Management Strategy Evaluation: Realizing its Full Potential
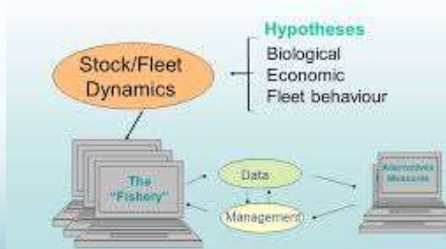
Gerard DiNardo
NOAA Fisheries, Southwest Fisheries Science Center

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Presentation Outline

- **Management Framework and Elements**
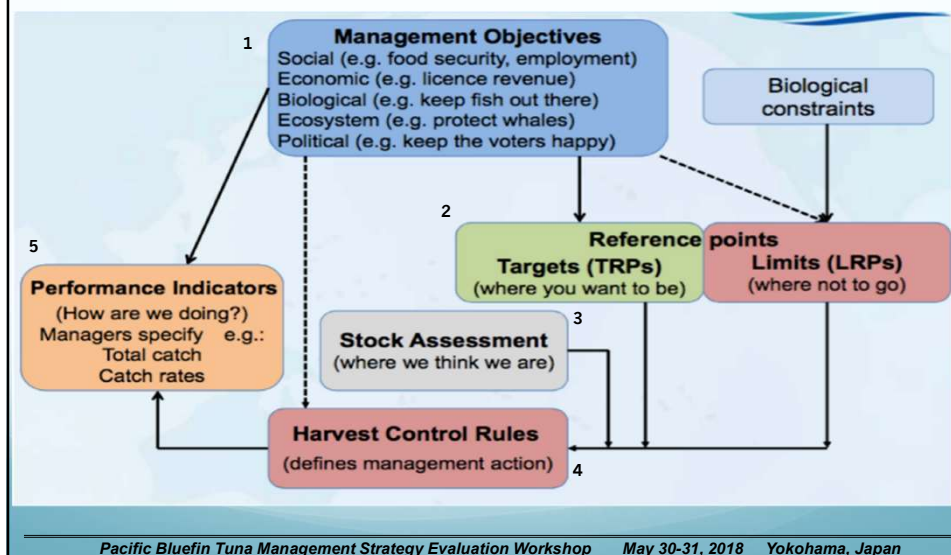
- **What is Management Strategy Evaluation**

- **Final Thoughts**

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Management Framework

The management framework encompasses all key processes in managing a fishery

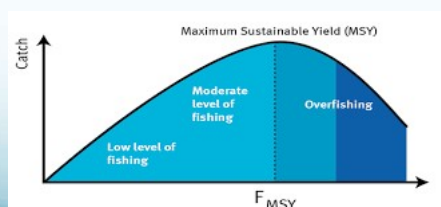# Management Objectives

Types of Objectives

- **Status (Conservation) :** To **maximize** the probability of maintaining the **stock above** the biomass **target reference point**.
- **Precationary (Conservation):** To **minimize** the **probability** that the stock will fall **below** the biomass **limit reference point**.
- **Yield:** To **maximize catch (or effort)** across regions and/or fishing gears.
- **Abundance (Economic):** To **maximize catch rates** to enhance fishery profitability.
- **Stability (Economic):** To **maximize stability in catches** to reduce commercial uncertainty by minimizing variability in catch from year to year.

?   *Difficult to Obtain*
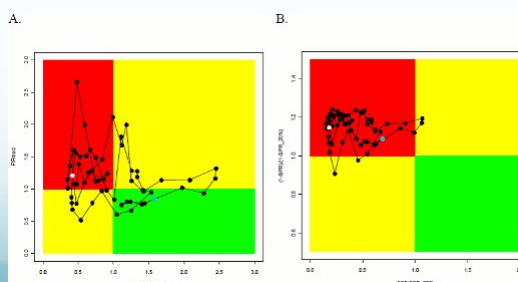
Reference Points

- **Are a management tool used to achieve biological and socio - economic management objectives.**

- **Are pre - determined levels of a given indicator (generally biological) that correspond to a particular state of the stock that management either seeks to achieve (target) or avoid (limit); examples-B_{MSY} & F_{MSY}; B_{lim} & F_{lim}.**

- **Threshold reference points identify intermediary (precautionary) actions designed to ensure the limit reference point is not violated; there incorporation into HCR result in more robust management frameworks.**

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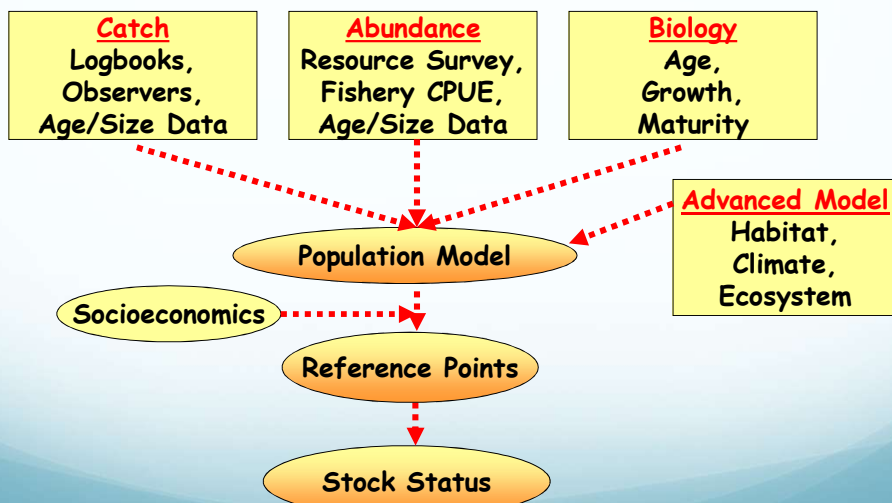
Role of Stock Assessments

- **Provide scientific advice to resource managers on the current status and future trends in abundance and productivity of exploited marine resources. Status is generally based on the magnitude of the population and level of fishing relative to the reference points.**

- **Provide the technical basis for setting annual fishery quotas and other fishery management measures to achieve maximum or optimum yield from the fishery while avoiding overfishing and ecosystem harm.**

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Stock Assessment Process

Catch
Logbooks, Observers, Age/Size Data

Abundance
Resource Survey, Fishery CPUE, Age/Size Data

Biology
Age, Growth, Maturity

Advanced Model
Habitat, Climate, Ecosystem

Population Model

Socioeconomics

Reference Points

Stock Status

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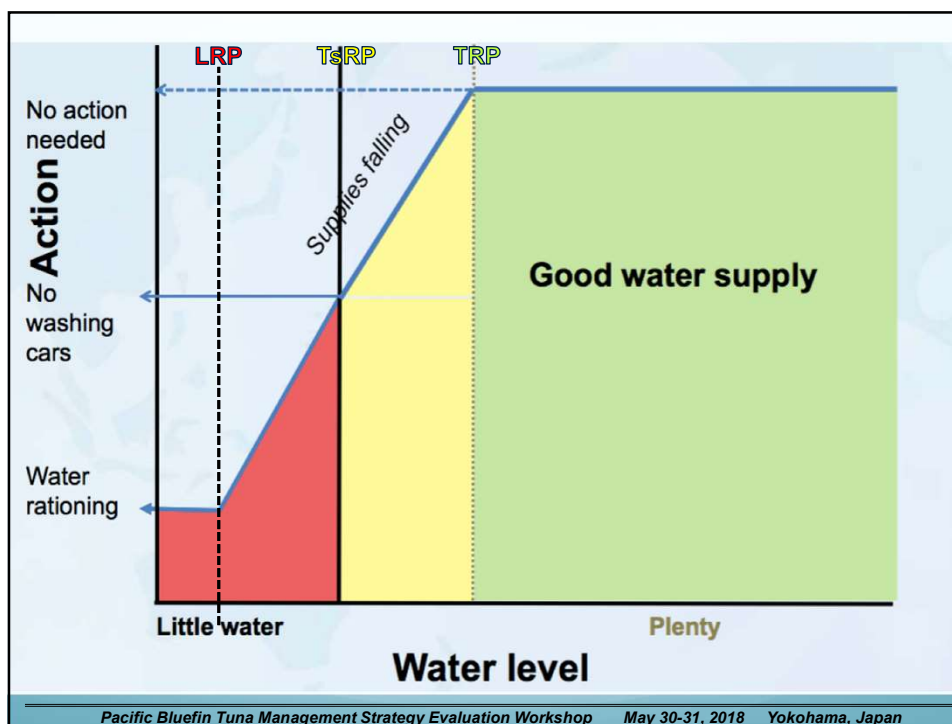
Harvest Control Rules (HCRs)

- Pre-agreed management actions taken in response to stock status indicators

- Increase the efficiency and transparency of management.

- Helps avoid costly and difficult political negotiations.

- Incorporating Target, Threshold and Limit Reference Points into HCRs result in more robust management frameworks.
  - Target ≠ Threshold ≠ Limit

EXAMPLE – WATER USAGE

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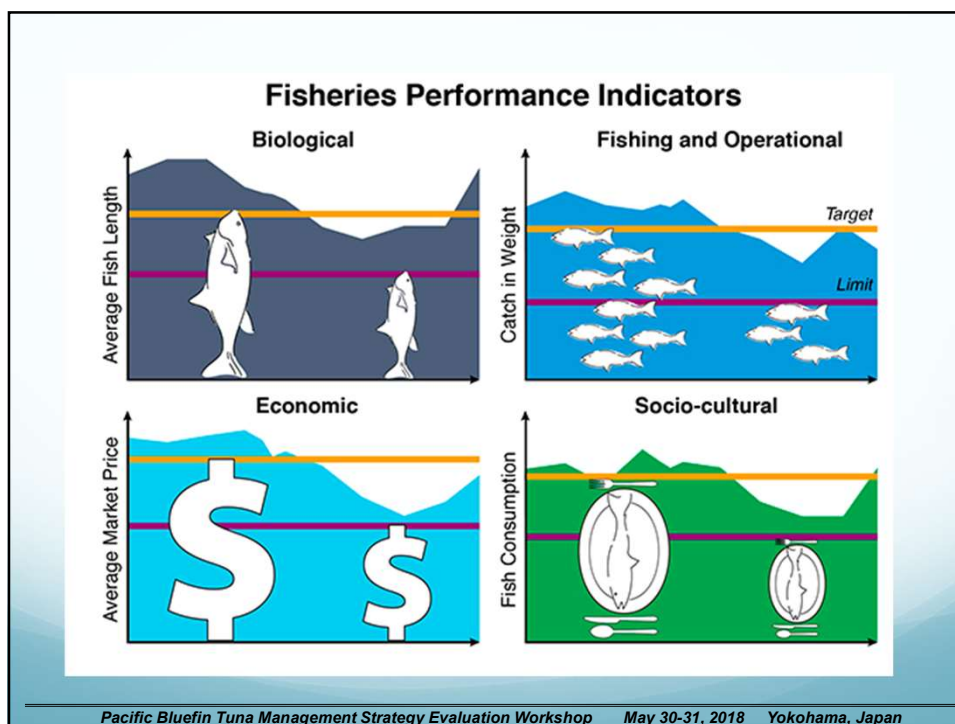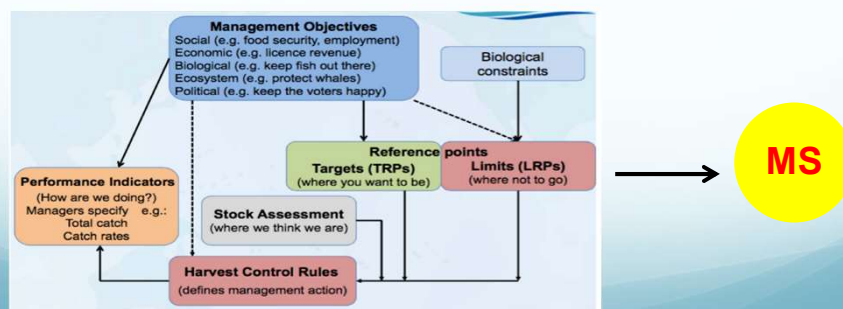
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Main Types of Harvest Control Rules

HCR type	Description	What it looks like
Constant	Allows for a constant level of fishing based on one value, regardless of stock status. The single value could be mortality (F), total allowable catch, days at sea, etc.	
Threshold	Fishing is allowed at a single target level until a limit is reached, at which point fishing is stopped.	
Step	Incorporates steps so higher fishing levels are permitted as the stock's status improves.	
Sliding (simple linear)	A sliding rule allows for a continuous adjustment in fishing controls. Higher fishing levels are permitted with improved stock status.	

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Fisheries Performance Indicators

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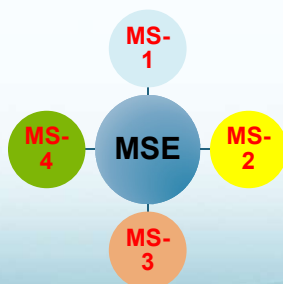

What is MSE

Management strategy: combinations of data collection schemes, analyses applied of those data, and the harvest control rules (HCRs) used to identify management actions

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What is MSE

MSE: use of simulation to evaluate the relative effectiveness of alternative management strategies and to determine how well an existing strategy performs and value of information (new data streams)
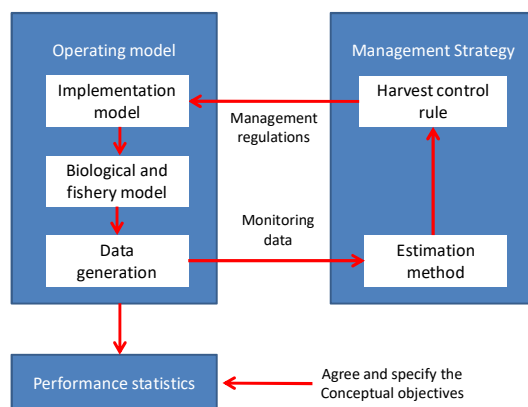
MS-1

MS-4 MSE MS-2

MS-3

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Objectives of MSE

- **Development of the specific and operational management strategy for a particular fishery;**

- **Evaluation of management strategies to achieve the goal(s);**

- **Identification of management strategies that do not achieve the goal—these should be eliminated from further consideration;**

- **Quantifying achievable performance given the quality of the data available and the types of uncertainties inherent in the system being managed; and**

- **Evaluation of the benefits of additional data streams stemming from data collection programs.**

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Implementation of MSE

Operating model
- Implementation model
- Biological and fishery model
- Data generation

Management regulations

Monitoring data

Management Strategy
- Harvest control rule
- Estimation method

Performance statistics

Agree and specify the Conceptual objectives

Punt et al (2016)

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The Operating Model (OM)

- **Includes the biology, fishery, and how any data are generated.**

- **Represents the "real world"**
  - **Several operating models can be considered each is an alternative state of nature.**
  - **The full suite of uncertainties should be included (model, process, estimation, implementation, etc.).**

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Roles and Responsibilities

- **MSE is at the interface between science and decision making**

- **Scientists:**
  - **Identify the hypotheses to represent in the operating model.**
  - **Represent the objectives of the decision makers quantitatively.**
  - **Identify factors which could be used in management strategies.**

- **Stakeholders / decision makers / advocates:**
  - **Identify management objectives**
  - **Identify candidate management strategies.**
  - **Make decisions on the final management strategy this is a (policy call not a science endeavour).**

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Where is MSE used?

Nationally
- **Australia**
- **New Zealand**
- **South Africa**
- **USA**
- **Canada**
- **Europe**

RFMOs
- **International Whaling Commission**
- **CCSBT**

USA
- **PFMC: Sardine**
- **PFMC: groundfish**
- **NPFMC: control rules**
- **NPFMC: crab ABCs**
- **[+ many academic studies]**

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Advantages / Disadvantages

- **Makes decision making easier.**

- **Full consideration of objectives.**

- **Focus on uncertainty and robustness.**

- **Value of additional data streams**

- **Development can be lengthy.**

- **Stakeholders reluctant to state their objectives.**

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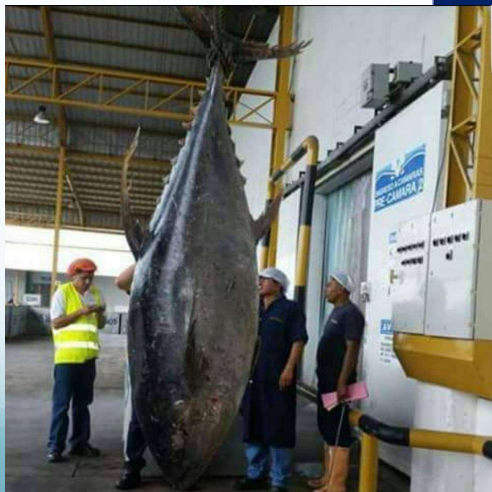
Concluding Thoughts

MSE provides a platform to:
- **Compare strategies to achieve predefined objectives**
- **Identify which strategies work and those likely not to work**
- **Identify core uncertainties and test the performance of strategies over the range of uncertainties**

Input from stakeholders and managers is critical to the MSE Process

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Thank You Questions?

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