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Management Strategy Evaluation Template: Information and Instructions

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Management Strategy Evaluation Template: Information and Instructions

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Background

Management strategy evaluation (MSE) is a structured approach to designing fishery management systems that are likely to meet the objectives of stakeholders and managers.

Management objectives are essential to the MSE process because they identify things that are important for a stock/fishery and they are used to evaluate and distinguish between alternative management procedures. A **management procedure** maps the pathway from fisheries data to fisheries management actions, and it describes when management actions occur and what management actions occur in response to changes in a stock/fishery. A management procedure includes three components: fishery monitoring data, the evaluation of the data (e.g., the stock assessment), and harvest decision rules or **harvest control rules (HCR)**. A HCR sets catch or effort limits based on estimates of stock status. **Reference points** are control points that are used to determine which HCR is used based on stock status in a management procedure. Management procedures can be set up so that they are identical except for their reference points (thus they are alternative candidate procedures) and in this way the MSE process can be used to evaluate the performance of alternative candidate reference points, e.g., target reference points for north Pacific albacore as requested by NC10.

A MSE involves simulation testing of management procedure(s) performance against a fixed set of management objectives over a range of possible **scenarios** for the stock and fishery. A scenario is a structural hypothesis about the fish stock and/or fishery dynamics that are not currently resolved by the available data (e.g., future recruitment or spatial dynamics in north Pacific albacore assessments). A realistic scenario describing stock and fishery dynamics for simulation testing of alternative management procedures is often called an **operating model** in the MSE literature. The evaluation of management procedures across operating models and the incorporation of uncertainty (related to data collection, related to the assessment, related to management actions) into the simulations is the basis for identifying the "best management procedure" from a set of candidates. The "best management procedure" means the procedure that most closely meets the desired management objectives over a range of plausible scenarios

about the stock and fishery processes. This procedure is thus robust to uncertainties about the real world. The success of candidate management procedures at achieving management objectives is judged by comparing a set of statistics (**performance indicators/criteria**) obtained from simulating the consistent application of the procedures into the future using the simulated data collected up to each point in the future. A successful management procedure should, on average, achieve the desired management objectives even if the stock assessment component of the procedure is incorrectly structured or the results are erroneous.

The ALBWG is looking for input to define management objectives for north Pacific albacore tuna to begin the MSE process. These objectives typically fall into three broad categories, although other things also may be important for the stock/fisheries:

- Ecological – things important for the biological sustainability of the stock (abundance, age/size composition, spatial distribution, etc.);
- Socio-economic – things important to the sustainability of a fishery/fisheries (e.g., average annual catch or effort, inter-annual stability of catch or effort, etc.); and
- Cultural – things important to participants (harvesters, processors, etc.) in the fishery (e.g., fishing opportunities, fleet size, etc.)

Based on the policy objectives outlined by NC10, the ALBWG identified three potential objectives:

1. Ecological: Maintain biomass around its current level with reasonable variability
2. Ecological: Maintain biomass with low risk of breaching the Limit Reference Point (LRP) (20%Spawning Stock Biomass $(SSB)_{current\ F=0}$)
3. Socio-economic: Maintain biomass around its current level in order to allow recent exploitation levels to continue"

. The set of objectives needs to be complete in that nothing important is left out, it should be relatively concise with no duplication among objectives, and each objective should be useful in distinguishing between alternative management procedures. The potential objectives identified above might be complete or additional objectives might need to be considered.

One way to develop management objectives is to ask simple questions about the stock and the fishery. The answers to these questions represent potential management objectives. For example:

1. What is the desired status of the stock?
2. What catch level (or effort) is needed to support a fishery?
3. What variability in catch or effort from year to year is tolerable?
4. What is the desired level of participation (e.g., vessels) in a fishery?

Once a management objective is proposed, we need more specific information to develop the **operational objectives** that will be used to evaluate alternative management procedures. For example, if a management objective is related to some biomass level, then we need to know the type of biomass (spawning biomass, total biomass, age 1+ biomass, other, etc.) and the level of concern (specified either as a ratio or absolute level, e.g., 2 million t). Operational objectives have three components: (1) a target or threshold (the quantity of interest, e.g., biomass, catch, effort, etc.), (2) a time period for measurement, and (3) a statement of acceptable risk associated with the objective. **Acceptable risk** is defined as "the level of risk that we are willing to accept with a particular management procedure" and the **risk level** is the % of time a stock is predicted to be above/below a target or threshold, respectively, in the future (SPC-OFP 2014[1]). A key point to consider is that as the acceptable risk is lowered, stock biomass or other

[1] SPC-OFP 2014. Consideration of acceptable levels of risk of exceeding Limit Reference Points for the four main tuna stocks: uncertainty and implications for Target Reference Points and Harvest Control Rules. Western and

quantities of interest will need to be higher and further away from a specified target or threshold (SPC-OFP 2014). For example, if the acceptable risk for stock biomass being below a LRP is 5% (or 95% of the time the stock is above the LRP), then the estimated biomass must be much higher than LRP compared with the estimated biomass if an acceptable risk of 50% is used. In addition, as uncertainty in estimated quantities increases, the stock will need to be higher and further away from a target or threshold (SPC-OFP 2014).

Instructions

A template consisting is attached consisting of:

(1) a page designed to capture information on objectives and variables used to measure achievement of those objectives (performance indicators/criteria); and
(2) a second page designed to identify potential HCRs.

The text in bold on each of these pages are examples of the kind of information that the ALBWG is requesting. They are intended to guide you in filling out these templates; they are not intended to limit your choices. Blank pages for your proposals are attached.

Note that a management objective that specifies maintaining biomass at the current level will require details on the following: what biomass (spawning or total, age 1+, etc.), what is current level (last year in the assessment, average over some period of time), and the level of variability associated with this level (10%, 25%, etc.).

The example management objectives shown in the template are derived from the policy statements in the North Pacific albacore management framework approved by NC10. They are included in the table only to show the level of detail that is requested.

Types of objectives and questions to consider when defining operational objectives. Note that the examples in **bold** are presented to show the level of detail necessary to craft a useful operational objective from policy statements for MSE.

Value	Question	Potential Management Objective	Target or Threshold Value	Measurement Time Horizon	Acceptable Risk (Probability for Achieving Target/Avoiding Threshold)	Performance Indicators/Criteria
Ecological	**What is the desired status (i.e., abundance) of the stock?**	**Maintain biomass above the LRP**	**20% $SSB_{0\ F=0}$**	**2 generations, 30 yr**	**95% of the projected years**	**Number of years in which stock in/not in overfished state**
		Maintain biomass around its current level with reasonable variability	**SSB_{2012}; average $SSB_{2008\text{-}12}$; total B_{2012}; median Biomass. Reasonable variability = CV10%, 25%; = ± 10%, 25%**	**2 spawning cycles - 10 yr**	**50%**	**Proportion of projected years in which biomass is within variability limits**
Socio-economic	**What is the desired level of catch?**	**Maintain catch at average levels subject to achieving ecological objectives**	**Average catch**	**1981-2010; or 2008-2012**	**50% of projected years; or ±10% of average**	**Proportion of years in which average catch achieved**
Socio-economic	**What is the maximum change in catch (or effort)?**	**Limit average annual variability (AAV) in catch (or effort)**	**10%, 25%**	**5 yr, 10 yr**	**50%**	**CV of annual catch**
Cultural	**What is a viable level of resource access for harvesters?**	**Maintain current fishing effort in targeting and non-targeting fisheries**	**Average; Median (2008-12)**	**Annual**	**50% of projected years**	**Average annual fishing effort by fishery**

Harvest control rules (HCRs) re a set of well-defined pre-agreed actions used for determining a management action in response to changes in indicators of stock status with respect to reference points. The annual level of fishing is defined by the HCR, not through annual negotiation, which simplifies and improves management response time (MOW 2 WP3).

Model-based HCRs – require outputs from assessment model in order to evaluate, e.g., biomass levels. Means assessment model must be run, for albacore this means HCR evaluated every three years.

Data-based HCRs – use annual catch or effort data and can be evaluated annually; assessment model does not need to be run. However, some idea of how these data relate to reference points or stock status is required.

Evaluation Method	Fishery Control	Reference Point	Data Evaluated by Rule	Evaluation Period	Rules	
					Spawning Biomass Below Reference Point	Spawning Biomass Above Reference Point
Model	**Total allowable catch (TAC)**	**Limit Reference Point (LRP)**	**SSB**	**3 yr (when assessment model run)**	**TAC_{t+3} =0; or TAC_{t+3} = (F-target x SSBcurrent)/LRP**	**TAC = F-target (i.e., use the agreed F-target when SSB is above the LRP)**
	Total allowable effort (TAE)	**LRP**	**SSB**	**3 yr**	**TAE_{t+3} = (F-target*SSBcurrent)/LRP**	**TAE_{t+3} = F-target when SSBcurrent > LRP**
Data	**TAC**	**Average catch**	**Annual catch**	**Every year**	**$TAC_{t+1} = TAC_t$ when Annual catch < Average Catch**	**$TAC_{t+1} = TAC_t$ x (TAC_t/$Catch_t$) when Catch in Year *t* is > 1.1 x TAC_t**
	TAE	**Average effort (2002-2004)**	**Annual effort**	**Every year**	**$TAE_{t+1} = Average_{2002-2004}$, when Annual effort < $Average_{2002-2004}$**	**$TAE_{t+1} = TAE_t$ x ($Average_{2002-2004}$/TAE_t) when TAE in Year *t* is > 1.1 x $Average_{2002-2004}$**

NOTE: In the data-based HCRs a buffer of 10% (1.1) is used when Catch is > TAC or effort is > Average effort (2002-2004). The buffer recognizes that catch and effort are not perfectly known and avoids recalculating TAC or TAE in the next year when minor overages (e.g., 10 t over TAC or 20 days over Average effort (2002-2004)) occur.

Proposed Management Objective Information for North Pacific Albacore Tuna.

Value	Question	Potential Management Objective	Target or Threshold Value	Measurement Time Horizon	Acceptable Risk (Probability for Achieving Target/Avoiding Threshold)	Performance Indicators/Criteria

Proposed Harvest Control Rule Information for North Pacific Albacore Tuna.

Evaluation Method	Fishery Control	Reference Point	Data Evaluated by Rule	Evaluation Period	Rules	
					Below Reference Point	Above Reference Point