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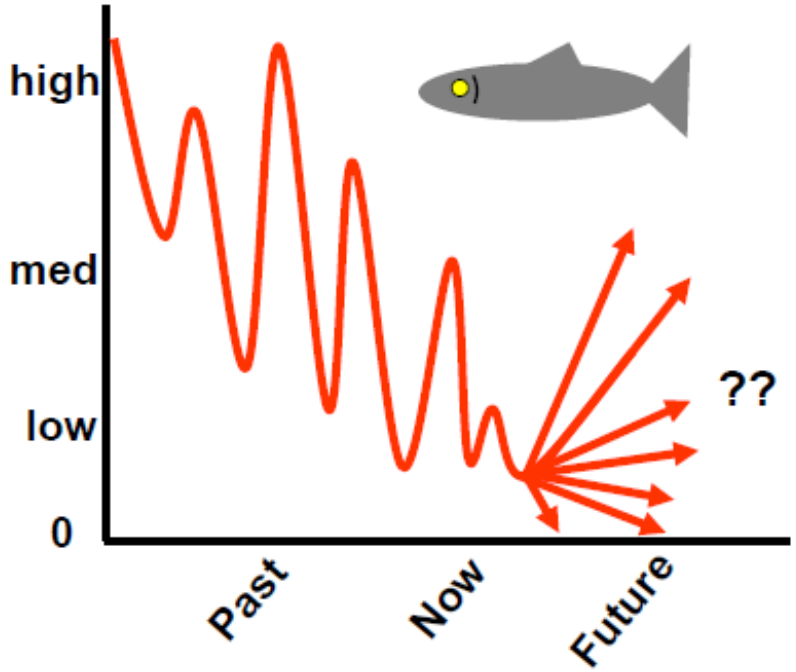
Considering Uncertainty in Council Decisions



Steve Cadrin (SMAST)
Tom Nies (NEFMC)
Lisa Kerr (SSC Chair, U Maine)
Cate O'Keefe (SSC Vice Chair, Fishery Applications)

January 25, 2023 NEFMC Council Meeting

University of Massachusetts Dartmouth SMAST

New England Fishery Management Council

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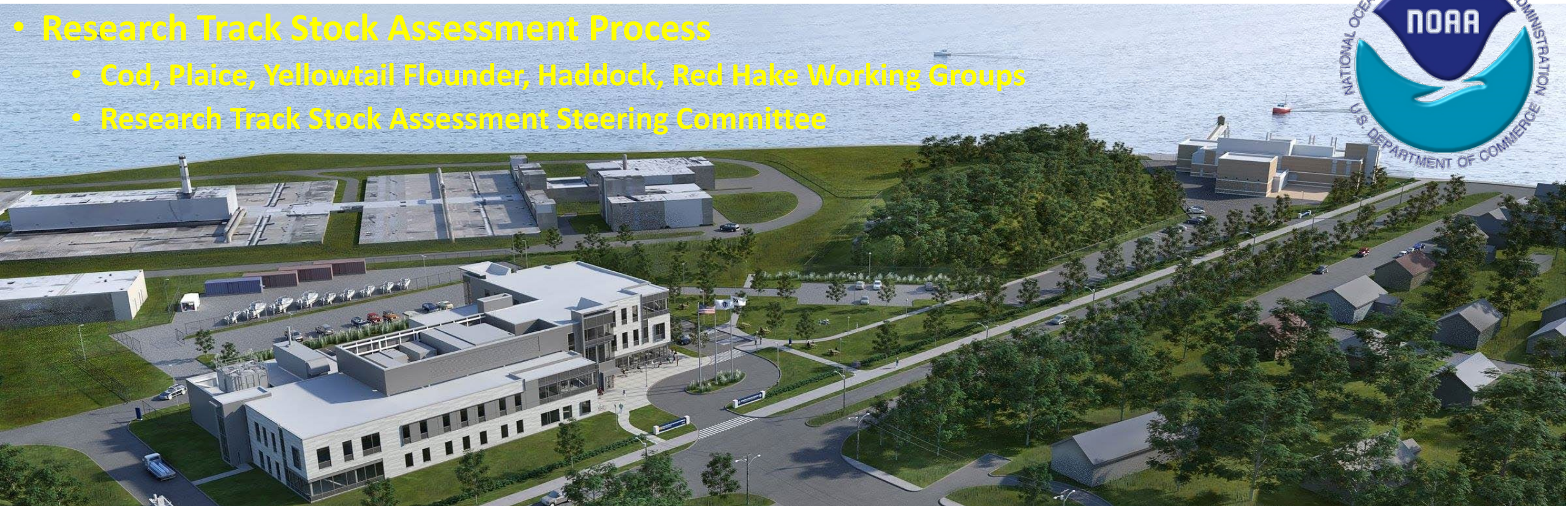
Fishery Applications Consulting Team

Re-Introduction

- Stock assessment and fisheries management advice (UMass SMAST)
- Recent Council Engagement
  - Fishery Data for Stock Assessment Working Group (2018-2019)
  - Scientific and Statistical Committee (2008-2017)
  - Risk Policy Working Group (2013-2016)

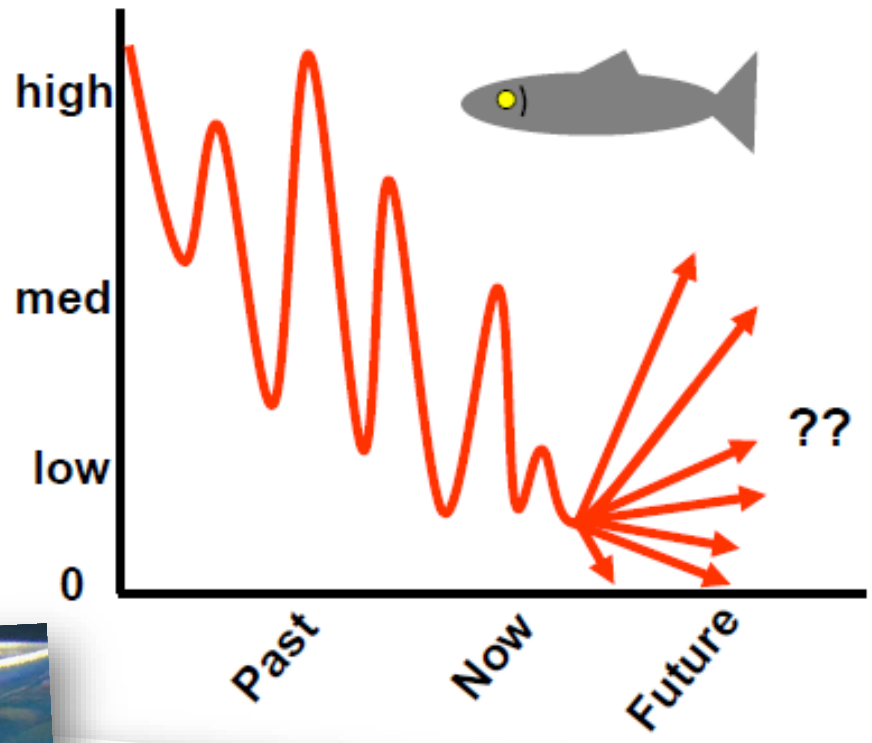
New England Fishery Management Council

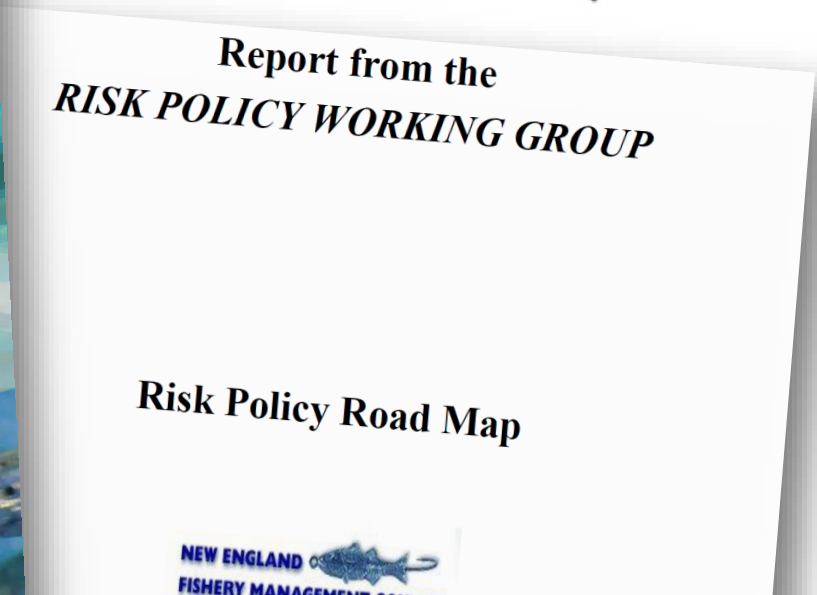
- **Research Track Stock Assessment Process**
  - **Cod, Plaice, Yellowtail Flounder, Haddock, Red Hake Working Groups**
  - **Research Track Stock Assessment Steering Committee**



Uncertainty in Stock Assessments

- Sources of Scientific Uncertainty
  - Data
  - Models
  - Ecosystems
- Identifying, Communicating & Reducing Uncertainty
  - Environmental change
  - Risk-based management
- Risk Policy





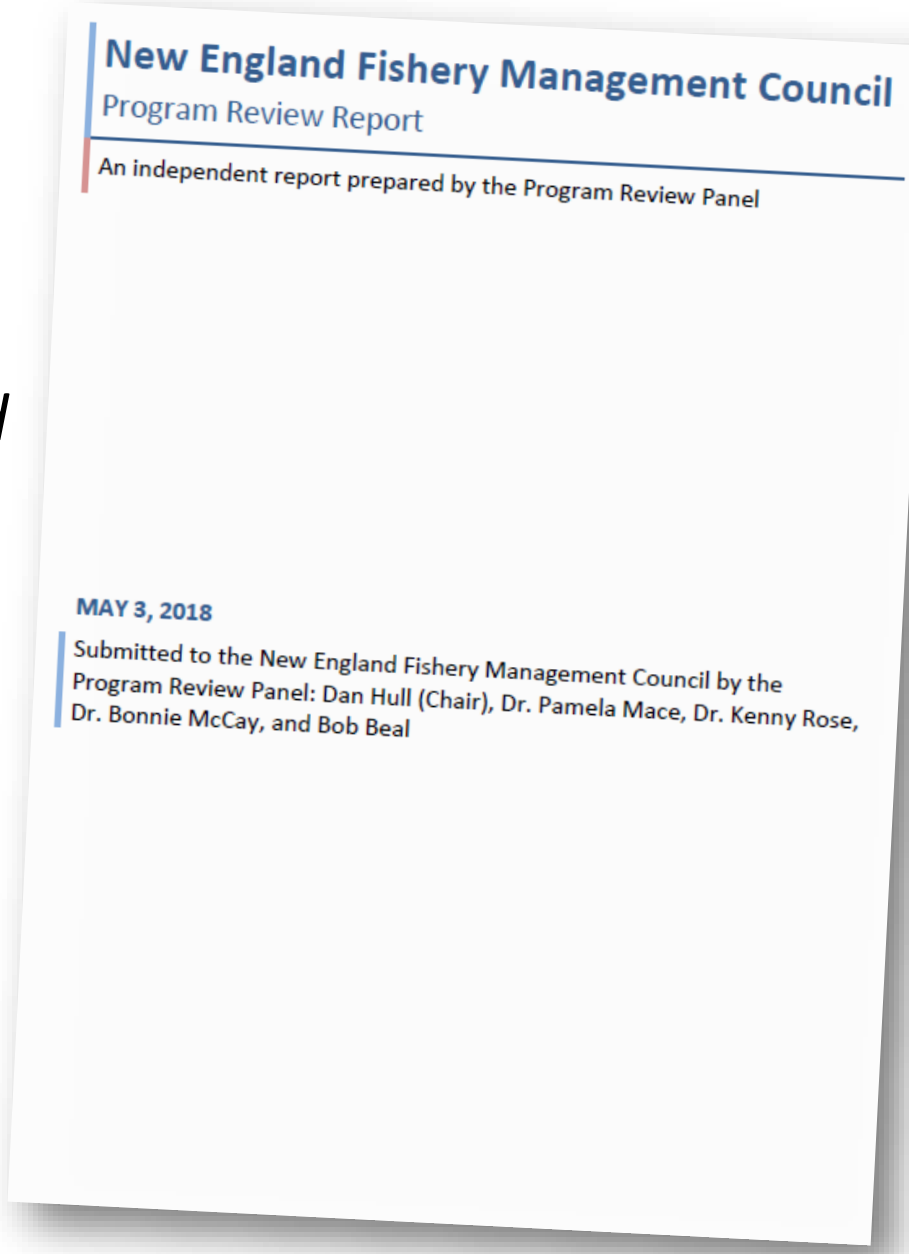
2018 Program Review

- The impact scientific information has on the performance of the Council

- *"The level of uncertainty in information and how to deal with that uncertainty needs to be better appreciated and understood."*

- *"The Panel recommends that the Council be fully informed about the limitations of biological, ecological, economic and social data and how uncertainty affects the ability for Council staff and others to answer specific questions."*

- *"Offer short (1-2 hour) courses for the Council and longer-term (1-2 day) courses for staff training in quantifying, interpreting, and communicating uncertainty."*


New England Fishery Management Council

Program Review Report

An independent report prepared by the Program Review Panel

MAY 3, 2018

Submitted to the New England Fishery Management Council by the Program Review Panel: Dan Hull (Chair), Dr. Pamela Mace, Dr. Kenny Rose, Dr. Bonnie McCay, and Bob Beal

January 2019 Presentation to Council

- Recommendation 1: Clearly communicate sources, treatment and impacts of uncertainty
- Sources of Uncertainty
  - Scientific Sources
    - Data – '*measurement error*'
    - Model – '*estimation error*'
    - Ecosystem – '*process error*'
  - Management Sources – '*implementation error*'

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Uncertainty in Fishery Data (Measurement Error)

- At-Port
  - Dealer reports - census of commercial landings but no information on fishing effort and some misreporting
  - Port sampling – size and age composition but recent decrease in sampling intensity
  - Recreational catch – species and size composition but uncertain expansion to fishing effort
- At-Sea
  - Vessel Trip Reports - census of fishing effort but imprecise location
  - Observers - samples of discards with some deployment and observer effects
  - Electronic monitoring - pilot programs estimate discards with high resolution but not used in assessments
  - Vessel Monitoring Systems - higher resolution of fishing location but not used in assessments
- Catch Accounting and Monitoring System (CAMS) to integrate monitoring data - peer reviewed last week.

CAMS

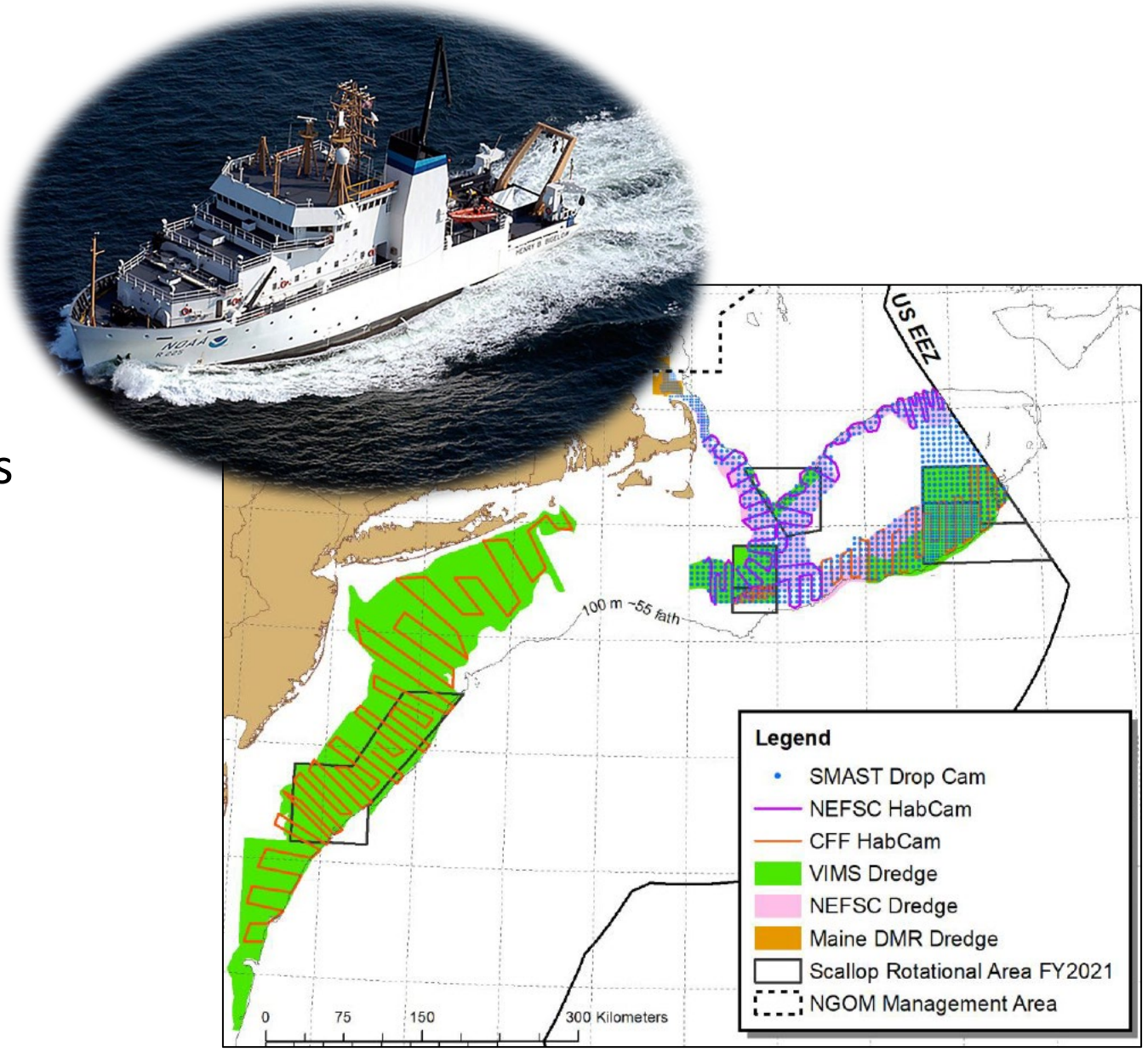
Stock Assessment

Quota Monitoring

Uncertainty in Fishery Data (Measurement Error)

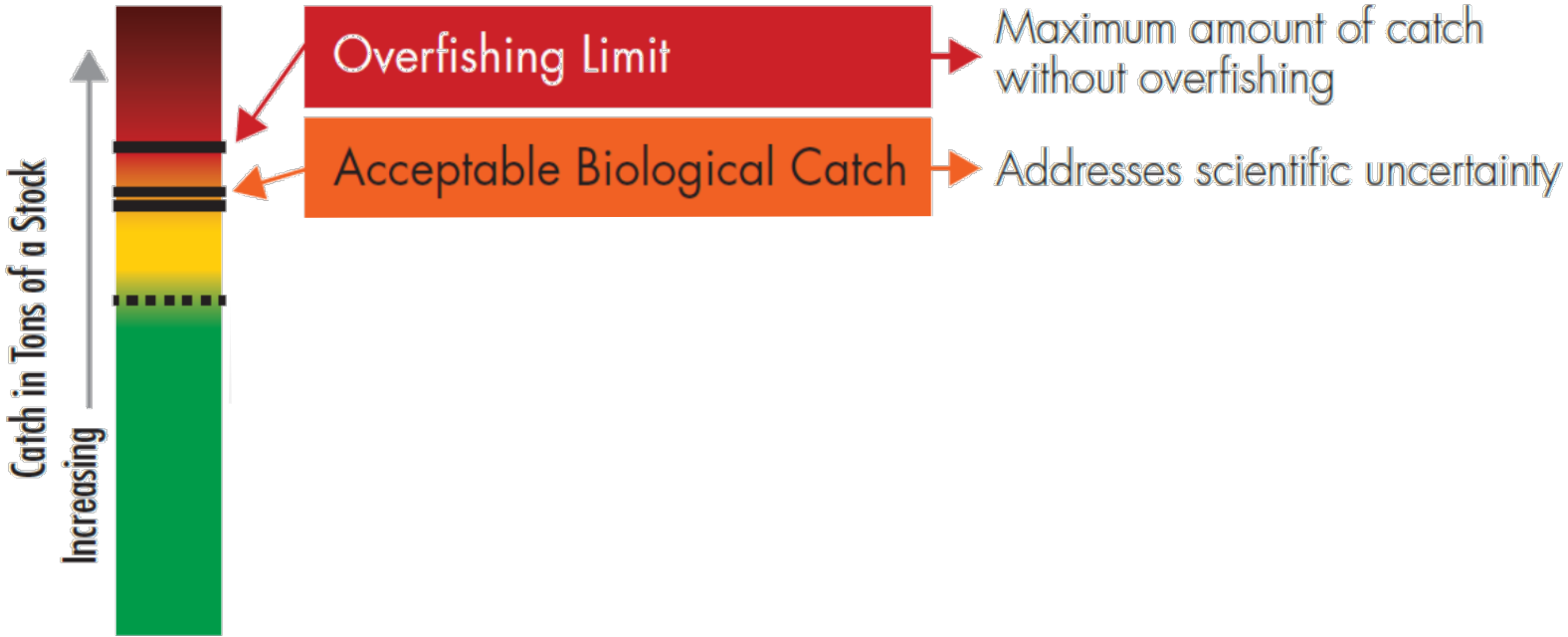
- Fishery-Independent Surveys
  - Stock trends, size, age composition
  - Multiple technologies and survey areas
  - Relatively few samples
  - Noisy indices for some stocks
  - Low precision for some overfished stocks
  - Recent changes in survey methods
  - Recent missing or incomplete surveys

- Spatial integration of multiple surveys for some stocks

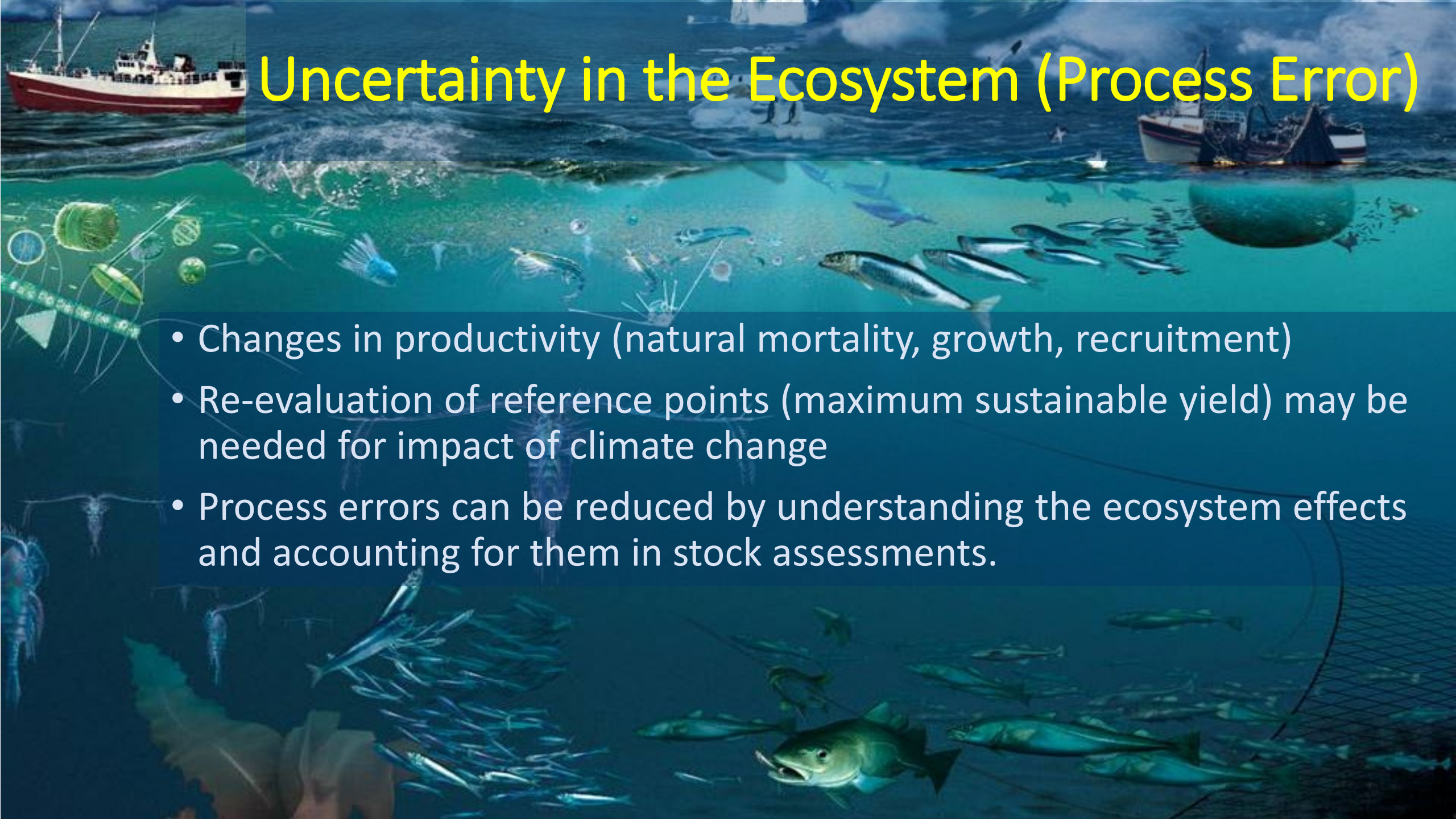


Uncertainty in Models (Estimation Error)

- Model assumptions: natural mortality, fishery selectivity, recruitment, maturity
  - Precision can be evaluated by fit to the data and accounted for in buffers between the overfishing limit (OFL) and acceptable biological catch (ABC)
  - Consistency is measured by retrospective analysis
  - Accuracy can be evaluated through simulation
- Projection uncertainty (recruitment, natural mortality, growth, selectivity)
- Estimation and projection error can be reduced by
  - more information
  - best practices in modeling
  - field estimates of predation, consumption, selectivity and maturity



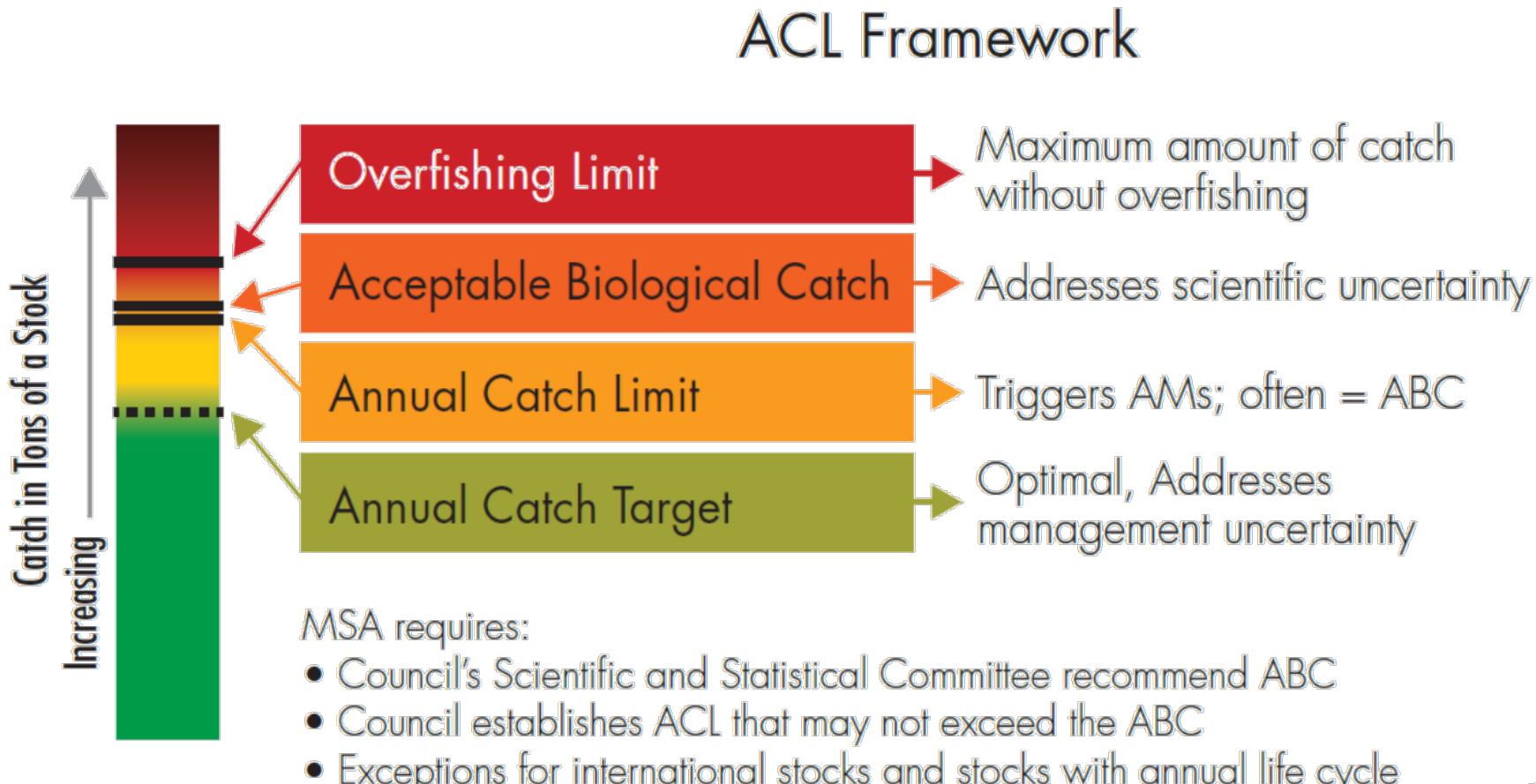
Uncertainty in the Ecosystem (Process Error)



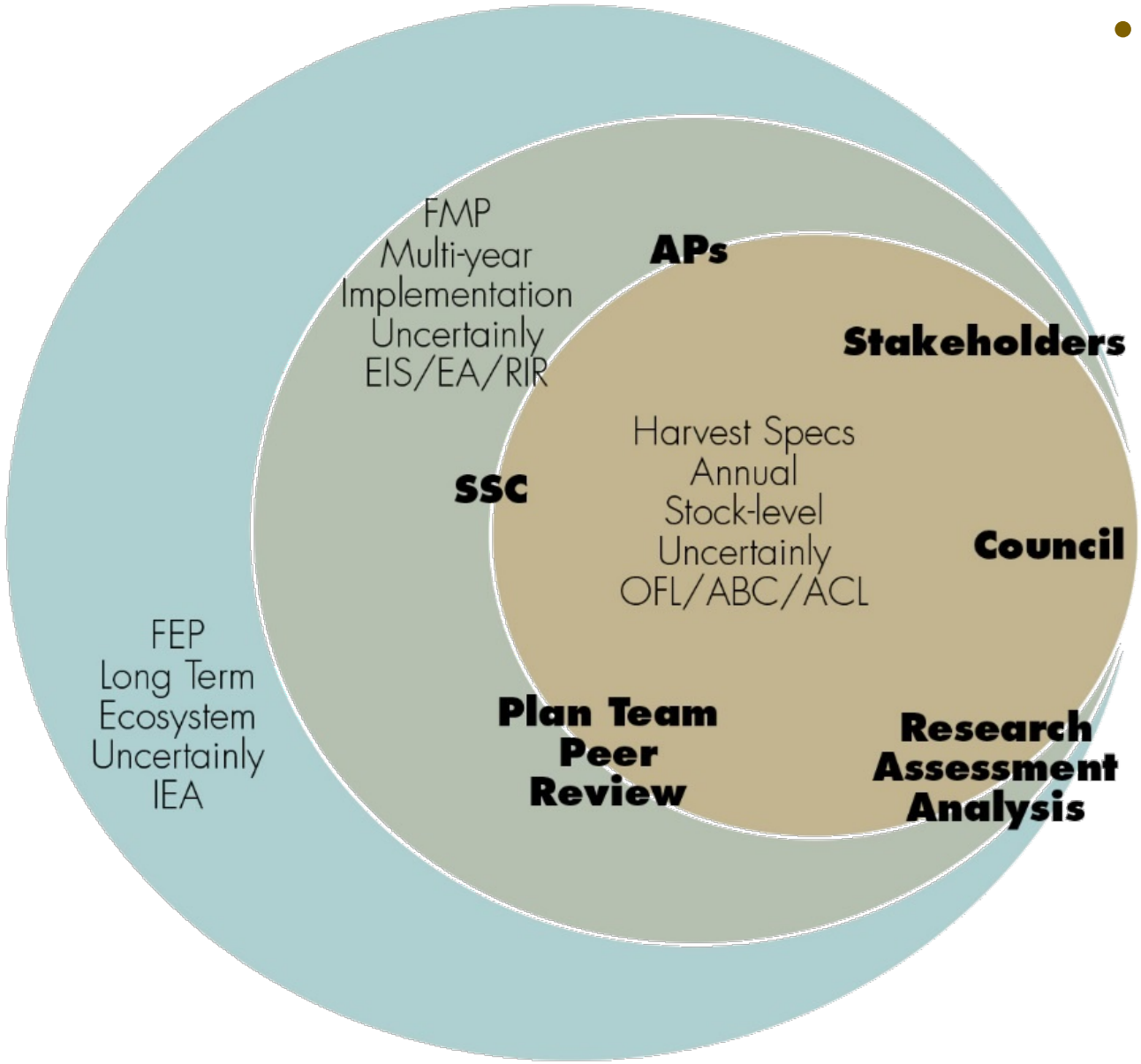
- Changes in productivity (natural mortality, growth, recruitment)
- Re-evaluation of reference points (maximum sustainable yield) may be needed for impact of climate change
- Process errors can be reduced by understanding the ecosystem effects and accounting for them in stock assessments.

Management Uncertainty (Implementation Error)

- Imprecise or biased catch monitoring (misreporting, misrepresentative samples)
- Annual Catch Target (ACT) can be less than the Annual Catch Limit (ACL)
- Implementation error can be reduced by in-season monitoring and enforcement.



Identifying Uncertainty



- Recommendation 2: Define stakeholder roles and responsibilities
  - Scientists and managers should work collaboratively in the fisheries science and management process so that they understand their responsibilities and interactions relating to uncertainty.
  - Fishery management plans involve longer-term objectives and strategies.
  - Fisheries Ecosystem Plans and Integrated Ecosystem Assessments provide long-term information on the marine 'climate'.

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Reducing Uncertainty

- Strategic allocation of investments in fishery-dependent and independent data, modeling and assessment processes can reduce uncertainty.

- Recommendation 3: evaluate benefits and costs of additional research, investments in data, or application of new methods for stock assessment.
  - A prioritization plan should focus resources to reduce uncertainty and risk.
  - Management Strategy Evaluation (MSE) can be particularly useful in this process.

- Recommendation 4: Congress and the Administration should support the Magnuson-Stevens Act with greater investments in the science needed to achieve its goals.
  - Particular attention is needed for recreational fisheries and data-limited situations.

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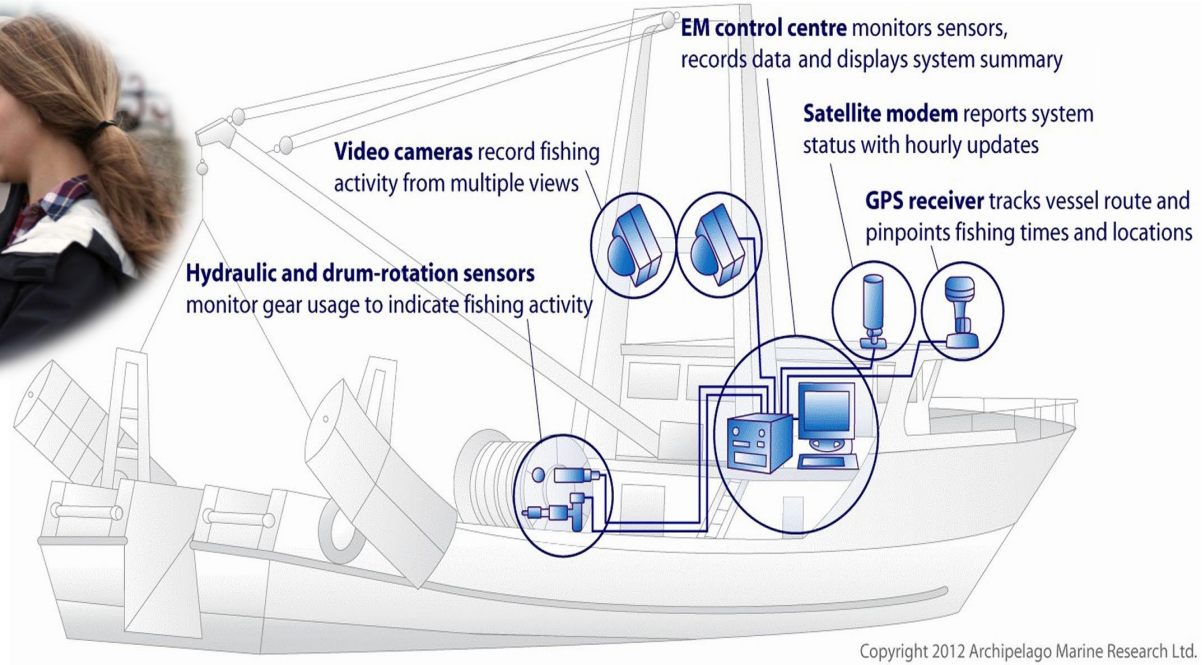
Reducing Uncertainty

- Recommendation 5: Prioritize improved catch accounting
  - When the benefits outweigh the costs, accurate catch accounting should be prioritized.
- Recommendation 6: Focus on cooperative research
  - Managers should invest in cost-effective cooperative research.
- Recommendation 7: Explore new technologies
  - Advanced technologies can improve fisheries-dependent and independent data.

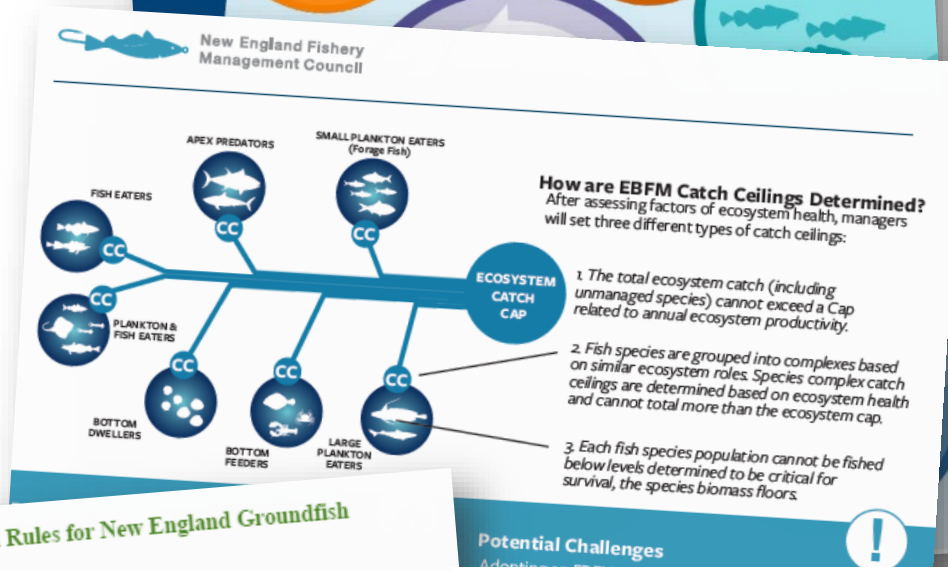


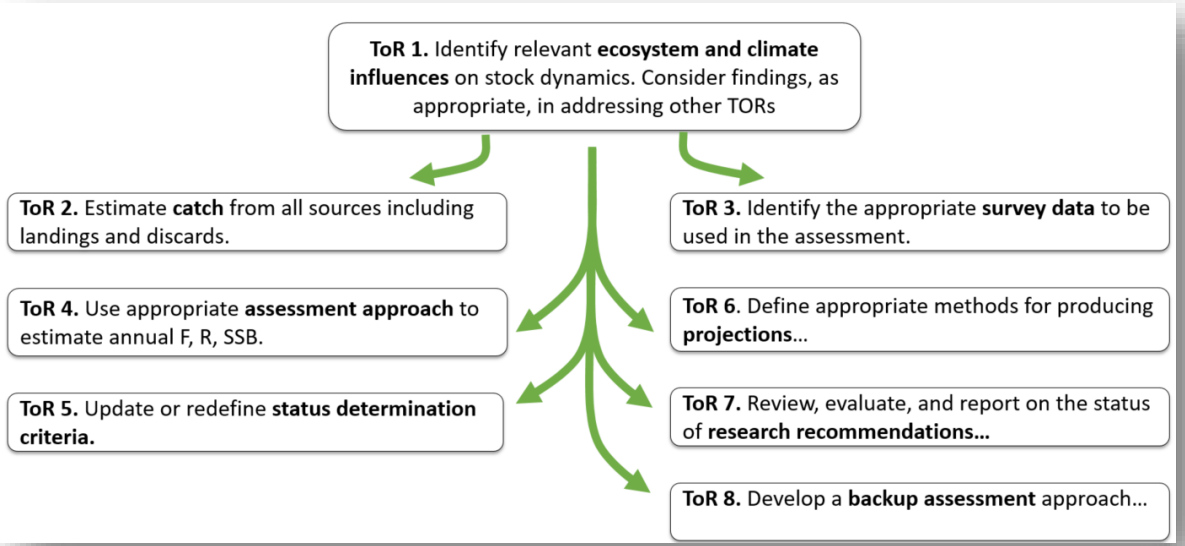
Reducing Uncertainty

- Recommendation 8: Address frequency of stock assessments
  - Promote the application of new information
- Recommendation 9: Evaluate methodologies for ‘data-limited’ stocks

Considering Environmental Change

- Recommendation 10: Expand fisheries oceanography research
- Recommendation 11: Integrate ecosystem science into stock assessments
- Recommendation 12: Prepare for environmental shifts through education, control rules and reference points



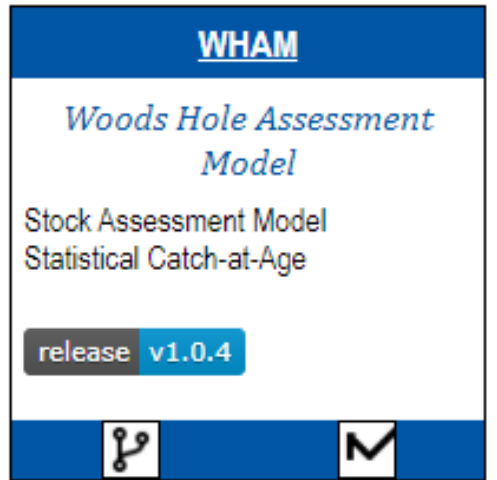



Evaluation of Alternative Harvest Control Rules for New England Groundfish

Mackenzie Mazur[1], Steve Cadrin[2], Jerelle Jesse[1], and Lisa Kerr[1]

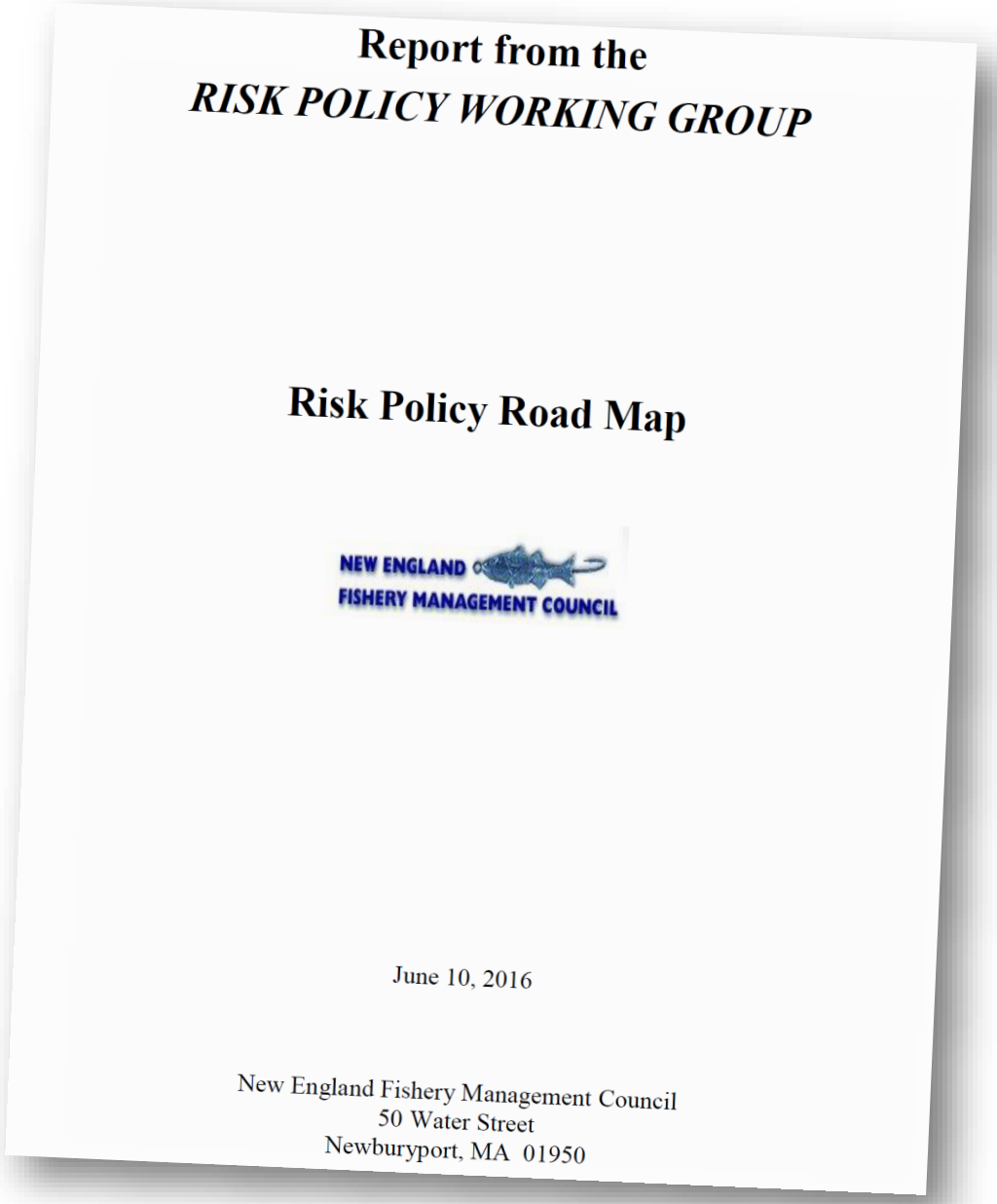
[1]Gulf of Maine Research Institute, 350 Commercial Street, Portland, ME 04101, mmazur@gmri.org
[2]School for Marine Science & Technology, 836 Rodney French Boulevard, New Bedford, MA 02744

November 23 2021



Risk-Based Management

- Recommendation 13: Adopt explicit risk policies
  - Incorporate considerations of risk (likelihood and severity of consequences) into fisheries management actions and communicate risks.
  - Many ABC control rules include an implicit risk tolerance, but other risks in the fisheries management system are confronted in a much more ad hoc manner.
  - **Council decision to revisit risk policy in 2023 (tomorrow's agenda)**


Report from the
RISK POLICY WORKING GROUP

Risk Policy Road Map

NEW ENGLAND FISHERY MANAGEMENT COUNCIL

June 10, 2016

New England Fishery Management Council
50 Water Street
Newburyport, MA 01950

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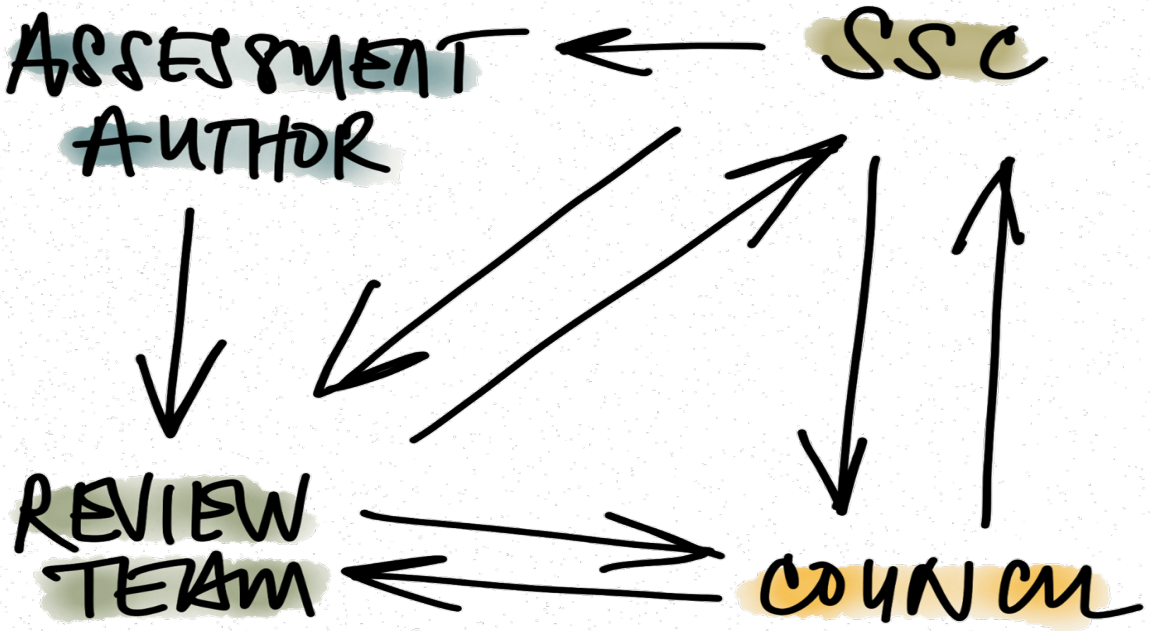
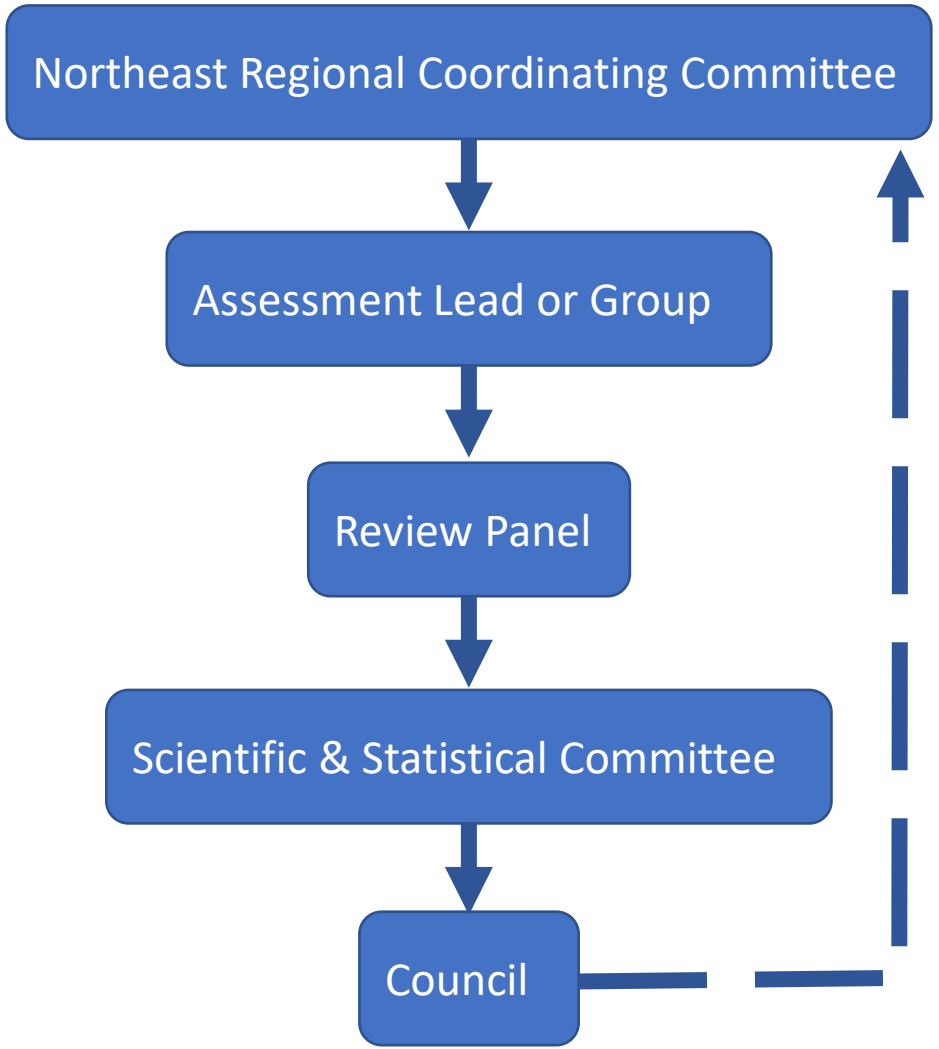
Risk-Based Management

- Recommendation 14: Adopt formal procedures to communicate risk
  - stock vulnerability, availability of data, and the perspectives of fishery participants (e.g., stability of the fishery from year to year).





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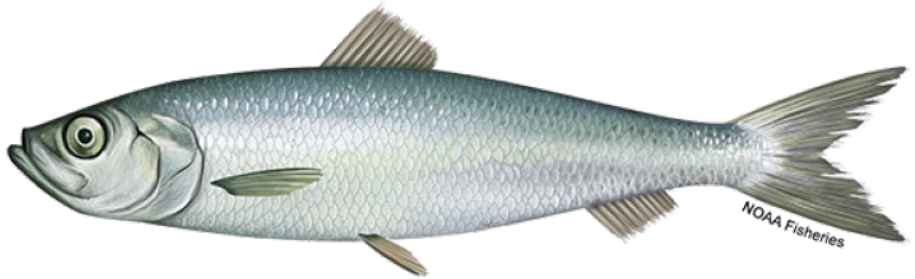
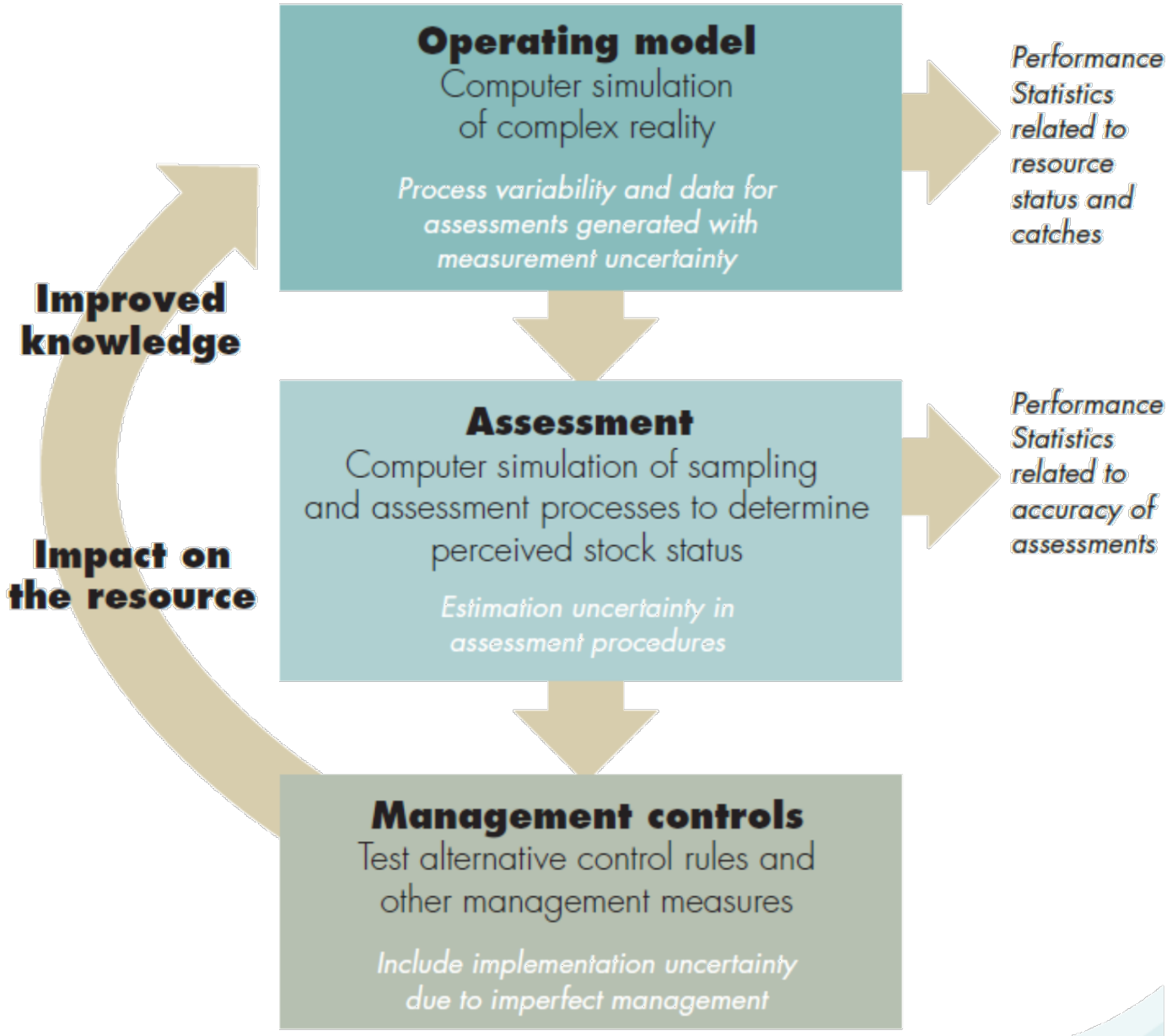
Management Strategy Evaluation

- Recommendation 15: Test management procedures for robustness to uncertainty
  - MSE workshops can improve communication of uncertainty
  - Performance of alternatives accounts for uncertainty in data, models, ecosystem and management.
  - Process is relatively expensive and time consuming.





Council Risk Policy (2014) Objectives

- Recognizing that all fishery management is based on uncertain information and that all implementation is imperfect, it is the policy of the New England Fishery Management Council to weigh the risk of overfishing relative to the greatest expected overall net benefits to the Nation.
- The purpose of the Risk Policy is to:
  1. Provide guidance to the Council and its subordinate bodies on taking account of risk and uncertainty in Fishery Management Plans and specification-setting;
  2. Communicate the priorities and preferences of the Council regarding risk and uncertainty to NOAA Fisheries; and
  3. Make fishery management more transparent, understandable, and predictable while better achieving FMP objectives in the face of uncertain information and imperfect implementation.

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Council Risk Policy (2014) Strategic Approaches

1. Account for the probability of an undesirable outcome and the negative impact of the outcome.
2. Account for cumulative effects of risk at all levels of the fishery management process (e.g., estimation of OFL, ABC, ACL, ACT, and setting accountability measures).
3. Harvest control rules and management procedures will consider stability in the face of uncertain information and inherent variability in ecosystems.
4. Implementation of the policy will be analysis-based, using methods commensurate with the importance of short and long-term tradeoffs between conservation, ecosystem roles, and social and economic benefits.

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Council

Uncertainty in Stock Assessments

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