Improving science advice for fisheries management with Ecosystem and Socioeconomic Profiles

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Spring 2025

Acknowledgements

- National Coordination Team
- Northeast Fisheries Science Center
- Alaska Fisheries Science Center
- Alaska Fisheries Information Network
- Alaska and Northeast Communications Branches
- Northeast Research Track Stock Assessment Working Groups
- & other collaborators

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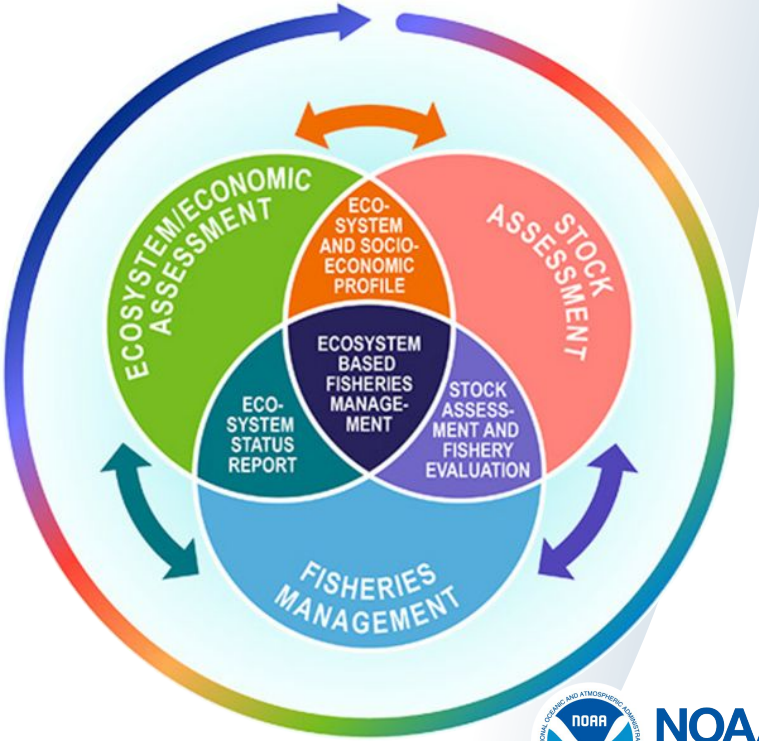
Next-generation fisheries science needs

- Changing systems, but most monitoring & management is designed for stability
- Research & reports are often siloed
- Clear need for a synthetic process that can help achieve Ecosystem Based Fisheries Management



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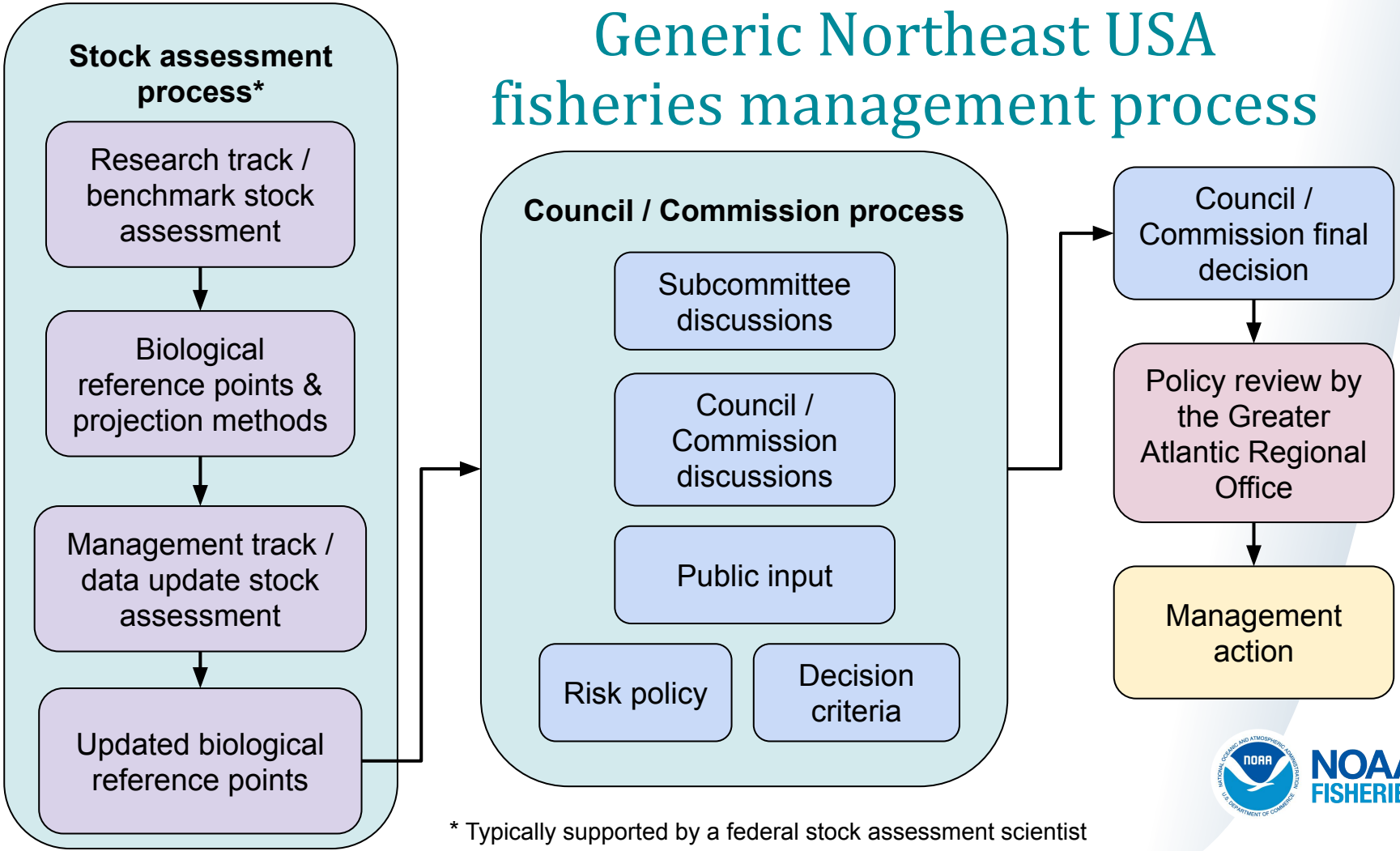
Generic Northeast USA fisheries management process



* Typically supported by a federal stock assessment scientist

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FISHERIES SCIENCE AND MANAGEMENT SYSTEM

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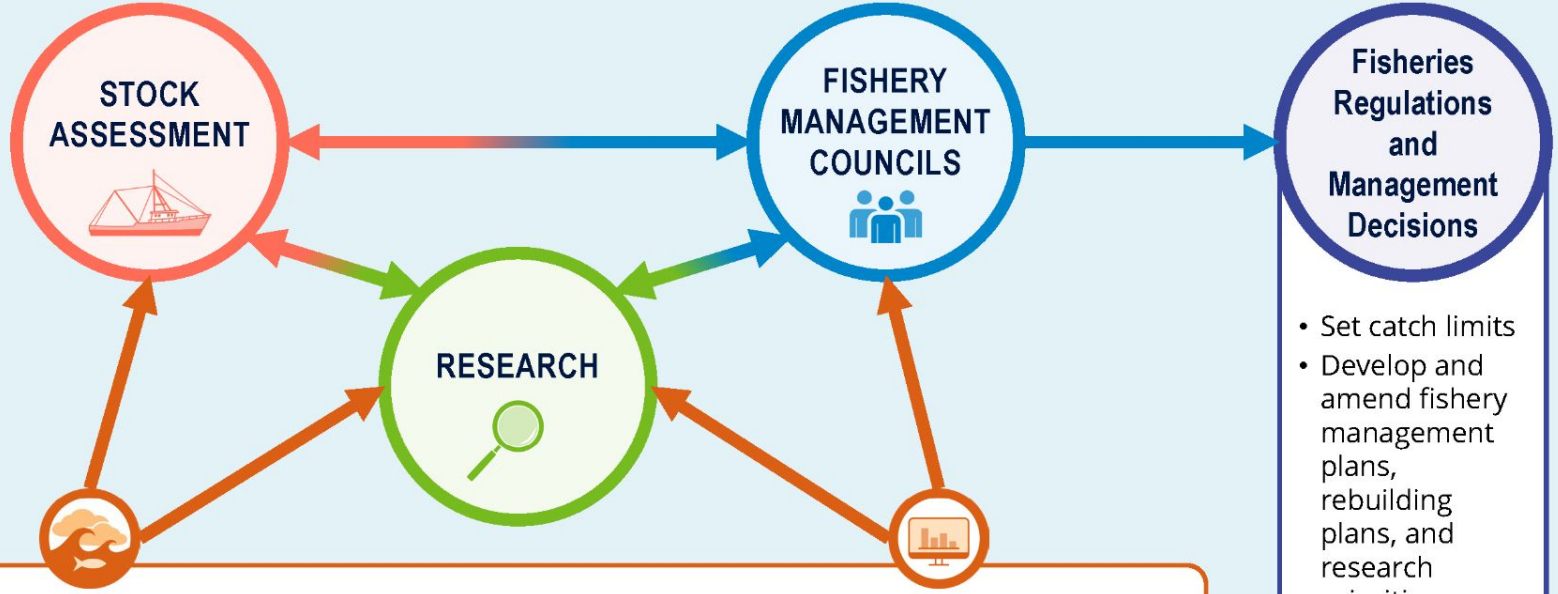


Addresses Term of Reference to identify ecosystem and climate influences

- Improves fisheries stock assessments
- Informs decisions that determine the health and abundance of fish stocks

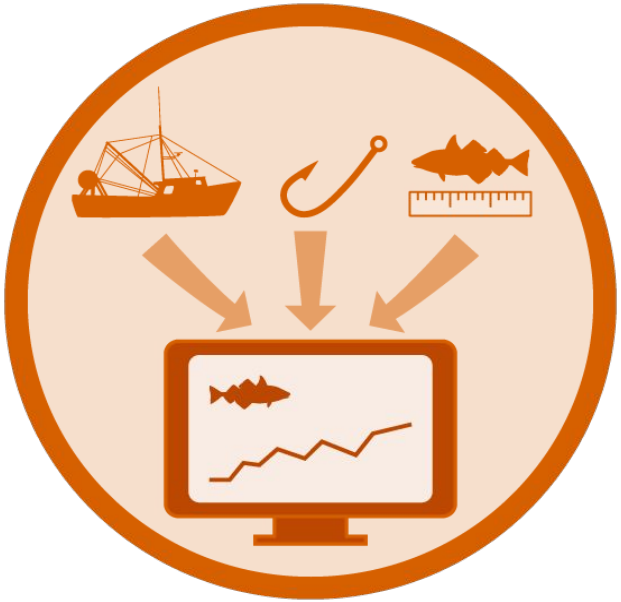
Ecosystem and Socioeconomic Profile Information

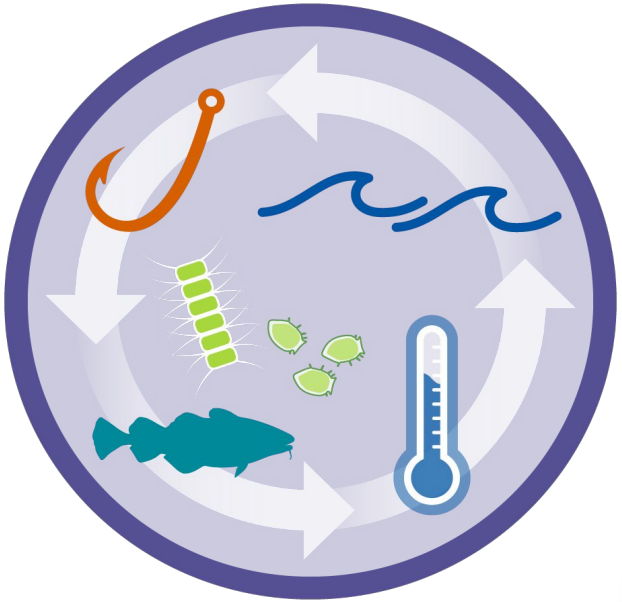
Provides scientific information to fisheries managers

- Improves estimates of risk and uncertainty
- Can be used in setting sustainable harvest policies
- Highlights research needs and data gaps

Using ecosystem & socioeconomic information for fisheries management

- Quantitative applications: "in the model"
- Qualitative applications: "outside the model"





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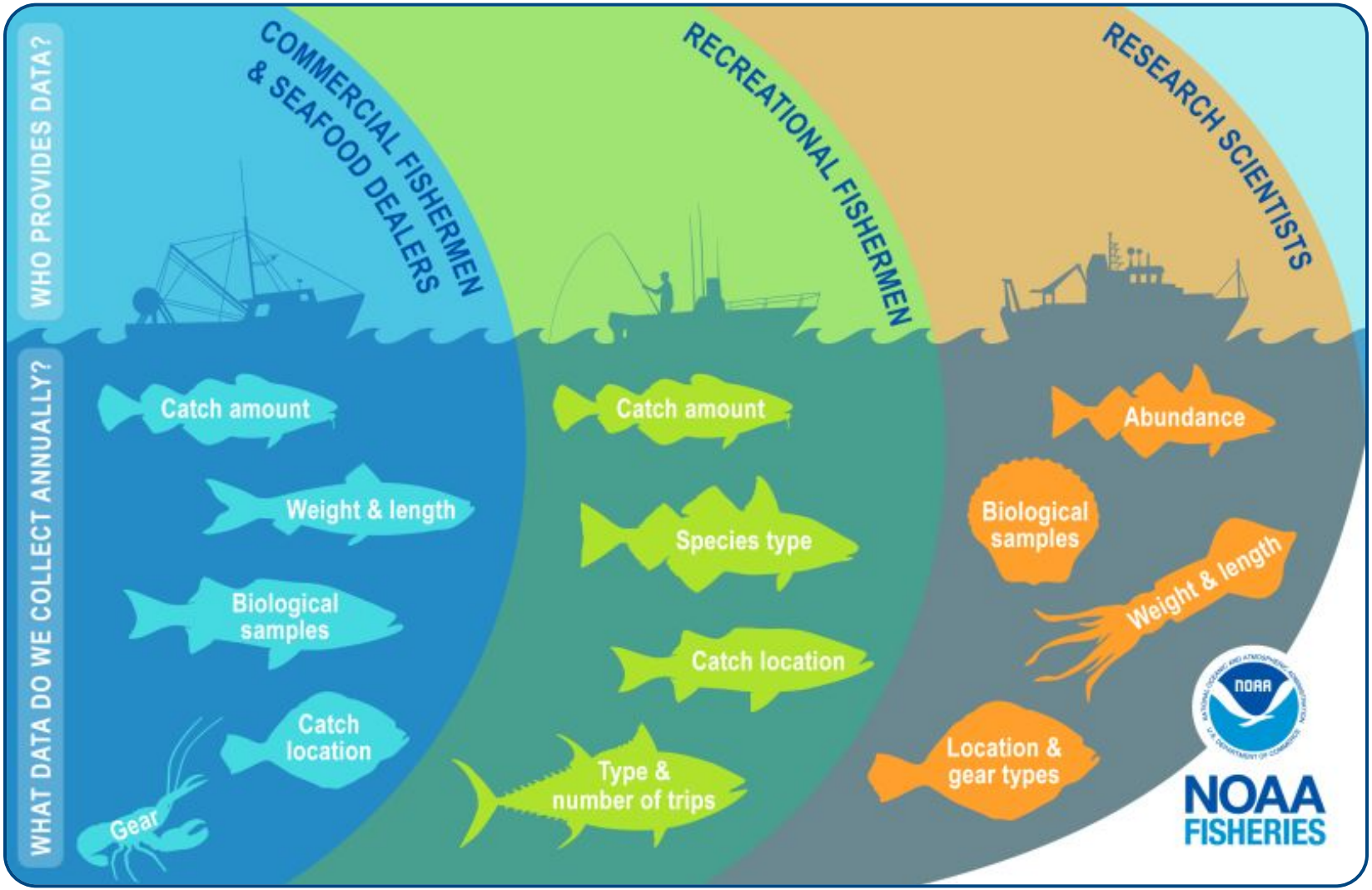
WHO PROVIDES DATA?
COMMERCIAL FISHERMEN & SEAFOOD DEALERS
RECREATIONAL FISHERMEN
RESEARCH SCIENTISTS
WHAT DATA DO WE COLLECT ANNUALLY?
Catch amount
Weight & length
Biological samples
Catch location
Gear
Catch amount
Species type
Catch location
Type & number of trips
Abundance
Biological samples
Weight & length
Location & gear types
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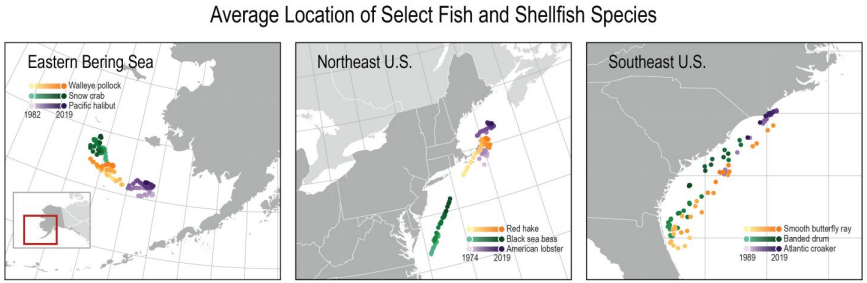
Qualitative applications: "outside the model"

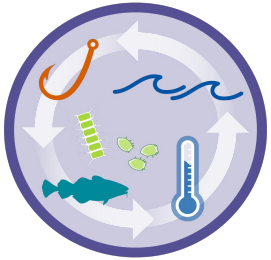
- Help Science and Statistical Committees set Acceptable Biological Catch, understand uncertainty and risk, develop rebuilding plans
- Help Fisheries Management Councils set Total Allowable Catch, create harvest control rules, develop rebuilding plans
- Inform scientific survey plans, help set research priorities and requests for proposals

	Environmental/ecosystem considerations
Level 1: Normal	No apparent environmental/ecosystem concerns.
Level 2: Substantially increased concerns	Some indicators showing an adverse signals but the pattern is not consistent across all indicators.
Level 3: Major Concern	Multiple indicators showing consistent adverse signals a) across the same trophic level, and/or b) up or down trophic levels (i.e., predators and prey of stock)
Level 4: Extreme concern	Extreme anomalies in multiple ecosystem indicators that are highly likely to impact the stock. Potential for cascading effects on other ecosystem components.

Part of the Alaska risk table (Dorn and Zador 2020)



https://www.globalchange.gov/indicators/marine-species-distribution



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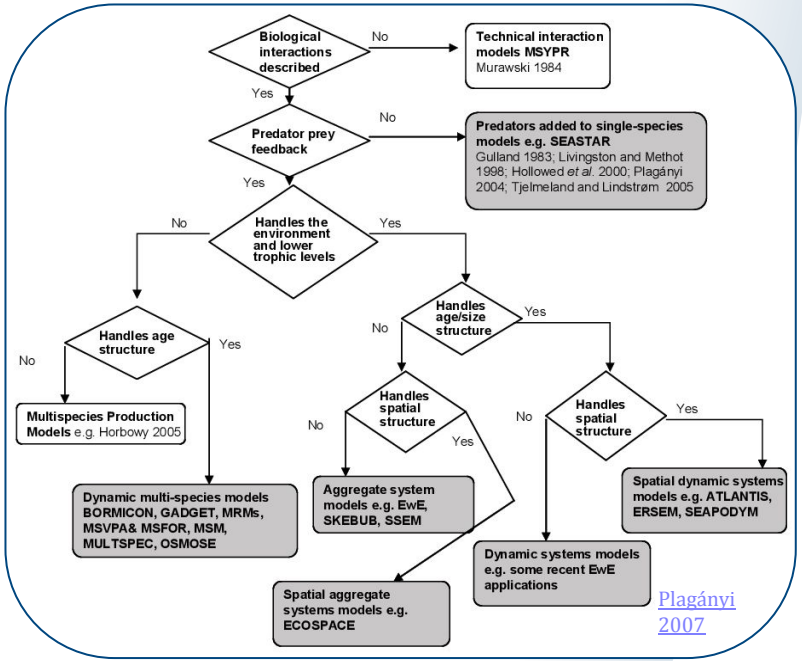
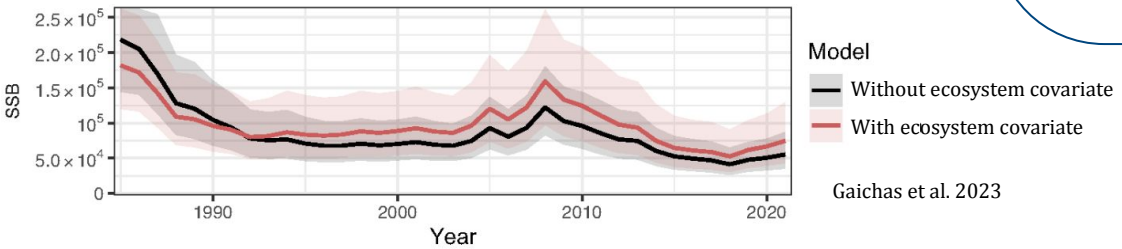
Quantitative applications: "in the model"

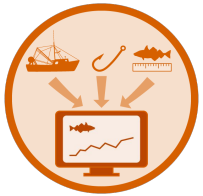
- Support selection of model platform; model assumptions around mechanistic linkages and life history
- Inform model choices such as data condition, time blocking, setting fixed parameter values
- Include in model as a covariate (e.g., Woods Hole Assessment Model)



Plagányi 2007



Gaichas et al. 2023



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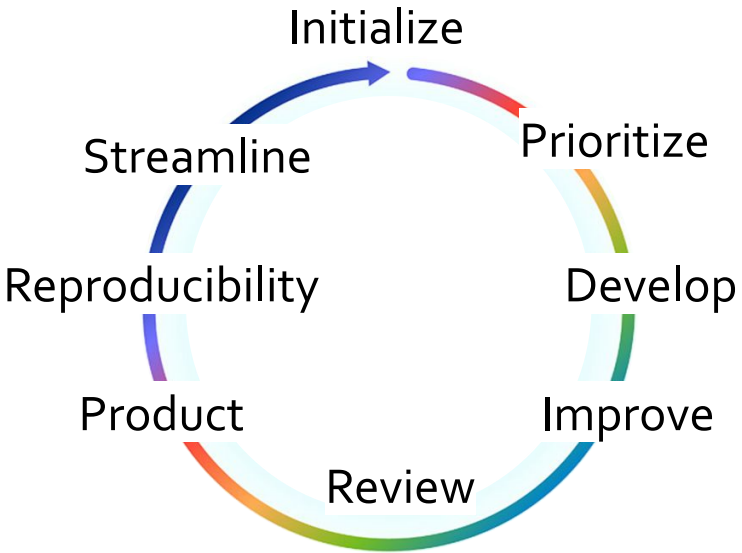
ESP Progression

2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024

Alaska ESPs



Pacific Islands ESPs

Northeast ESPs

National workshops & resources to support ESP development

General ESP Process

Shotwell et al. 2023

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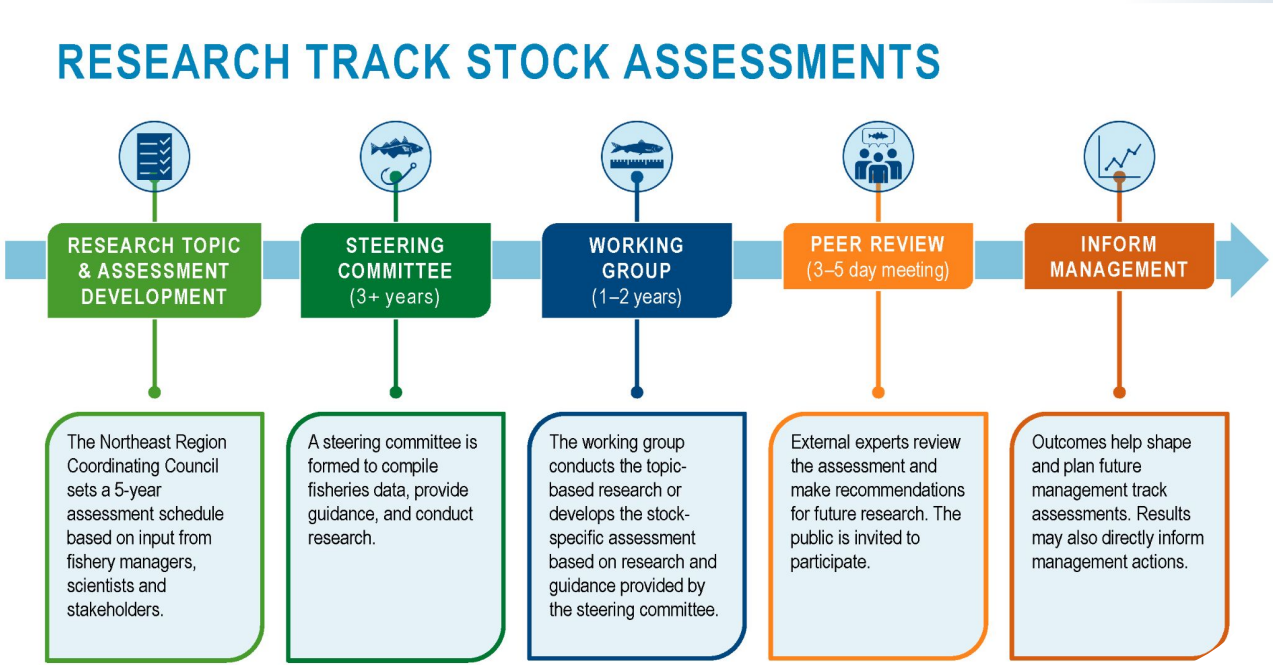
Research Track Stock Assessment schedule set by the Northeast Regional Coordinating Council (NRCC)

- Objectively review stocks
- Use regional priorities
- Identify ESP stocks



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Working towards ESP implementation in Research Track Stock Assessments in the Northeast

Species	Status	Peer Review Date
Shortfin squid	Ecosystem working paper	2022-02-02
American plaice	Ecosystem working paper	2022-07-18
Bluefish	ESP	2022-12-05
Atlantic cod	ESP	2023-07-31
Black sea bass	ESP	2023-12-05
Golden tilefish	ESP	2024-03-11
Yellowtail flounder	Ecosystem working paper	2024-11-01
Atlantic herring	In progress	2025-03-11
Longfin squid	Under consideration	2026-02-01

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- Conduct literature evaluation
- Create ecological synthesis
- Identify mechanistic linkages

- Semi-systematic literature review using Web of Science
- Conceptual model of stock life history and major bottlenecks

detailed summary	region	summary	Article Title	Authors	Publication Year
Gonadosomatic indices and larval abundance and distribution (MarMAP) suggest continuous spawning in bluefish. Oceanographic model predicts that larvae from the middle of the spawning season do not recruit, giving bimodal recruitment peaks.	Western Atlantic	bluefish gonadosomatic index and spawning timing	ECOLOGICAL AND EVOLUTIONARY IMPLICATIONS OF THE LARVAL TRANSPORT AND REPRODUCTIVE STRATEGY OF BLUEFISH POMATOMUS-SALTATRIX	HARE, JA; COWEN, RK	1993
Description of otolith microstructure					
Bluefish occurence significantly dec But no change in bluefish length wit					

Estuarine juvenile

Habitat and distribution

Spring and summer cohorts had low spatial overlap in the estuary.	Stormer and Juanes 2017
Bluefish occurrence was significantly lower when dissolved oxygen was below 2mg/L. There was no relationship between bluefish length and dissolved oxygen concentration.	Howell and Simpson 1994

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- Create indicator suite
- Monitor indicators frequently
- Conduct tests on trends

- Some variation depending on stock
- Trend and status (±SD from mean)
- Correlations and/or Generalized Additive Models to assess connections between environment and stock

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- Create standard templates
- Integrate with management
- Report status and trends

- Working paper in stock assessment report
- Goals: provide contextual advice, identify mechanistic linkages for data training, evaluate indicators for use in stock assessment model
- Developing standard report format at May 2024 workshop

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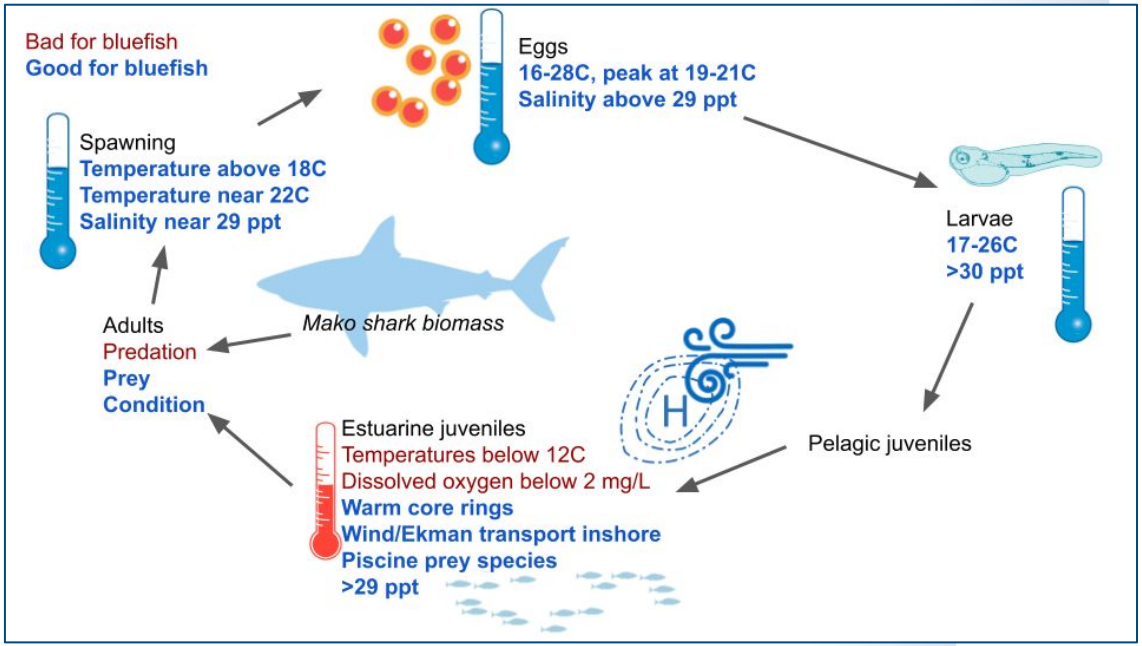
Northeast ESP example: Bluefish

- Developed indicator rating criteria ("theoretical and operational suitability")
- Distribution and temperature analyses
- Socioeconomic data suggested a shift towards catch and release



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Developing a national toolbox for analysis & communication

- Standardizing and automating methods for all ESP steps (a work in progress)
- Indicator development
  - Common data streams: satellite data, scientific surveys, commercial landings
- Figures, tables, and reporting
  - AKesp and NEesp2 R packages
- Analytical methods
  - Correlatory statistics
  - Causal statistics
  - Best practices for ecosystem-liked stock assessments
- Working to expand utilities and collaborate nationally

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- **ESPs provide regions with a structured but adaptable approach** to support and track climate-informed fisheries management and EBFM.
- **ESPs are an opportunity for cross-region and cross-disciplinary collaboration** that fosters creative research and iterative improvements.
- **Data management and automation methods are in development** to help launch, streamline, and coordinate the ESP process at all six science centers.

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