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Northeast Fisheries Science Center

Mid-Atlantic State of the Ecosystem Report & Discussion of EAFM Risk Assessment

Sarah Gaichas

MAFMC SSC March 2018

So what

Can ecosystem indicators inform fishery management?

- State of the Ecosystem Report 2018
  - Changes for 2018
  - Overview of indicators, messages
- Mid Atlantic EAFM framework
  - Step 1: Indicator-based risk assessment
  - Step 2: Frame questions/analyses
  - Step 3: MSE

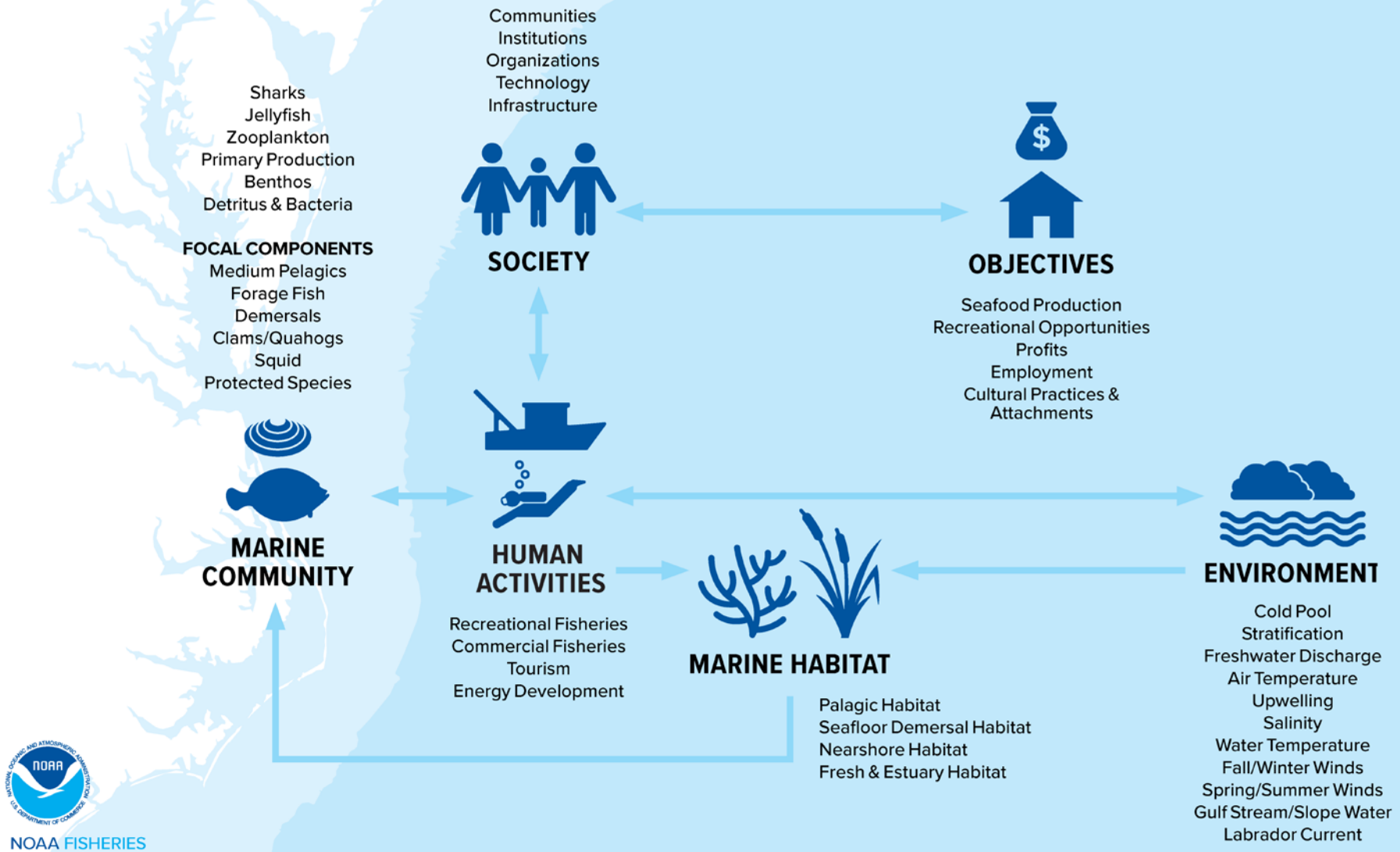
Ecosystem reporting: Big picture

- Highlight linkages
- Understand how human well-being is affected by changing conditions

State of the Ecosystem

Conceptual Model

MID-ATLANTIC



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Summary: performance relative to objectives

Executive Summary

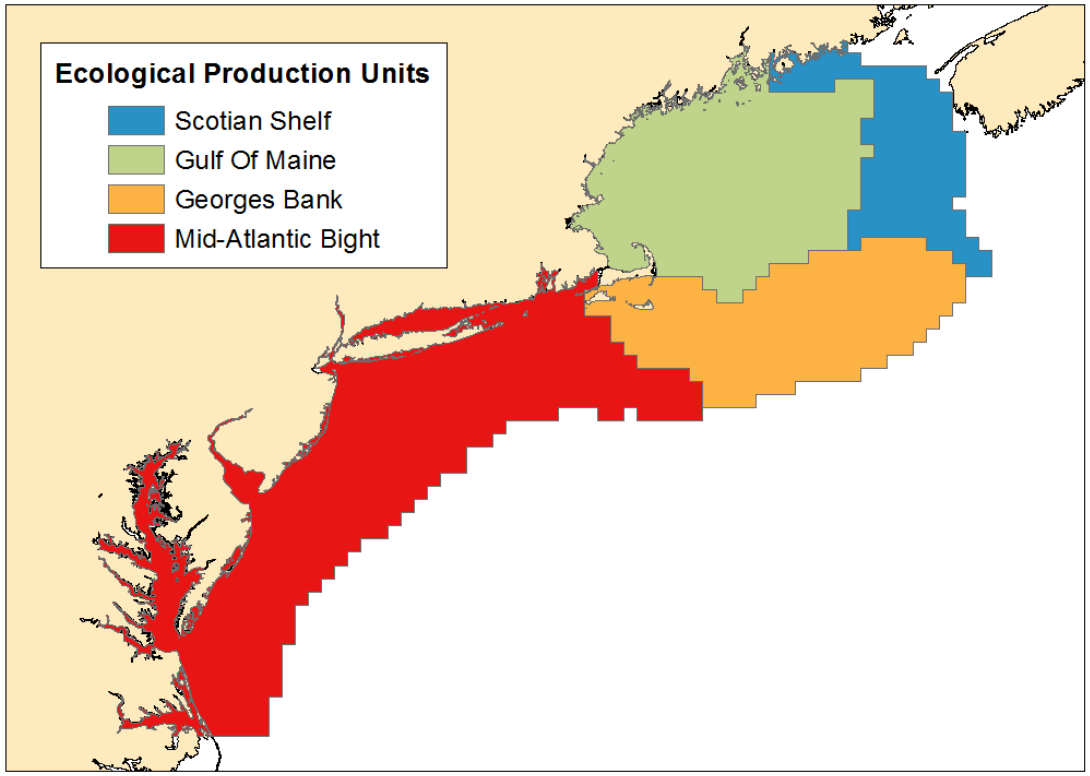
We have organized this report using a proposed set of **ecosystem-scale objectives** derived from US legislation and current management practices.

Table 1: Mid-Atlantic ecosystem objectives

Objective Categories	Indicators reported here
Seafood production	Landings by feeding guild, mariculture
Profits	Revenue by feeding guild
Recreation	Number of anglers and trips; recreational catch
Stability	Diversity indices (fishery and species)
Social-Cultural	Commercial and recreational reliance; social vulnerability
Biomass	Biomass or abundance by feeding guild from surveys
Productivity	Condition and recruitment of MAFMC managed species
Trophic structure	Relative biomass of feeding guilds, primary productivity
Habitat	Thermal habitat projections, estimated habitat occurrence

Revised outline; synthesis across indicators

- Big picture
- Human dimensions
- Protected species-fishery interactions
- Resource Species
- Ecosystem conditions and productivity



Other changes for 2018

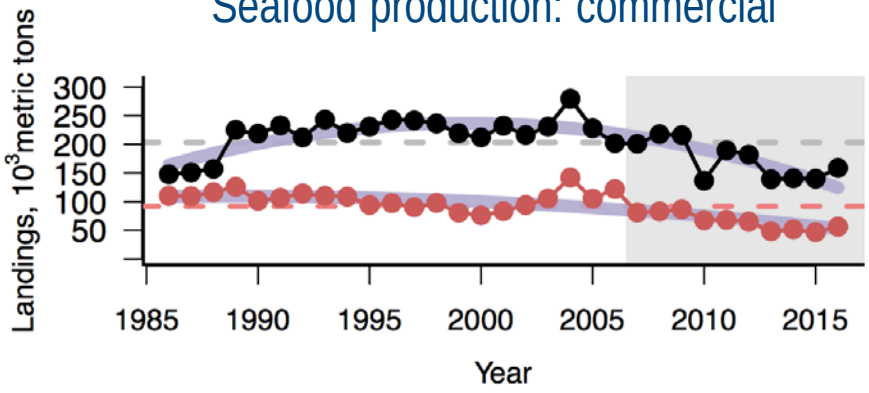
Table 2: Mid-Atlantic feeding guilds.

Group	N species	Major species in the group
A: **Apex predator** (Highest trophic level)	4	shark (Unc.), swordfish, yellowfin and bluefin tuna
B: **Piscivore** (Eat fish)	23	spiny dogfish, summer flounder, bluefish, striped bass, weakfish, monkfish, winter and thorny skates, silver and offshore hake, Atlantic cod and halibut, fourspot flounder
C: **Planktivore** (Eat plankton)	16	Atlantic and blueback herring, alewife, shad, menhaden, cusk, Atlantic mackerel, butterfish, blackbelly rosefish, sculpins, lumpfish, northern searobin, northern sand lance, northern shortfin and longfin squid
E: **Benthivore** (Eat bottom dwellers)	25	black sea bass, scup, tilefish, tautog, cunner, blue crab, red crab, lobster, ocean pout, haddock, yellowtail, winter, and witch flounders, barndoor skate, American plaice, other crabs
F: **Benthos** (Filter feeders)	9	scallops, surfclam, quahog, mussels, whelks, conchs, sand dollars and urchins

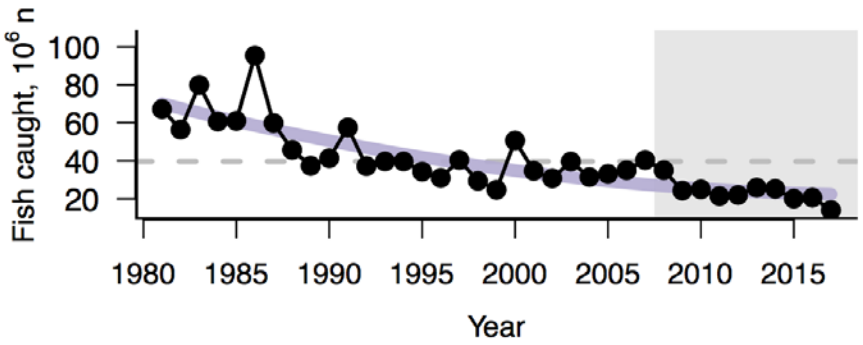
- Trend assessment limited to 30 year time series based on simulations
- Updated all indicators; additional info on HABs as requested by SSC
- Work in progress section (indicators requested by MAFMC)

Ecosystem indicators addressing objectives

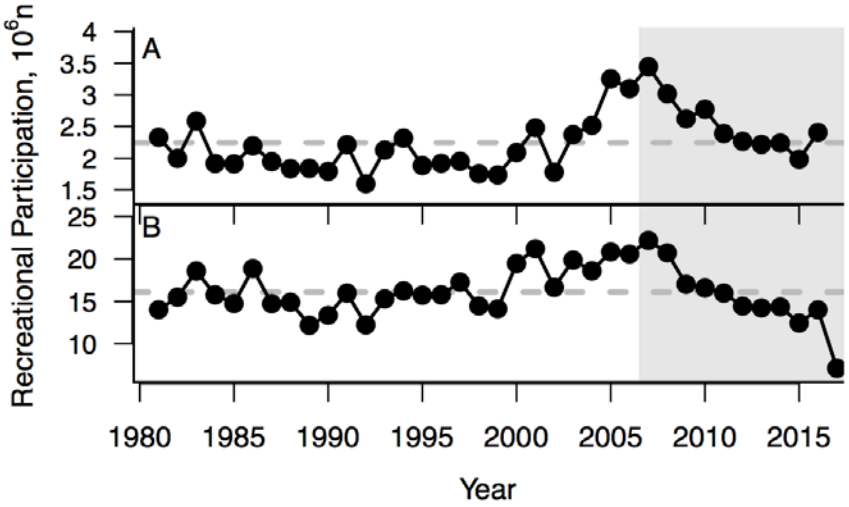
Seafood production: commercial



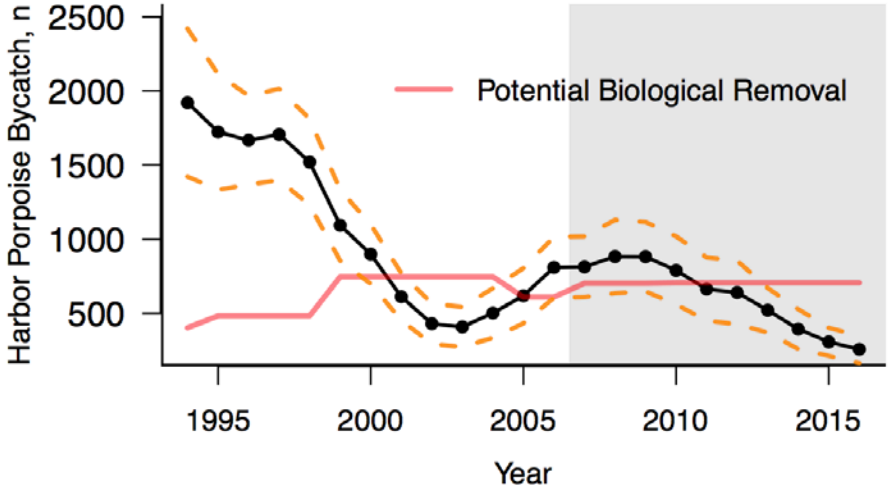
Seafood production: recreational



Recreational opportunities



Reducing fishery-protected species interactions



Ecosystem indicators for shifting species and habitats

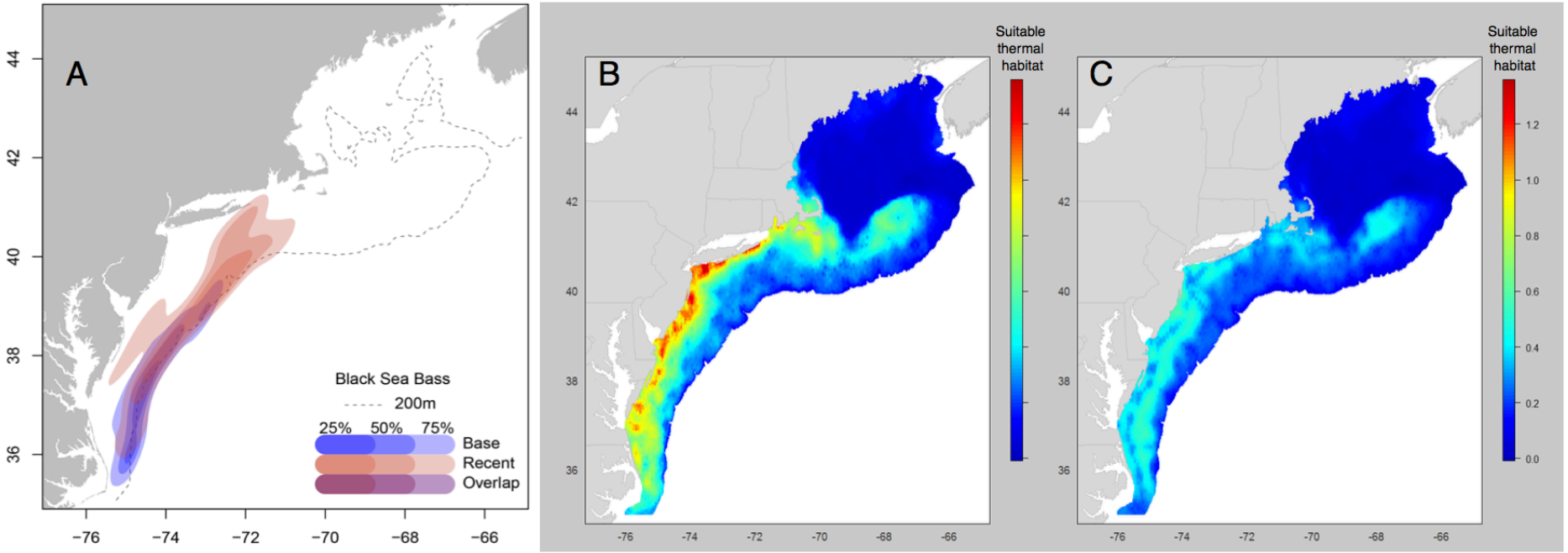
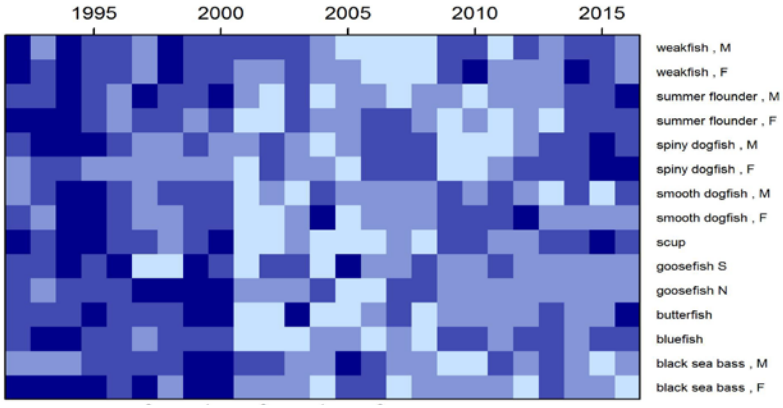
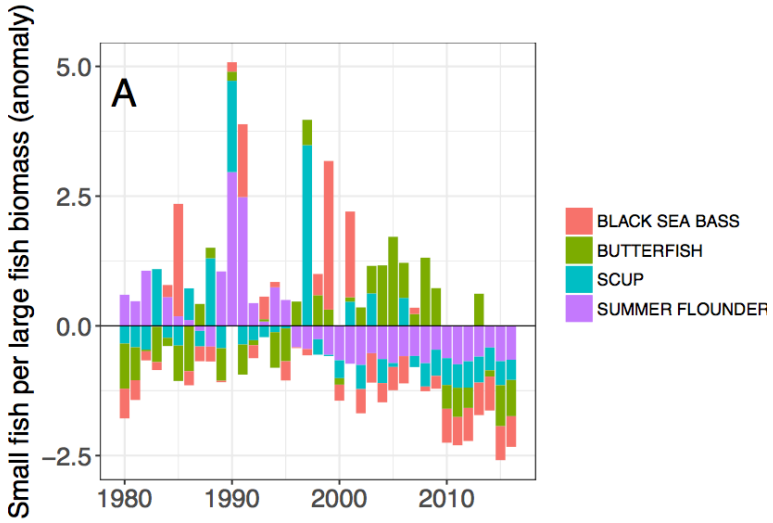


Figure 19: Black sea bass historical and current abundance estimates (A), current thermal habitat estimate (B), and 20-40 year thermal habitat projection (C).

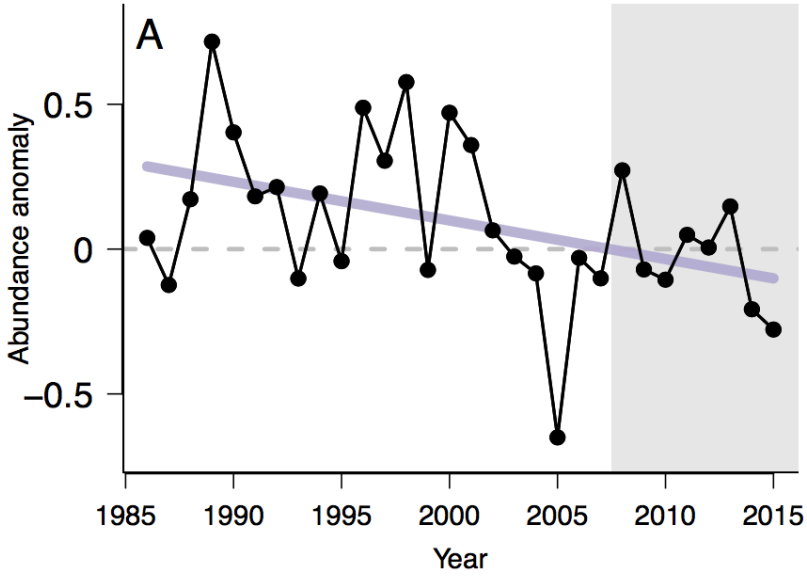
Ecosystem indicators for system productivity

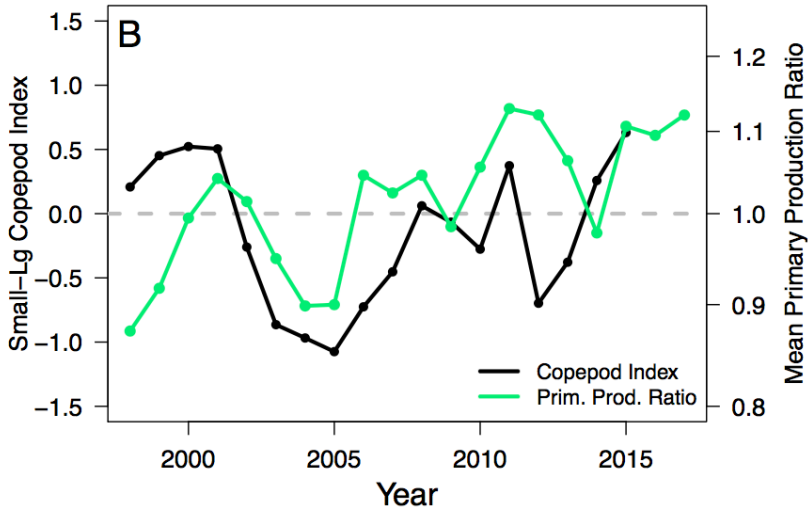
Groundfish condition and productivity





Base of the food web: Copeopods and primary production



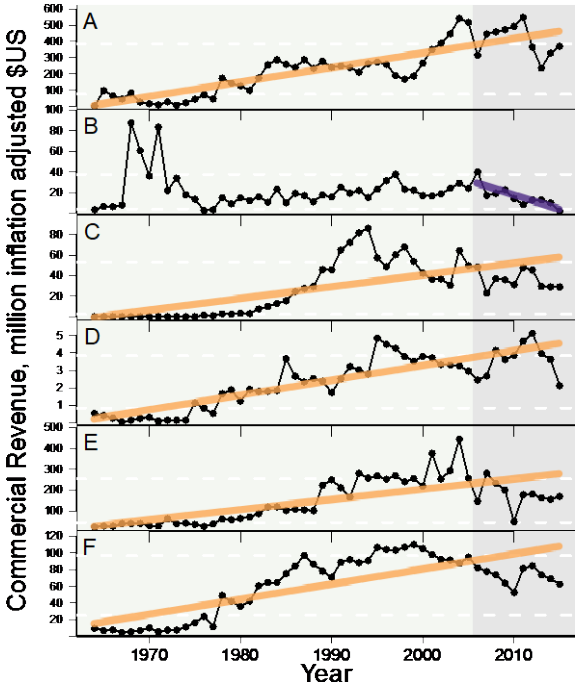


Specific SSC feedback requested

- Report updated mackerel status?
- Comments on executive summary?
- Comments on changes for 2018?
- Comments on any individual indicators?
- Anything missing?
- Feedback will be incorporated in report at April Council meeting if possible and/or in 2019 report

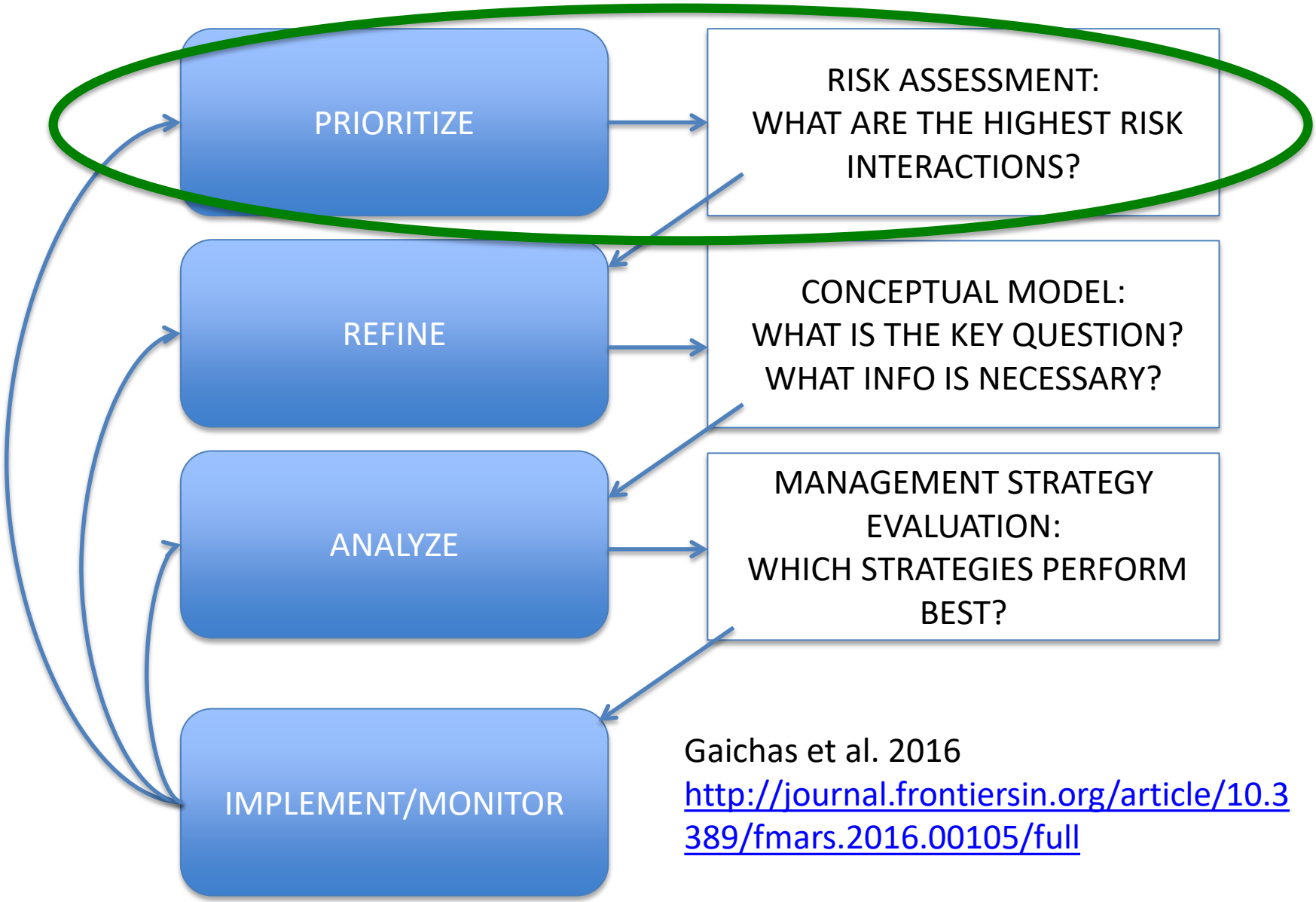
Indicators → Mid Atlantic EAFM

- Opportunity: use indicators from State of the Ecosystem to inform further risk assessment



Indicator	Risk
Revenue	
Employment	
Seafood	
Production	
Habitat	
Climate	

Framework for addressing interactions



Gaichas et al. 2016
http://journal.frontiersin.org/article/10.3389/fmars.2016.00105/full

Mid-Atlantic EAFM Risk Assessment

- Clarify exactly what we are assessing and why
  - What are we measuring = Risk Elements
  - Why are we measuring it = Risk Definition
  - How are we measuring it = Indicators Used

Full document reviewed in December 2017:
http://www.mafmc.org/s/SOE_MAB_RiskAssess-lzyt.pdf

Types of Risk Elements

Ecological

Economic

Social

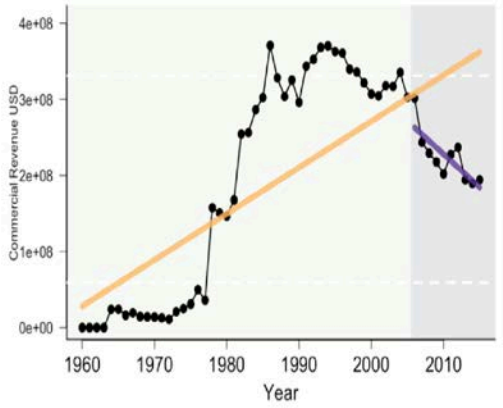
Food Production

Management

Element Name

Element definition, why are we interested in this?

Indicators, if available



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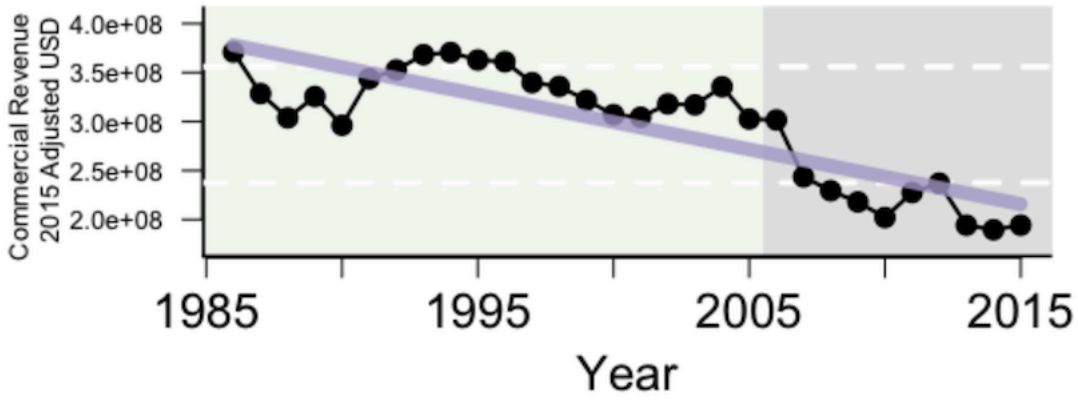
Element Type

Element			
Ecological			
Assessment performance			
F status			
B status			
Food web (MAFMC Predator)			
Food web (MAFMC Prey)			
Food web (Protected Species Prey)			
Ecosystem productivity			
Climate			
Distribution shifts			
Estuarine habitat	Risk of not achieving OY due to threats to estuarine/nursery habitat	Enumerated threats + estuarine dependence	
Offshore habitat	Risk of not achieving OY due to changing offshore habitat	Integrated habitat model index	
Economic			
Commercial Re			
Recreational A Days/Trips			
Commercial Fis Resilience (Rev Diversity)			
Commercial Fis Resilience (Sho Support)			
Social			
Fleet Resilienc			
Social-Cultural			
Food Production			
Commercial	Risk of not optimizing seafood production	Seafood landings in aggregate	
Recreational	Risk of not maintaining personal food production	Recreational landings in aggregate	
Management			
Control	Risk of not achieving OY due to inadequate control	Catch compared to allocation	
Interactions	Risk of not achieving OY due to interactions with species managed by other entities	Number and type of interactions with protected or non-MAFMC managed species, co-management	
Other ocean uses	Risk of not achieving OY due to other human uses	Fishery overlap with energy/mining areas	
Regulatory complexity	Risk of not achieving compliance due to complexity	Number of regulations by species	
Discards	Risk of not minimizing bycatch to extent practicable	Standardized Bycatch Reporting	
Allocation	Risk of not achieving OY due to spatial mismatch of stocks and management	Distribution shifts + number of interests	

Commercial Revenue

This element is applied at the ecosystem level. Revenue serves as a proxy for commercial profits.

Risk Level	Definition
Low	No trend and low variability in revenue
Low-Moderate	Increasing or high variability in revenue
Moderate-High	Significant long term revenue decrease
High	Significant recent decrease in revenue



Species level

Species	Assess	Fstatus	Bstatus	FW1Pred	FW1Prey	FW2Prey	Climate	DistShift	EstHabitat
Ocean Quahog	l	l	l	l	l	l	h	mh	l
Surfclam	l	l	l	l	l	l	mh	mh	l
Summer flounder	l	h	lm	l	l	l	lm	mh	h
Scup	l	l	l	l	l	l	lm	mh	h
Black sea bass	l	l	l	l	l	l	mh	mh	h
Atl. mackerel	h	mh	mh	l	l	l	lm	mh	l
Butterfish	l	l	l	l	l	l	l	h	l
Longfin squid	lm	lm	lm	l	l	lm	l	mh	l
Shortfin squid	lm	lm	lm	l	l	lm	l	h	l
Golden tilefish	l	l	lm	l	l	l	mh	l	l
Blueline tilefish	h	h	mh	l	l	l	mh	l	l
Bluefish	l	l	lm	l	l	l	l	mh	h
Spiny dogfish	lm	l	lm	l	l	l	l	h	l
Monkfish	h	lm	lm	l	l	l	l	mh	l
Unmanaged forage	na	na	na	l	lm	lm	na	na	na
Deepsea corals	na	na	na	l	l	l	l	l	l

Ecosystem level

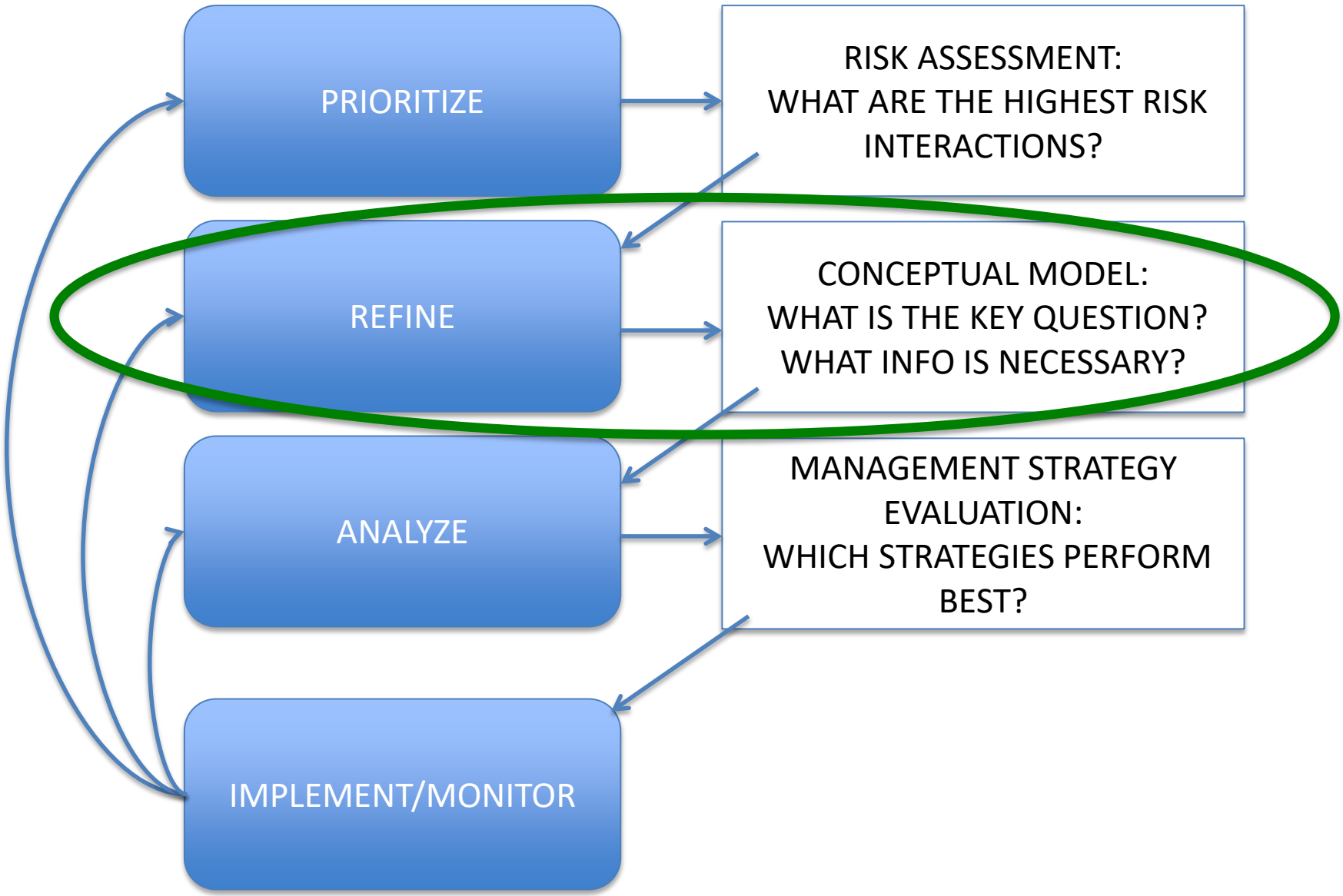
System	EcoProd	CommProf	RecVal	FishRes1	FishRe
Mid-Atlantic	lm	mh	h	l	mh

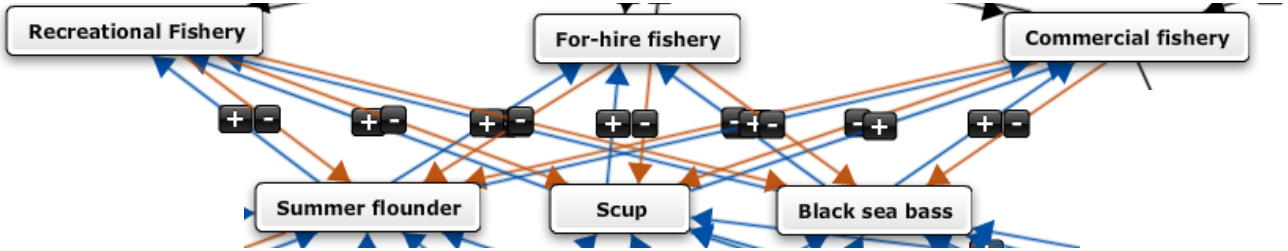
Species and Sector level

Species	MgtControl	TecInteract	OceanUse	RegComplex	Discards	Allocation
Ocean Quahog-C	l	l	lm	l	l	l
Surfclam-C	l	l	lm	l	l	l
Summer flounder-R	mh	l	lm	h	h	h
Summer flounder-C	lm	mh	lm	mh	lm	h
Scup-R	l	l	lm	mh	mh	l
Scup-C	l	mh	lm	mh	mh	l
Black sea bass-R	h	l	mh	h	mh	h
Black sea bass-C	lm	lm	h	mh	lm	h
Atl. mackerel-R	l	l	l	l	l	h
Atl. mackerel-C	l	lm	mh	h	lm	h
Butterfish-C	l	lm	mh	h	mh	l
Longfin squid-C	l	mh	h	h	h	h
Shortfin squid-C	l	lm	lm	lm	l	l
	l	l	l	l	l	l
	l	l	l	l	l	l
	l	l	l	mh	l	h
	l	l	l	mh	l	h
Bluefish-R	lm	l	l	l	mh	h
Bluefish-C	l	l	lm	lm	lm	h
Spiny dogfish-R	l	l	l	l	l	l
Spiny dogfish-C	l	mh	mh	mh	lm	h
Unmanaged forage	na	na	na	na	na	na
Deepsea corals	na	na	mh	na	na	na

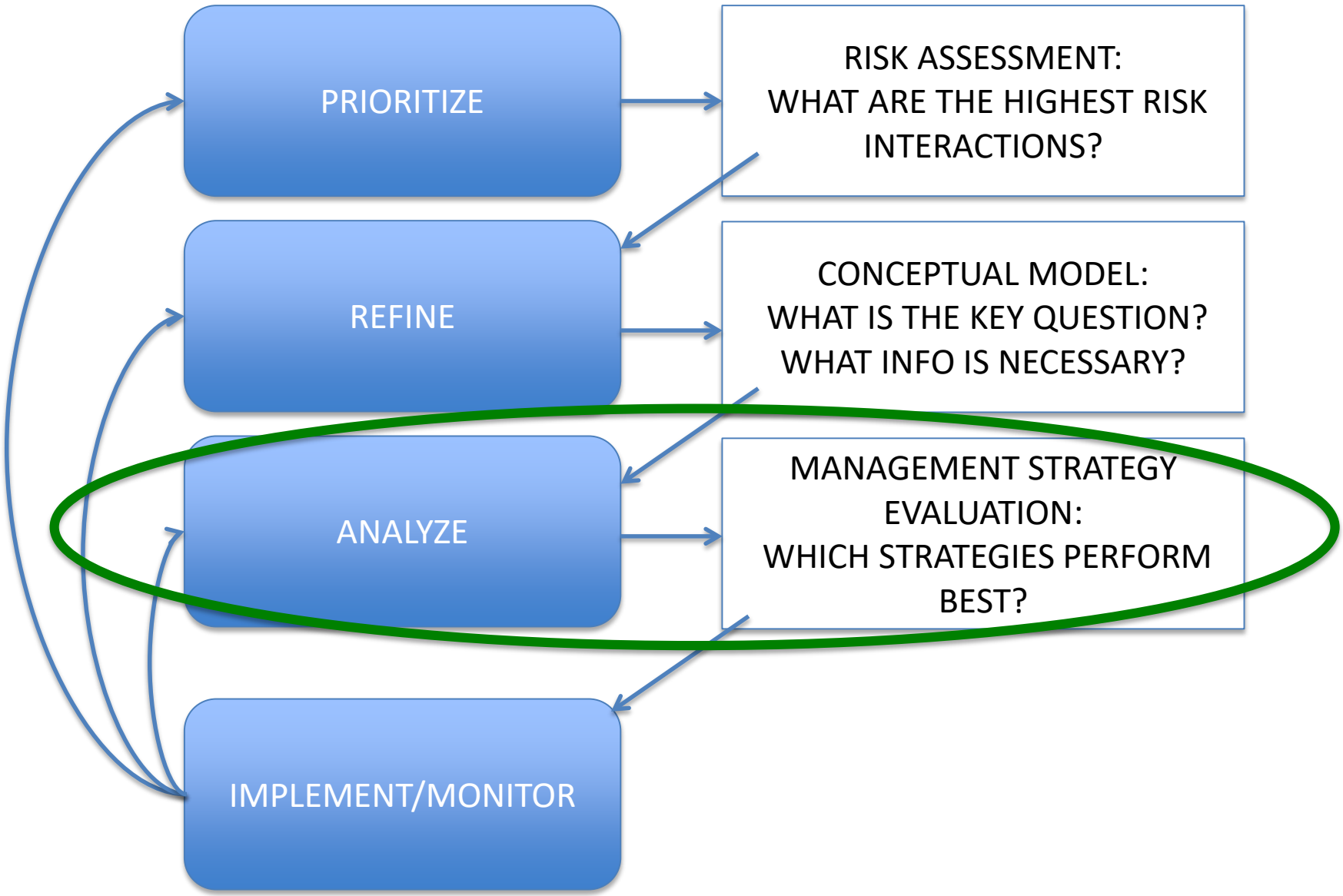
Full document at:
http://www.mafmc.org/s/SOE_MAB_RiskAssess-lzyt.pdf

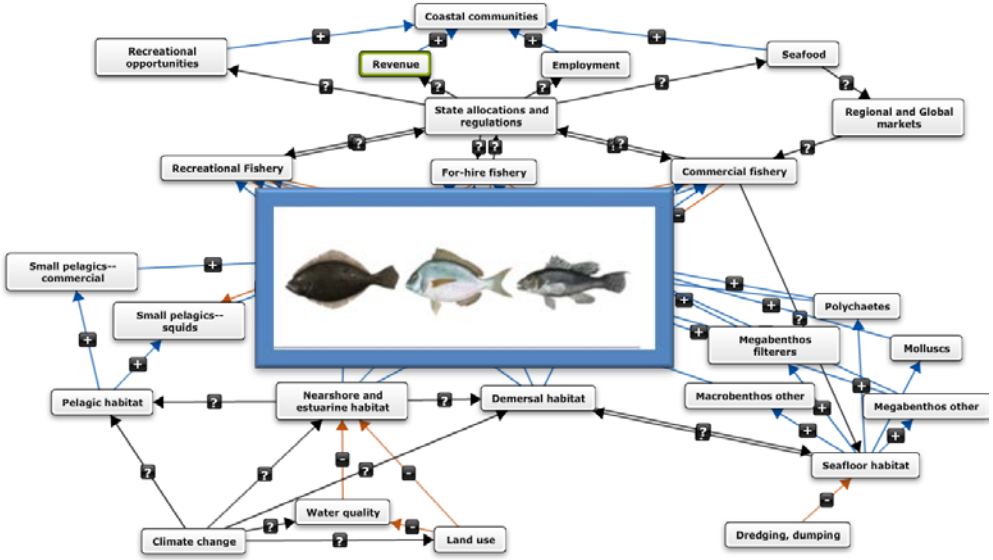
Framework for addressing interactions




Recreational Fishery
For-hire fishery
Commercial fishery
Summer flounder
Scup
Black sea bass

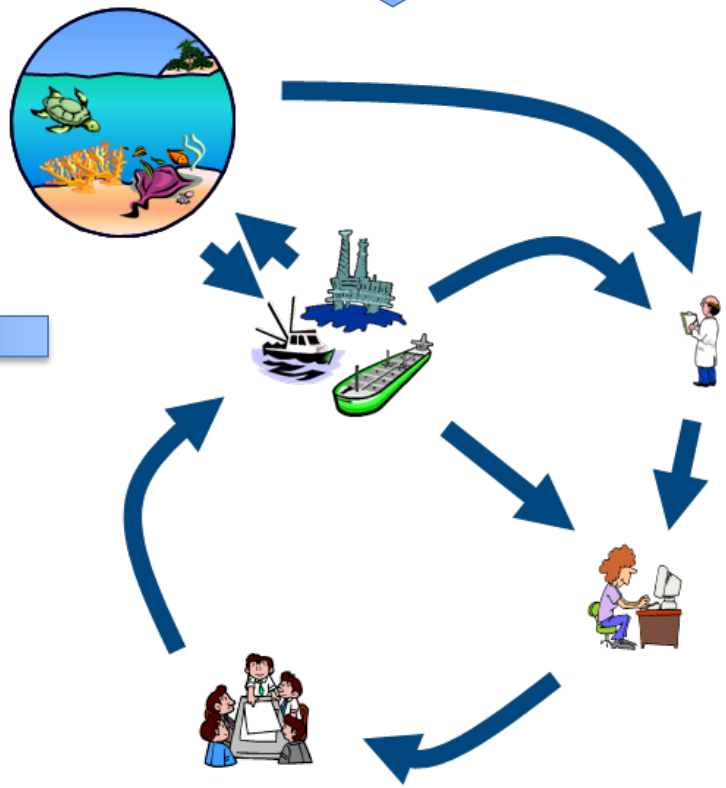
Framework for addressing interactions





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

Scientists develop tools



Performance measures

Council Decision Support:

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