

## MANAGEMENT STRATEGY EVALUATION: A MANAGEMENT TOOL TO EVALUATE TRADE-OFFS



### Why use Management strategy evaluation?

The goal of management strategy evaluation (MSE) is to examine the tradeoffs associated with a given range of management options. MSE is a decision support tool and process to evaluate how potential management strategies could achieve management objectives, cognizant of uncertainties in the management process. MSE can be applied on all scales of decision-making both for single species and ecosystem-level applications and apply to any step of the management process from harvest control rules through data collection. The results of a MSE do not prescribe management approaches but rather inform managers which strategies could be the most useful in achieving their objectives, which ones will not, and the tradeoffs associated with each option.

### Acknowledging uncertainty

Fisheries management necessarily deals with large uncertainties and the risk associated with making decisions in the face of that uncertainty. Reducing or eliminating uncertainty at every step of the management process is an unrealistic goal. MSE *acknowledges* uncertainties and asks – how well do alternative management approaches achieve our objectives, given these inherent uncertainties in the environment, fish biology, fishery, and management process?

### MSEs are NOT:

- Prescriptive – MSEs provide information about predicted outcomes for possible management actions. Managers use this information to weigh trade-offs and make decisions.
- Always complicated and expensive – MSE is a process that can be applied to questions big and small, and with wide ranges of data availability.
- A black box – the MSE process increases transparency of management decisions, and includes stakeholder engagement.

### How it works

MSE requires five main ingredients:

1. Clear management objectives
2. Performance metrics
3. Potential management strategies

4. Assumption of uncertainty at each step of the management system
5. Operating models that describe how the system operates (which can range from extremely data limited to complex ecosystem models such as Atlantis)

The results of the MSEs are then ranked by their ability to meet one or more objectives and highlight the tradeoffs between each management strategy. Ideally MSEs can be performed on a regular basis to serve as a learning tool to refine objectives over time.

#### **PFMC sablefish MSE:**

One example of single species MSE is included in this month's briefing book (Agenda item F.3). In this study, NMFS scientists were able to assess the expected impact of sea-level change, an indicator that captures several processes important to the recruitment of sablefish, to future productivity using forward looking climate models. By incorporating these factors in the MSE operating model (essentially improving our estimation of uncertainty in the MSE operating model) NMFS scientists identified climate ready harvest control rules that allow for increased catch once conditions become favorable for sablefish while preventing the stock from being declared overfished due to purely environmental reasons.

#### **Resources:**

Carruthers, T.R., Punt, A.E., Walters, C.J., MacCall, A., McAllister, M.K., Dick, E.J. and Cope, J., 2014. Evaluating methods for setting catch limits in data-limited fisheries. *Fisheries Research*, 153, pp.48-68.

Benson, A. J., Cooper, A. B., & Carruthers, T. R. (2016). An evaluation of rebuilding policies for US fisheries. *PloS one*, 11(1), e0146278.

Punt, A. E., MacCall, A. D., Essington, T. E., Francis, T. B., Hurtado-Ferro, F., Johnson, K. F., ... & Sydeman, W. J. (2016). Exploring the implications of the harvest control rule for Pacific sardine, accounting for predator dynamics: A MICE model. *Ecological Modelling*, 337, 79-95.

Punt, A. E., Butterworth, D. S., Moor, C. L., De Oliveira, J. A., & Haddon, M. (2016). Management strategy evaluation: best practices. *Fish and Fisheries*, 17(2), 303-334.

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