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An Introduction to the eFEP and Worked Example

New England Fishery Management Council

New England Fishery Management Council

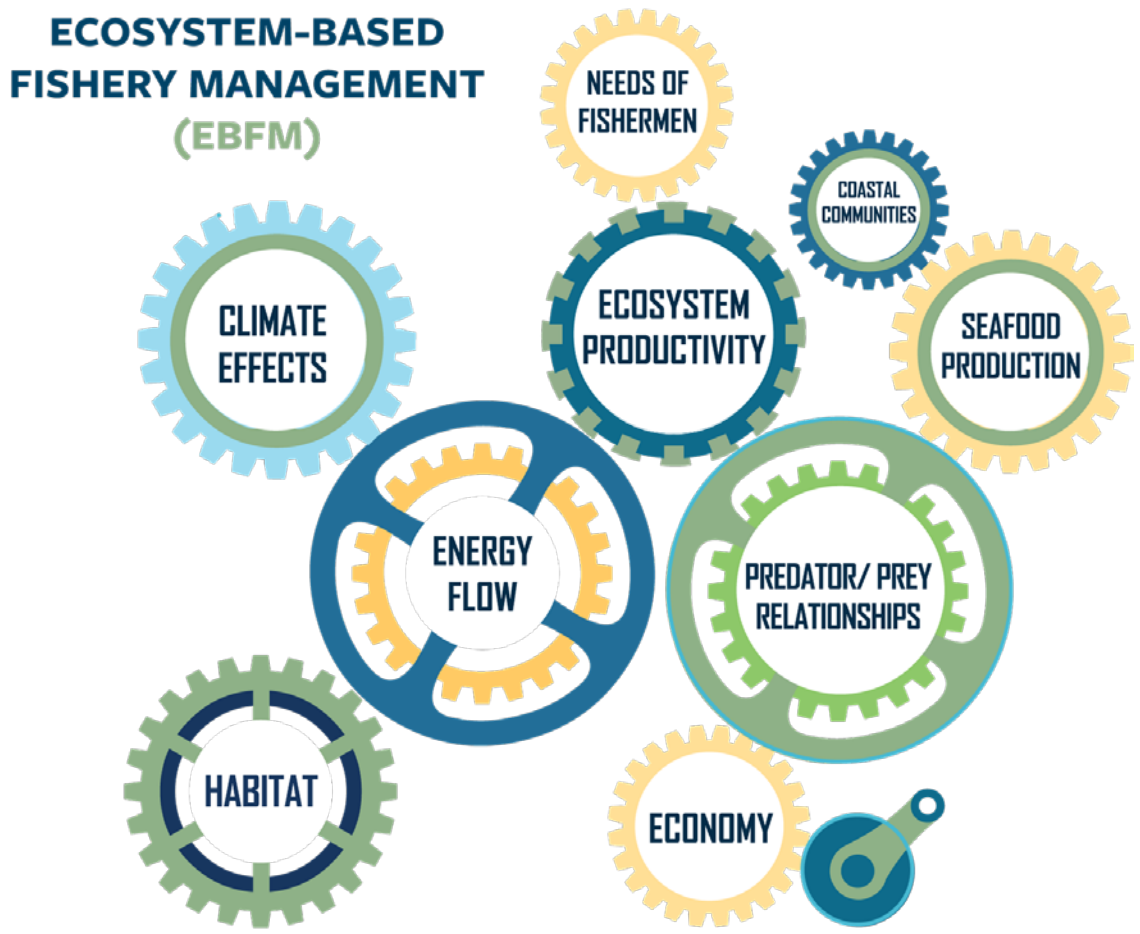
- The NEFMC conserves and manages fisheries through science, public participation and balancing competing interests.
- We are considering a new management model, Ecosystem Based Fishery Management (EBFM), to better support healthy and sustainable fisheries and resources.

Why are you here?

- To learn about the example fishery ecosystem plan (eFEP) for Georges Bank and discuss how we can improve fishery management to benefit all stakeholders.
- To understand the concepts of EBFM by using a set of worked examples and tools.

Why was the eFEP developed?

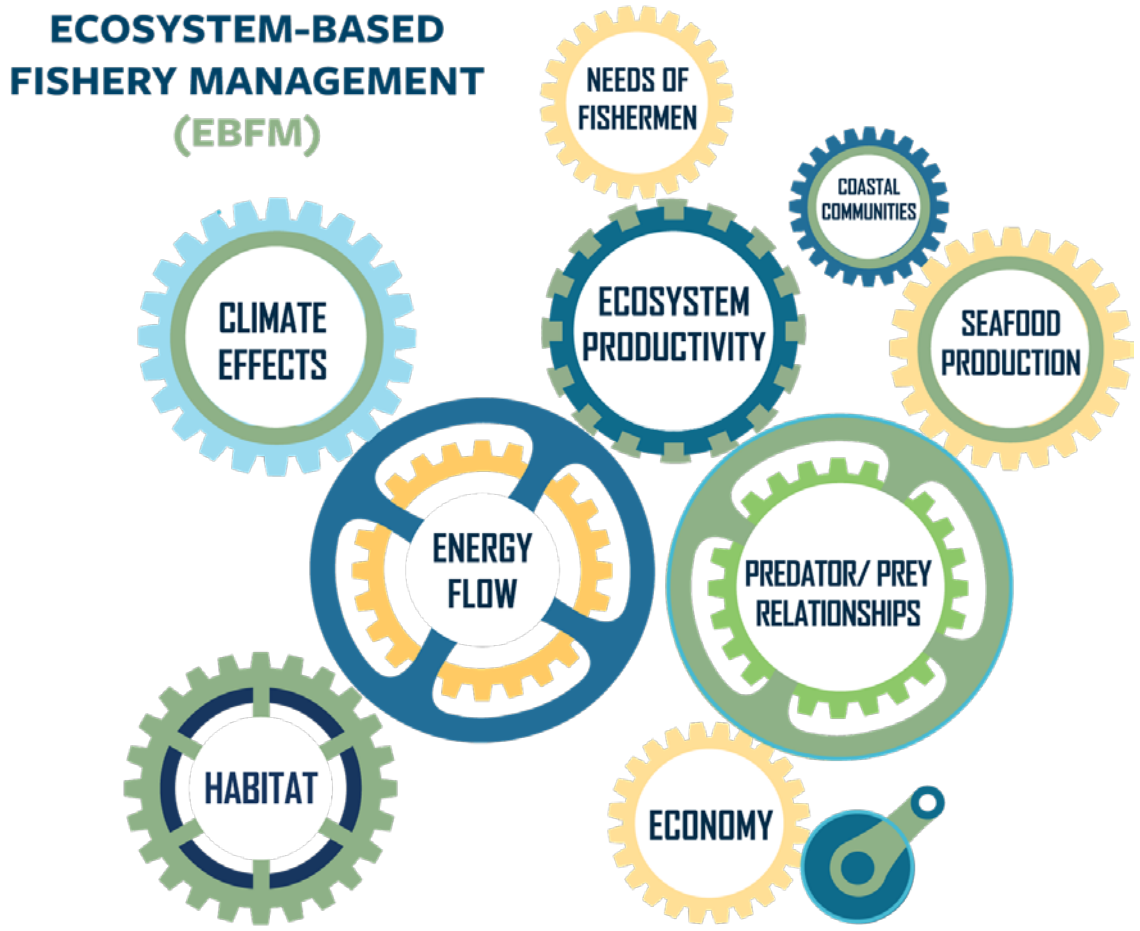
- The eFEP for Georges Bank was developed to explain EBFM as a new concept for New England fisheries.
- The intent of the eFEP is to identify workable management approaches that can achieve a range of goals and objectives.



Why was the eFEP developed?

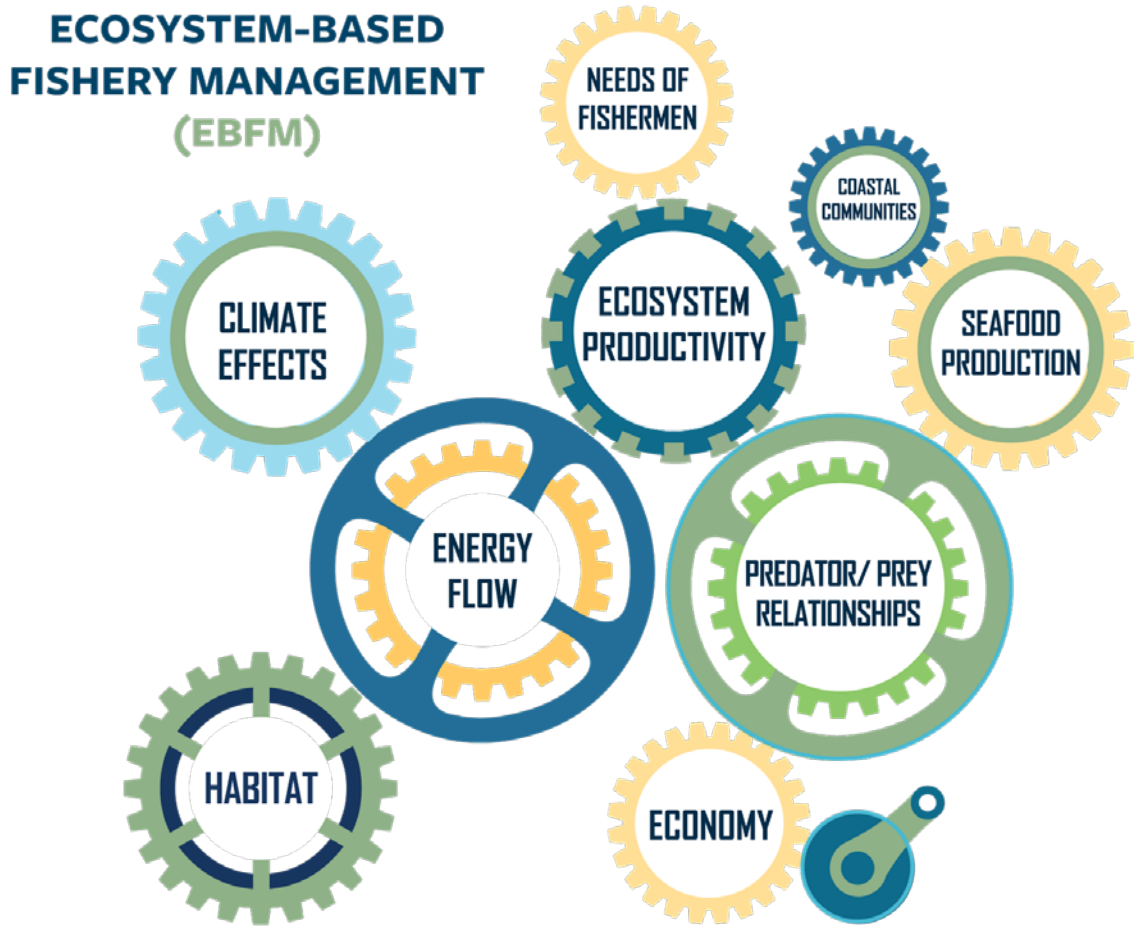
An FEP can improve management by:

- Considering a broader range of goals, objectives, and improvements.
- Limiting total ecosystem catch.
- Considering interactions between predators and prey.
- Adaptive and flexible allowing vessels to catch a suite of species in complex.



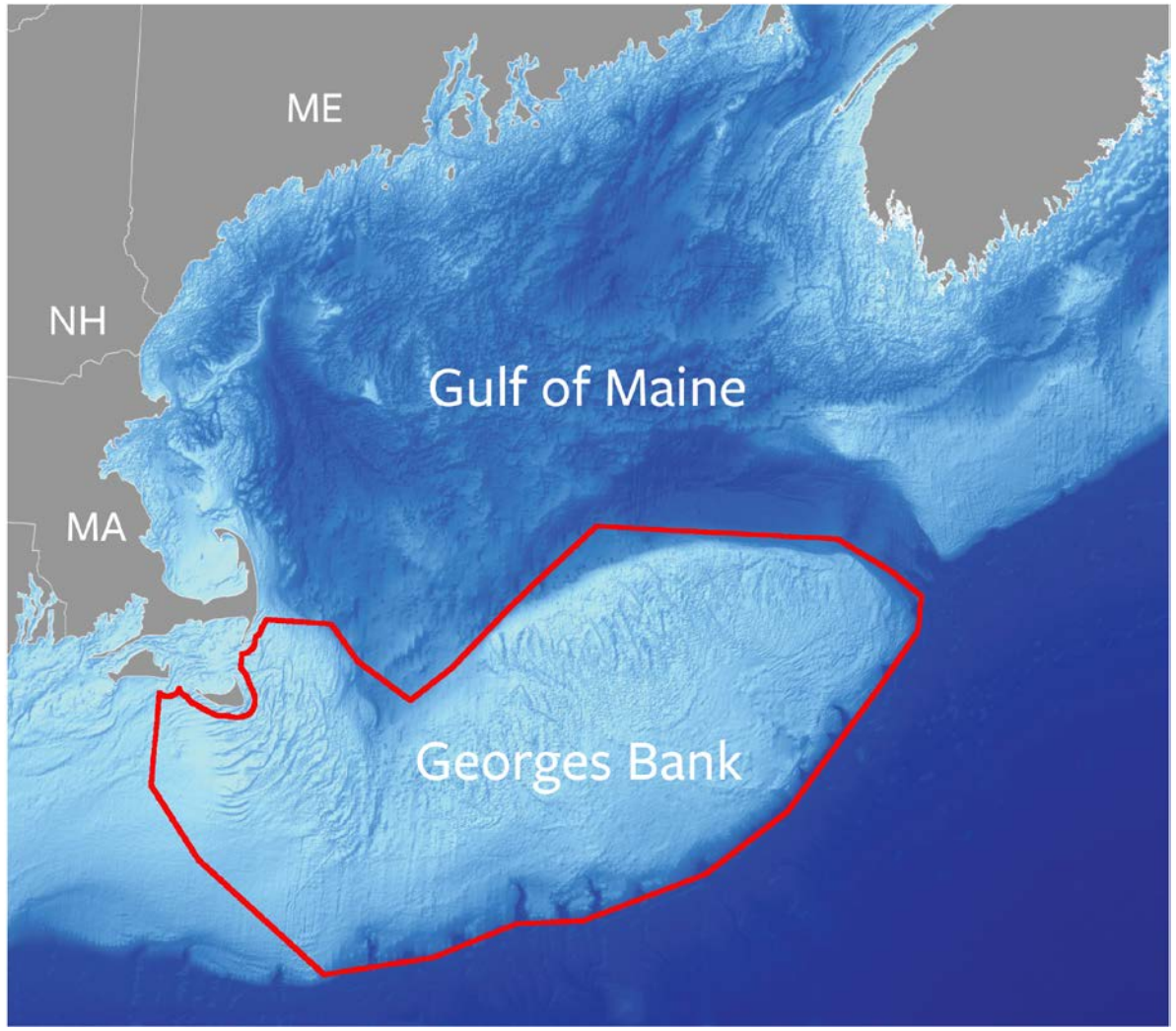
Why was the eFEP developed?

- The next step is to work through the Management Strategy Evaluation (MSE) process.
- An ultimate goal is to develop an approvable Fishery Ecosystem Plan (FEP).



Why Georges Bank?

- A considerable amount of ecological science and modeling has focused on this distinct area.
- Scientists already know a lot about the Georges Bank ecosystem and fisheries.
- They therefore have much of the information they need to understand how the system will respond to EBFM.



What are the eFEP goals?

- The New England Fishery Management Council has developed a set of draft goals or outcomes they hope to achieve via the eFEP.
- eFEP page 18.

Overarching goal: To protect the ecological integrity of US marine resources as a sustainable source of wealth and well-being for current and future generations.

Supporting goals:

1. Optimize Food Provision through targeted fishing and fishing for species for bait
2. Optimize Employment
3. Optimize Recreational Opportunity
4. Optimize Intrinsic (Existence) values
5. Optimize Profitability
6. Promote stability in both the biological and social systems

What are the eFEP objectives?

- The New England Fishery Management Council has also developed draft objectives or actions that will help achieve the goals.
- eFEP pages 18-19.

Strategic Objectives

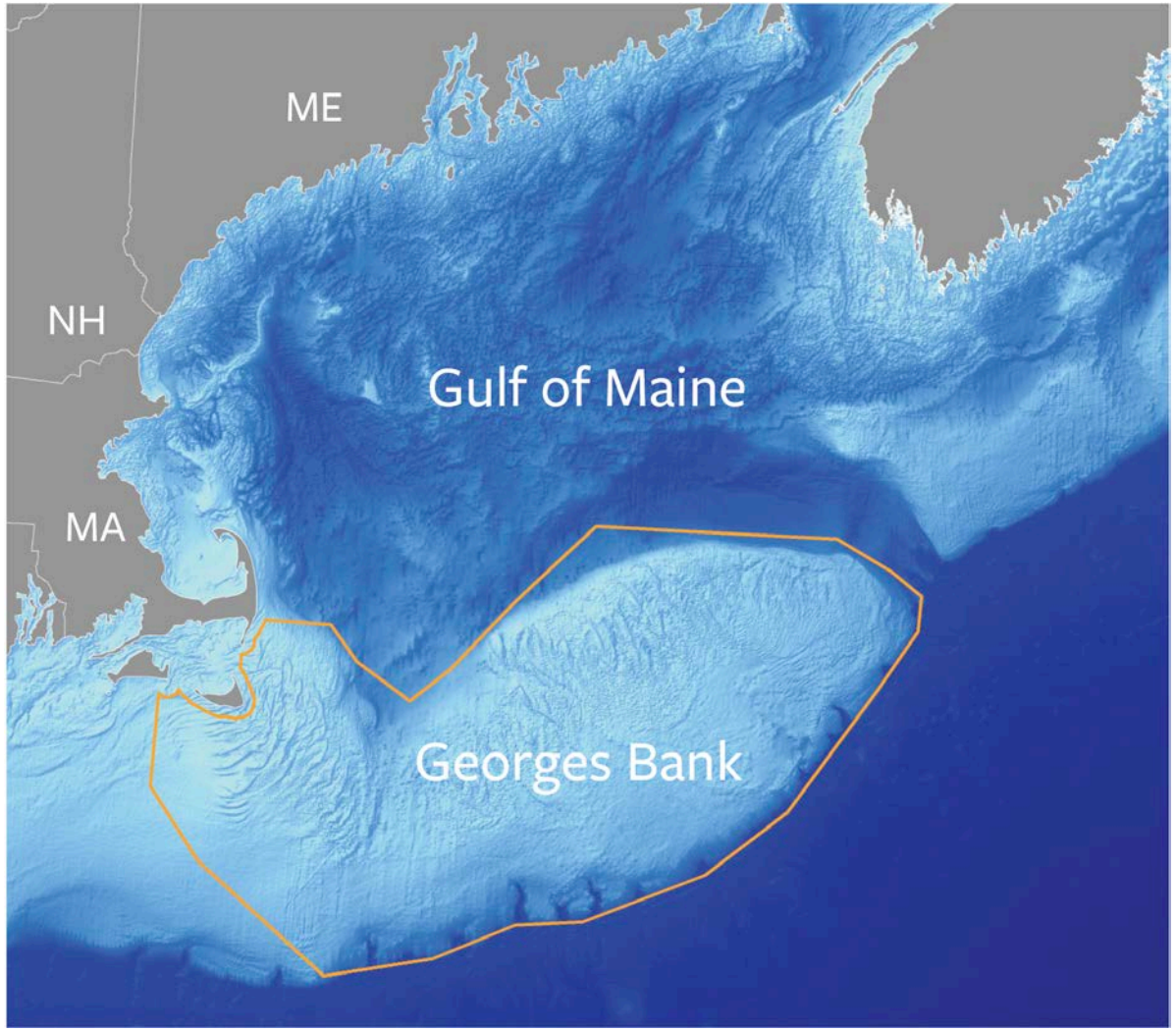
- Maintain/restore functional production levels
- Maintain/restore functional biomass levels
- Maintain/restore functional trophic structure
- Maintain/restore functional habitat

Operational Objectives

- Ecosystem & community fishing mortality/total catch below ecosystem catch ceiling
- Minimized fishing related mortality for threatened/ endangered/ protected species
- Managed and protected species biomass above floors
- Maintain ecosystem structure within historical variation
- Maintain habitat productivity and diversity
- Maintain habitat structure and function
- Minimize risks of permanent impacts

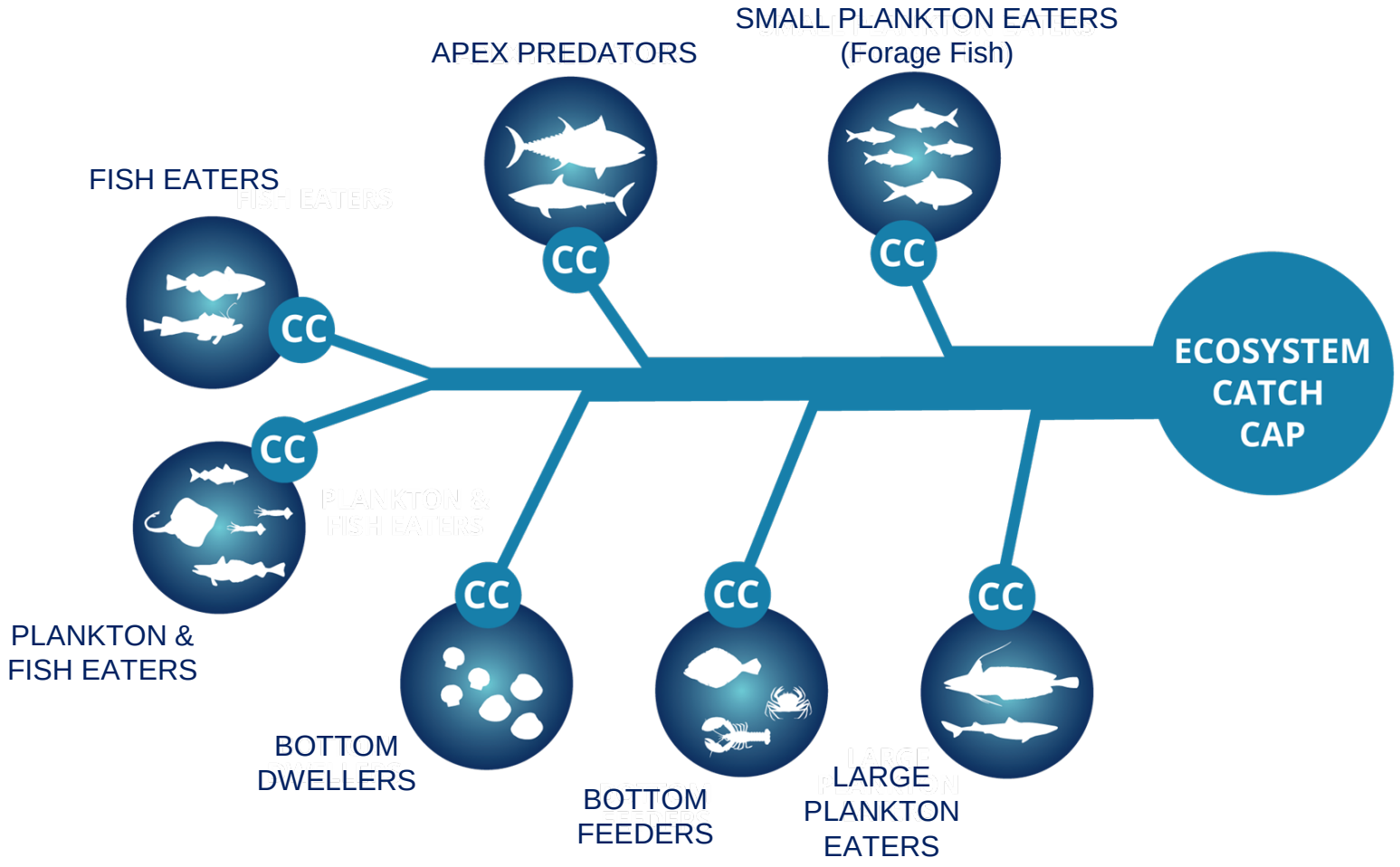
What are the boundaries of the eFEP?

- EBFM is developed for specific ecosystems, in this case the ecosystem is the Georges Bank Ecological Production Unit (EPU).
- EPUs are geographically specific areas on the continental shelf that have unique combinations of depth, bottom sediments, temperature, salinity, and primary production from phytoplankton.
- eFEP page 21.



Harvest management

Fish are managed in Stock Complexes not individually



Catch Ceilings:

1. **Ecosystem Catch Cap**: The total amount of fish that can be sustainably removed from the ecosystem or ecological production unit (EPU).
2. **Stock Complex Ceilings:** The total catch that can be sustainably removed from each of the stock complexes.
3. **Species Biomass Floors:** The total amount or biomass of an individual fish stock below which the stock is not allowed to drop.

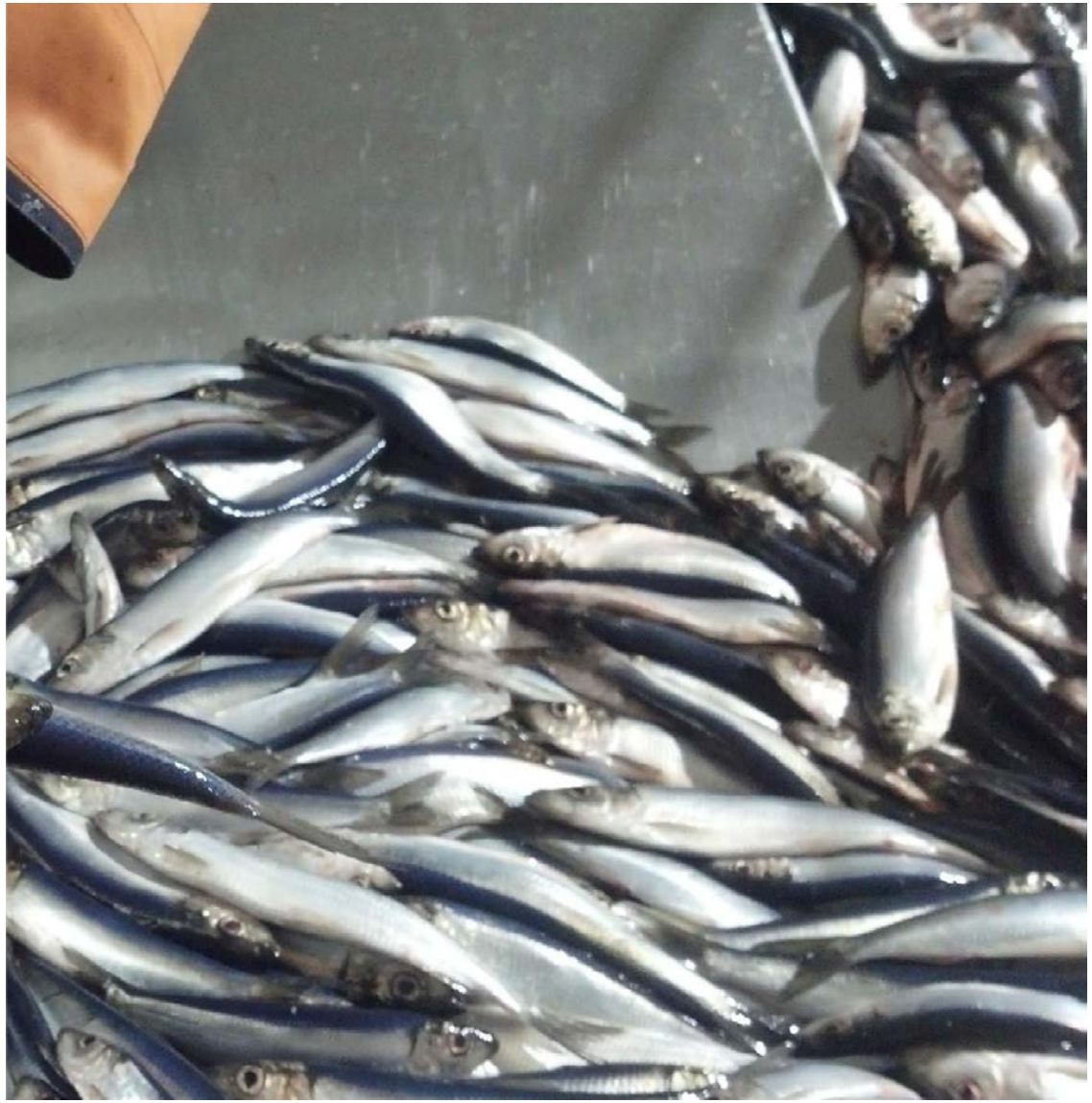
Setting catch ceilings

- **Ecosystem Catch Cap** – approaches being considered use a combination of indicators and estimates of ecosystem production.
- **Stock Complex Ceiling** – Three methods being considered.
  - Survey data with production model
  - Survey data and multispecies model
  - Trend based

eFEP pages 29-30; 44-50

Special priority management

- Special Management to protect forage species.
- Other stocks may need additional protection due to low productivity.
- Spawning or other habitat types require conservation
- eFEP pages 72-77.



Incentive-based measures

- Management will be designed to reinforce fishing behavior that supports Goals and Objectives.
- eFEP pages 59-70.

Fishing impacts and spatial management

- The eFEP describes strategies to sustain and restore habitat quality.
- The goal is to broaden consideration of spatial effects of fishing that affect juvenile fish growth and survival, focusing on improving productivity of the ecosystem.
- eFEP pages 91-93.

Jurisdictional and limited access issues

Three options being considered

1. Only set catch ceilings for species managed exclusively or jointly by the New England Fishery Management Council.
2. Develop a cooperative and collaborative approach with other management entities and set ceilings for the portion of stocks that are caught on Georges Bank.
3. Petition for sole management of all stocks caught on Georges Bank.

eFEP page 82

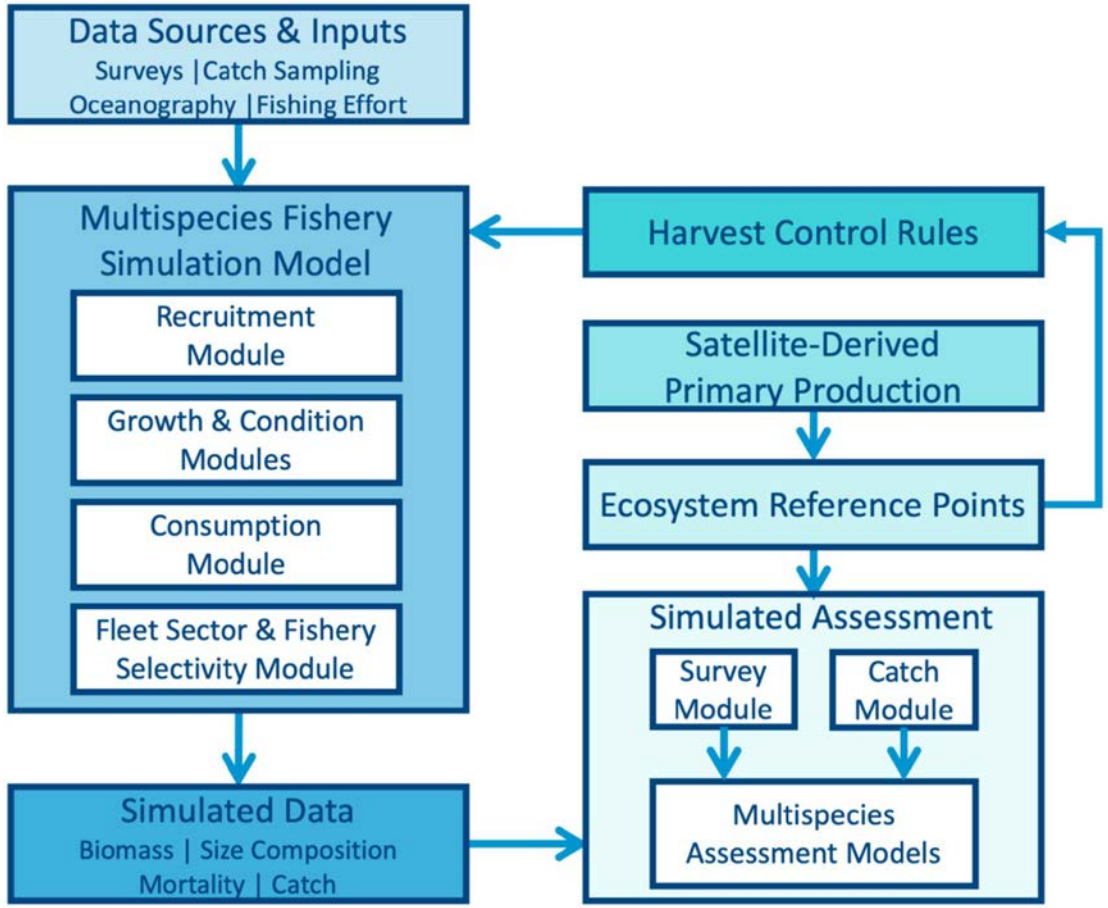
Monitoring and research priorities

1. Develop a modernized data system.
2. Catch monitoring.
3. Ecosystem data collection.
4. Ecosystem research.

eFEP pages 94-97

Management Strategy Evaluation

- MSE is a process used to better understand the trade-offs between different harvest control rules in meeting the goals of stakeholders and managers.
- MSE requires input from stakeholders.
- MSE is an iterative process.
- eFEP pages 40-43.



Management Strategy Evaluation

Three parts to an MSE

1. The goals and objectives are developed.
2. Models are developed that represent the ecosystem and the fish populations within them.
3. Management procedures like harvest control rules (catch ceilings) and strategies are developed, analyzed, and evaluated.

Management Strategy Evaluation – *Operating Models*

Why use operating models?

- Using fishery and environmental data, operational models allow scientists to simulate the real world and evaluate the impacts of different management strategies.

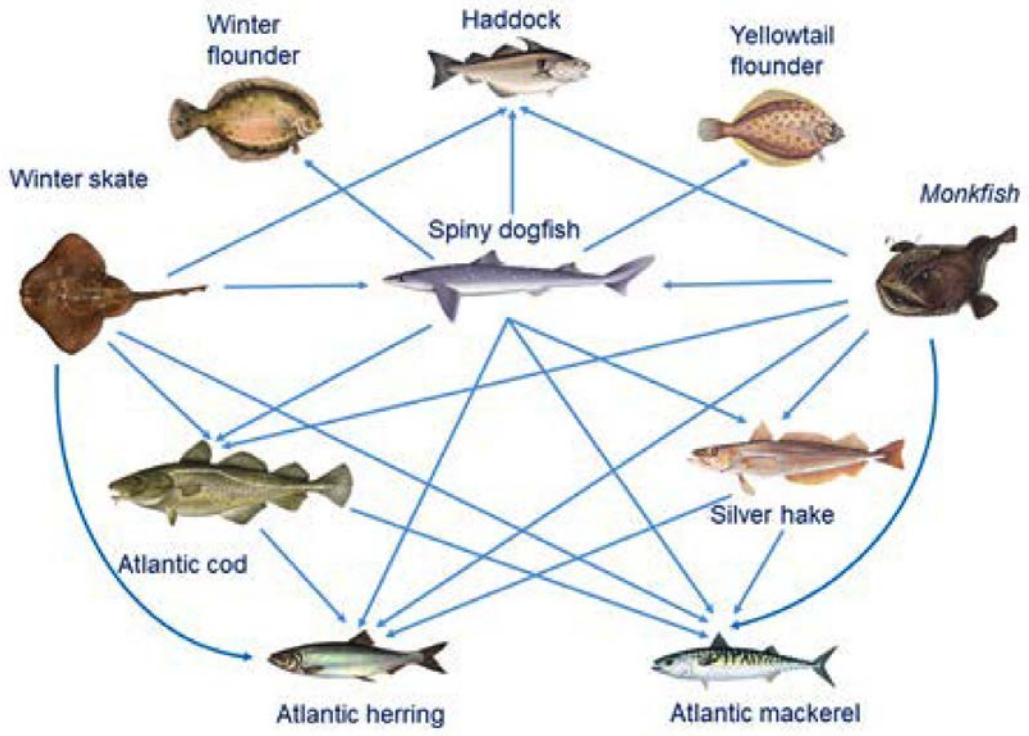
- Steady State - These models are run for several simulated years **before** management strategies are evaluated.

Worked Example – Steps

1. Identify the boundaries of the Georges Bank ecosystem
2. Identify the stock complexes
3. Specify the management rules
4. Create computer model of ecosystem
5. Compare outcomes of single and multispecies management

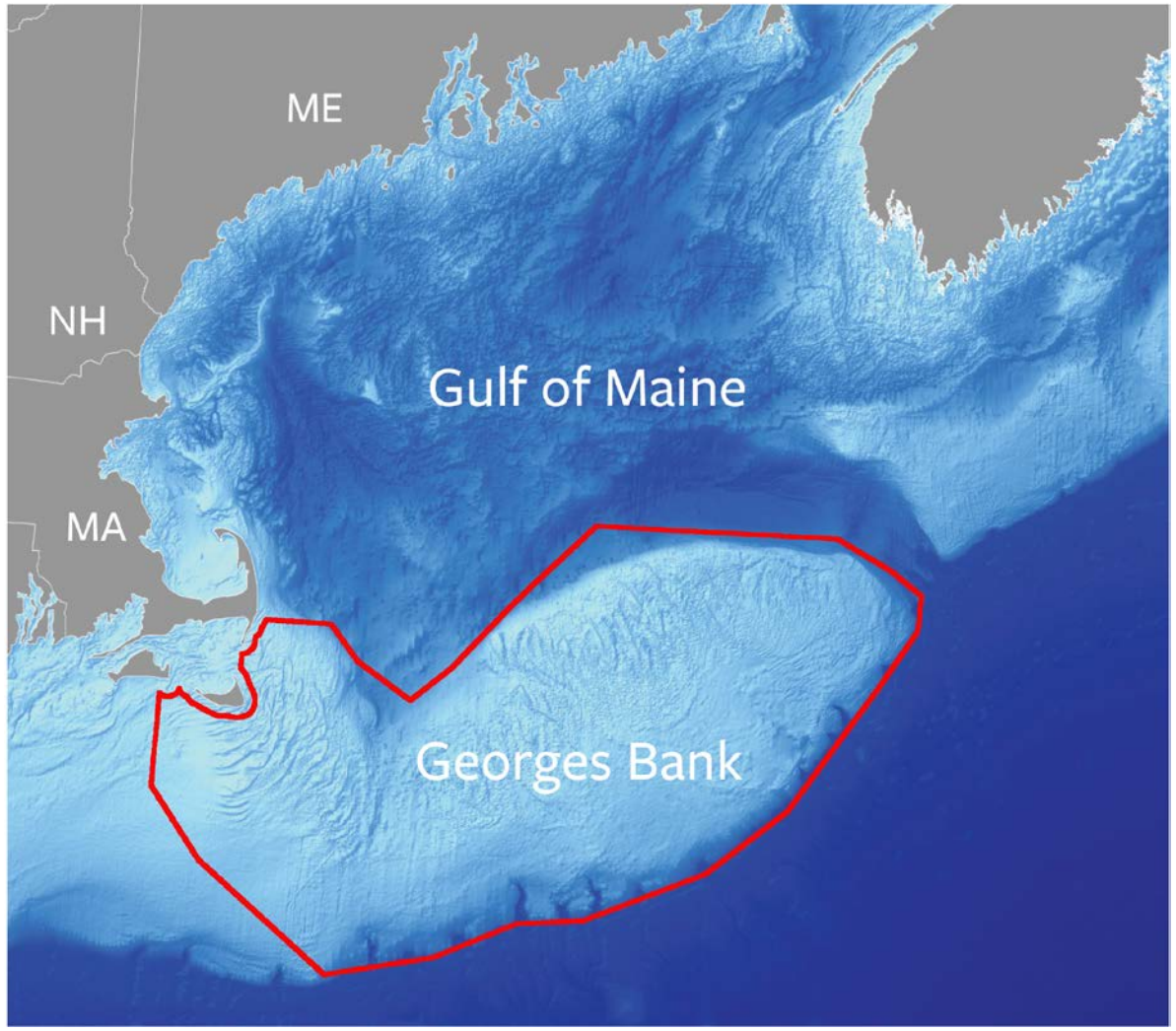
Worked Example

- Using data and the Hydra model, single species and ecosystem-based fishery management on Georges Bank were compared
- Link to Hydra document - https://bit.ly/HydraPlainLang



Worked Example – Boundaries

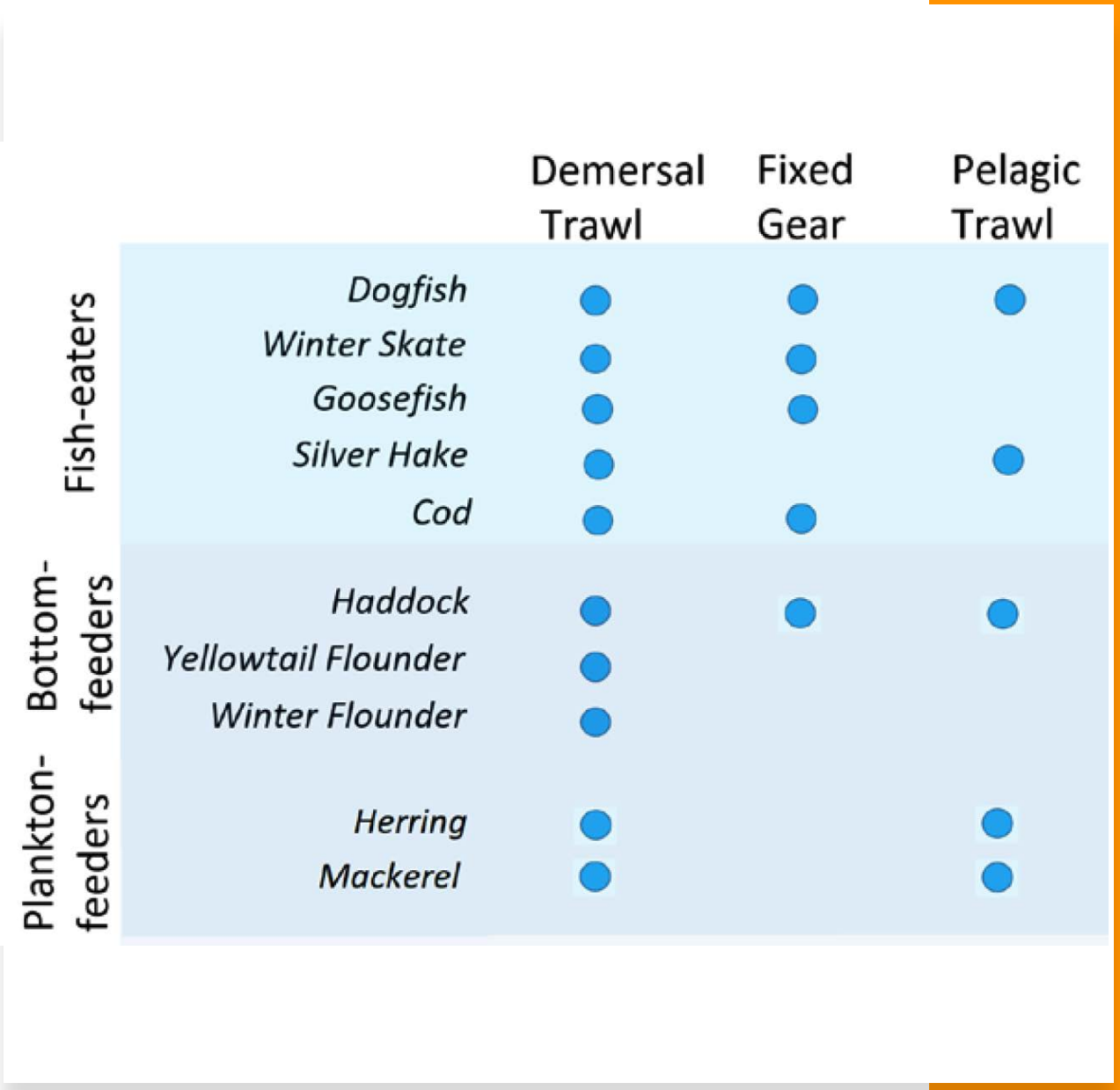
- Georges Bank and Nantucket Shoals identified
- Well studied and lots of data



Worked example – Stock complexes

Stock complexes are groups of fish that play similar roles in the ecosystem and are often caught together.

For the worked example, 10 species of fish distributed among three stock complexes that are caught by three different fleets were examined.



Worked example – Harvest control rules

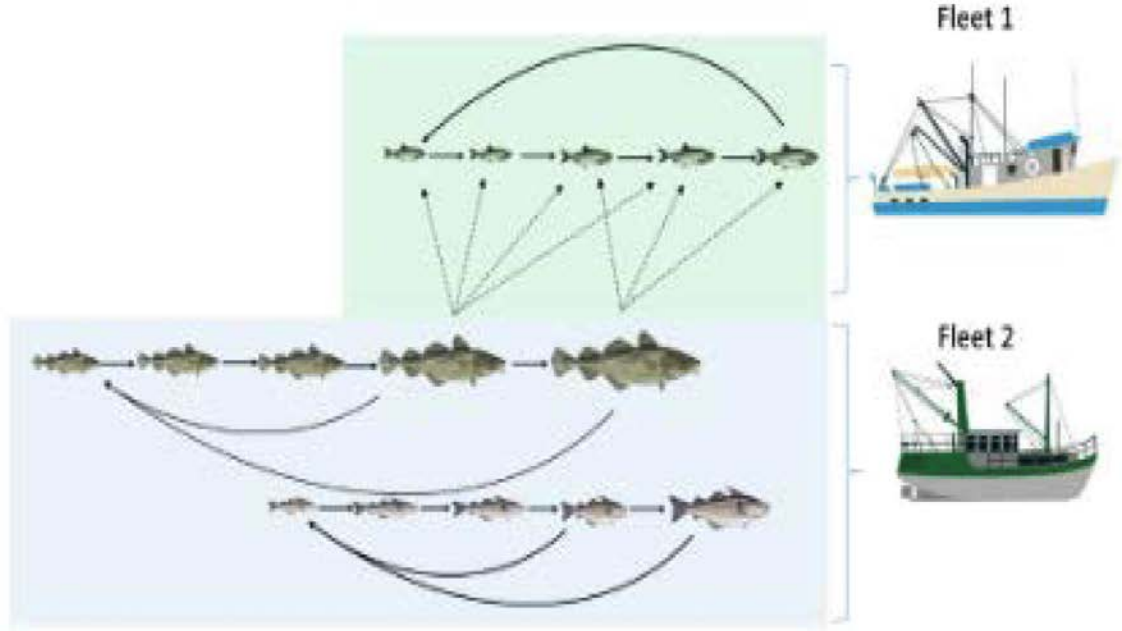
Example harvest control rules to illustrate the concept

1. Landings of a species are prohibited once its biomass falls below a threshold of 20% unfished (30% dogfish or winter skate)
2. Fishing pressure is gradually reduced once any species in a complex drops below 40% unexploited (50% dogfish and skate

Worked example – Hydra model

Computer model that examines environmental factors as well fishery factors including:

- Population biomass
- Catch (landings & discards)
- Gross revenues
- Stability in biomass
- Stability of the catch
- Probability of depletion
- Biomass of largest population and catch size classes



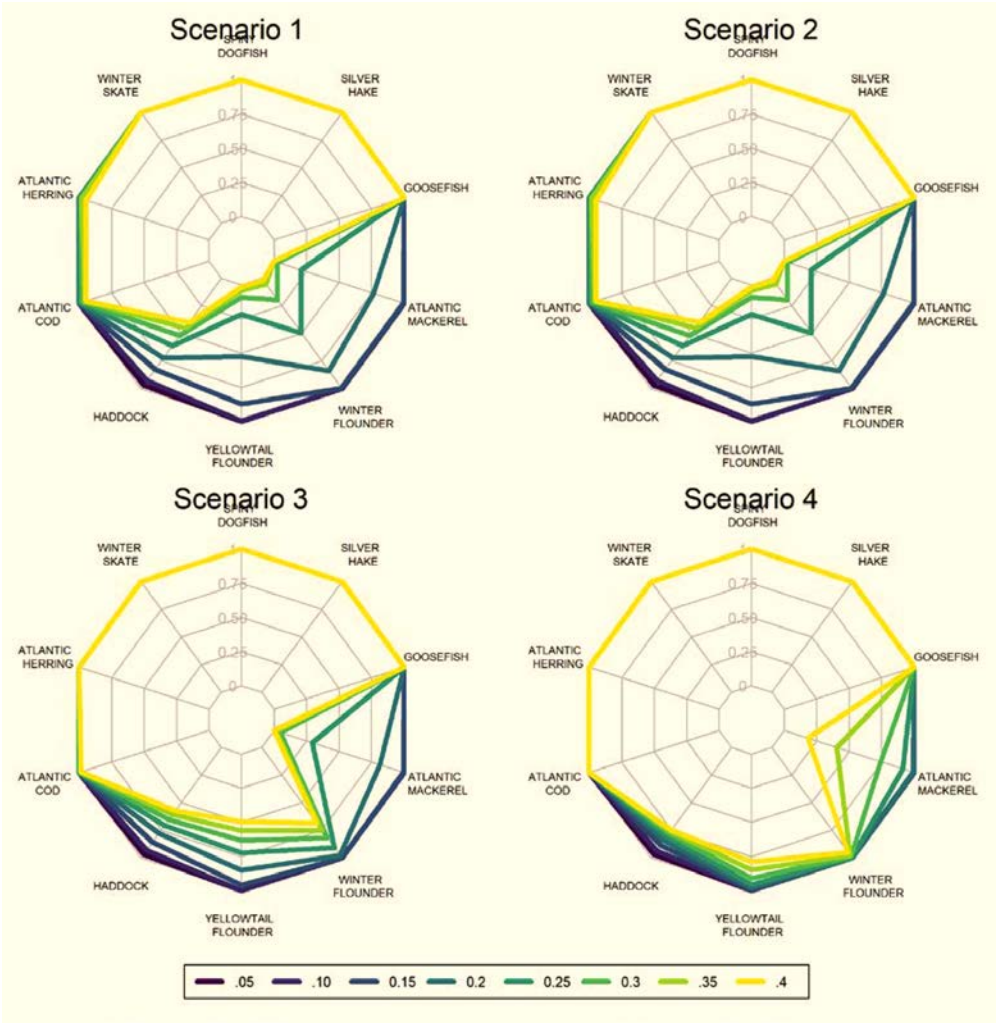
Worked example – Scenarios (different types of harvest control rules)

Scenario 1 – Fixed exploitation rate

Scenario 2 – Fixed exploitation rate with floors assessed at species level

Scenario 3 – Variable exploitation rate

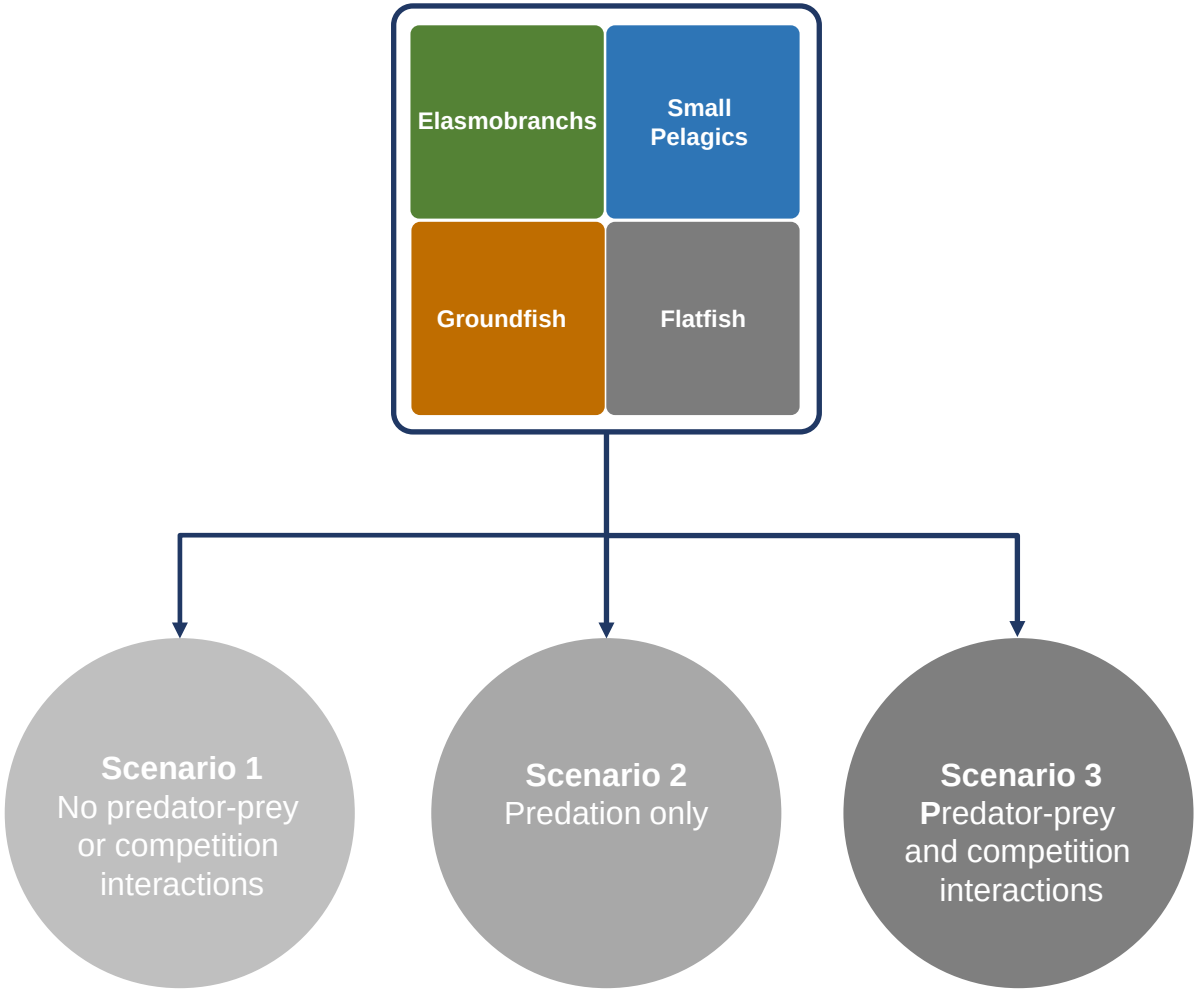
Scenario 4 – Variable exploitation with fishing pressure reduced over time



Kraken Visualization Tool

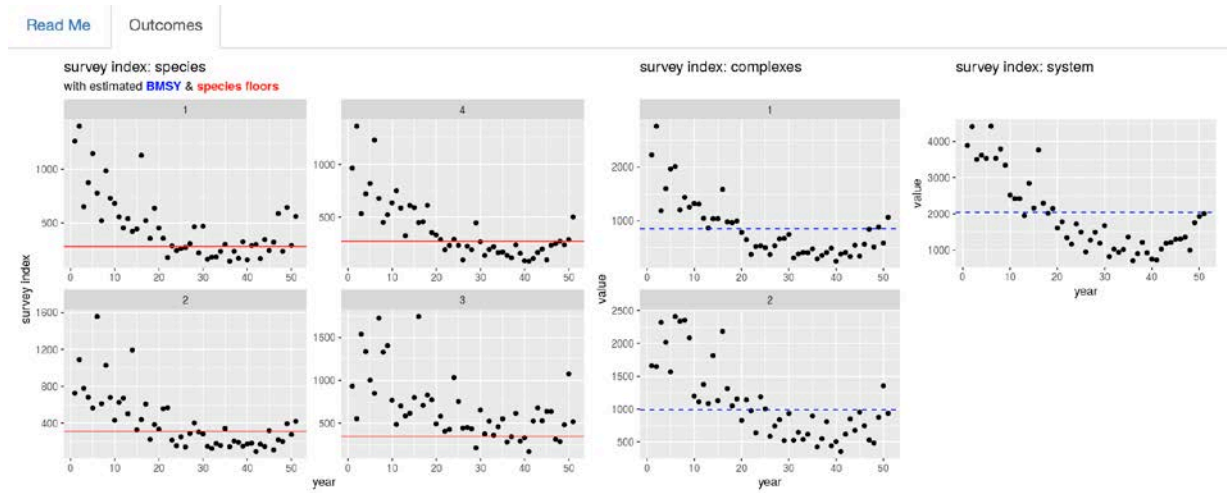
- A model developed to help demonstrate how biomass and catch estimates are impacted by consideration of predation and competition.
- There are 10 economically important species grouped in 4 complexes:
  - Elasmobranchs (skates and spiny dogfish)
  - Small pelagics (Atlantic herring and Atlantic mackerel)
  - Groundfish (cod, haddock, and redfish)
  - Flatfish (windowpane flounder, winter flounder, and yellowtail flounder)

Kraken document - https://bit.ly/KrakenDoc
Link to model - https://bit.ly/Kraken_exe



EBFM Catch Framework Demonstration

- Online tool that simulates the steps taken to develop catch advice as outlined in the eFEP.
- A user can test single species and stock complex management with or without catch ceilings and biomass floors



Neither stock complex has species assessed to be below the biomass floor, so F is not reduced.

Assessment results & catch advice

Complex	FMSY	BMSY	B_final	F/FMSY	B/BMSY	Catch at FMSY	Floor F multiplier	F	Catch at F	Ceiling	Advice
1	0.15	1,786	1,523	0.68	0.85	226	1	0.11	170	474	170
2	0.14	1,122	1,100	0.48	0.98	149	1	0.10	111	474	111

Assessment results & catch advice

Species	FMSY	BMSY	B_final	F/FMSY	B/BMSY	Catch at FMSY	F	Catch at F	Ceiling	Advice
1	0.15	983	913	0.73	0.93	141	0.12	106	474	106
2	0.12	727	510	0.72	0.70	62	0.09	46	474	46
3	0.16	406	520	0.31	1.28	85	0.12	64	474	64
4	0.10	991	669	0.70	0.67	69	0.08	52	474	52

Document - https://bit.ly/CatchFrameworkDoc
Online tool - https://bit.ly/CatchFramworkTool

For More Information:

- NEFMC EBFM committee page
  https://bit.ly/NEFMC-EBFM
- NEFMC Draft eFEP
  https://bit.ly/DrafteFEP