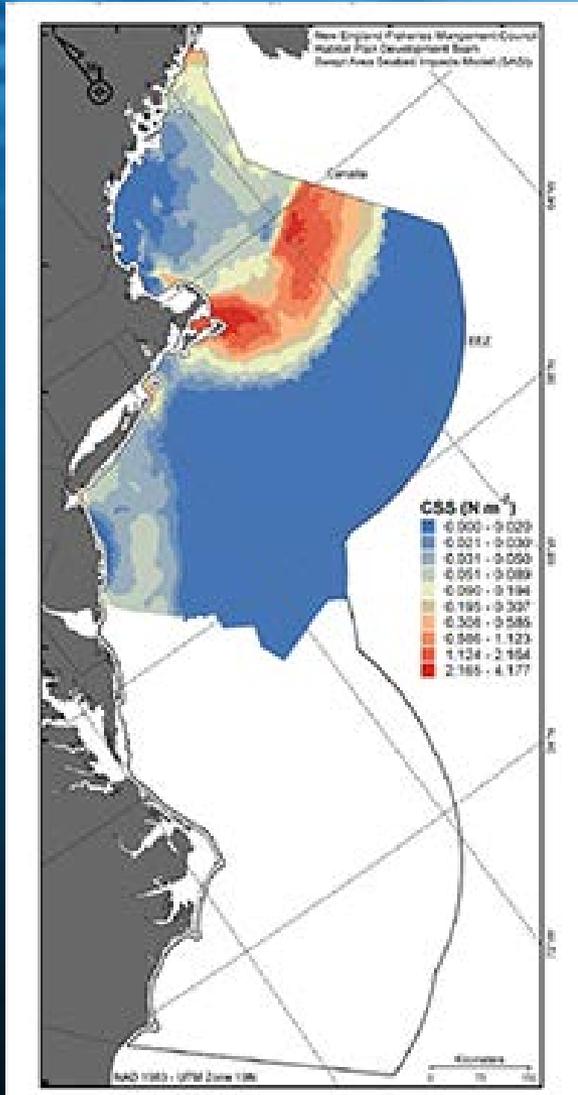
Drivers

Pressures

States



Understanding Habitat Dynamics and Risk



Risk to Benthic Communities:
High Energy Environments

Risk to Benthic Communities:
Low Energy Environments

Courtesy:
Chad Demarest SSB