Food and Agriculture Organization of the United Nations

Management Procedures and Management Strategy Evaluation: A Brief Guide for Managers

FISHERIES AROUND THE WORLD ARE TRANSITIONING TO MANAGEMENT PROCEDURES (MPs), also known as harvest strategies, which are developed and tested using management strategy evaluation (MSE). Why? Because compared to traditional stock assessment-based fisheries management, MPs lead to clearer scientific advice, streamlined and efficient decision-making, and more stability and predictability in the fishery and seafood market. MPs also better account for uncertainty in the system, including from climate change, leading to more confidence in the ability of management actions to achieve long-term objectives. One of the hallmarks of MP development is stakeholder engagement, increasing the inclusivity and transparency of the management framework and therefore earning more buy-in from users. This stakeholder engagement comes via close coordination with fisheries managers and direct communication with scientists throughout the process, so here we discuss what the MP development process looks like from a manager's perspective.

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MANAGEMENT PROCEDURE ELEMENTS FOR MANAGERS

Concept & Lead Role		Description	Why it matters to managers	Managers' responsibility
MP	Management procedure (MP) **Lead:** Managers	A pre-agreed, science-based framework for making fisheries management decisions, such as setting catch limits, that is designed to achieve specific management objectives. Also known as a harvest strategy.	Sets a framework for long-term decision-making.	• Decide to develop MP. • Adopt management objectives. • Select & adopt the final MP from a set of candidates (CMPs) provided by scientists. • Oversee MP implementation.
Management Objectives	Management objectives (MO) **Lead:** Managers	Formally adopted, measurable goals for the fishery, such as a healthy population level and high catch. To be operational, objectives must include a timeline and probability of achieving them.	Set the vision for the fishery over various time periods, providing the bar against which to evaluate MP performance (and thus the criteria for selecting the final MP).	• Adopt management objectives. • Ensure that each management objective is specific and measurable, with timelines and probabilities.
	Reference points (RP) **Lead:** Scientists	Benchmarks used to compare the current status of a fishery management system against the levels managers want. A RP can represent a desirable (target reference point, TRP) or undesirable (limit reference point, LRP) level. Often defined in management objectives and sometimes used to define the harvest control rule (HCR).	Guides the measure of success and failure of the management system for stock size (Biomass-based reference points) and/or fishing level (Fishing mortality-based reference points).	• Adopt target reference point(s) and limit reference point(s).
	Risk **Lead:** Managers	The probability of encountering an undesirable outcome or not achieving a desirable outcome.	Acceptable levels of risk help to operationalize management objectives containing reference points and inform scientists' testing of CMPs.	• Agree to acceptable levels of risk of breaching the LRP or not achieving the TRP.
	Performance indicator (PI) **Lead:** Scientists	A quantitative expression of a management objective used to evaluate how well the objectives are being achieved. For example, the average catch level over a 10-year period.	Each management objective should have at least one performance indicator. This determines how the MSE will assess MP performance against each objective.	• Review, provide feedback on, propose new, and approve performance indicators proposed by scientists.
MSE	Management Strategy Evaluation (MSE) **Lead:** Scientists	A computer framework used to evaluate and compare the performance of candidate MPs relative to the pre-specified management objectives. MSE does this by simulating the effect of implementation of CMPs on the stock under future stock and fishery conditions across a range of uncertainties. The outputs of MSE provide information on CMPs' likely ability to achieve managers' objectives in a set timeframe in the future, and in the face of uncertainty in environmental and fishery conditions.	The MSE results will guide selection of the final MP to adopt.	• Fund the MSE.
	Operating model (OM) **Lead:** Scientists	A building block of the MSE, representing different hypotheses or 'uncertainties' about the possible states of nature and fishery impacts.	Should select an MP that performs well across all of the most plausible OMs (that is, the reference set) and can also consider results of less plausible but still possible robustness OMs.	• Provide input on fishery dynamics that should be included in OMs (e.g., potential IUU fishing). • Advise on what should be included in reference set vs. robustness OMs.

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MSE	Conditioning **Lead:** Scientists	Process of fitting the OM to fishery data so that the simulated fishery reproduces the fishery dynamics seen on the water.	Gives confidence that OMs are reliable and suitable for projections as part of the MSE process.	• None
	Tuning **Lead:** Scientists	Tweaks MP options so that they all meet a single, shared performance standard (for example, on a status objective).	Allows like-to-like comparisons of MPs. If MP options all meet, for example, the minimum stock status requirement, tuning allows a more straightforward comparison of – and optimization of – performance on the other objectives, such as yield.	• Agree to the tuning objective.
MP Elements	Harvest control rule (HCR) **Lead:** Managers	A pre-agreed rule that sets fishing opportunities (catch limit, effort limit, etc.) based on the level of selected indicators (s) of stock status.	This is the operational part of the MP.	• Provide input on which HCRs to test.
	Data collection program **Lead:** Scientists	The plan for gathering the information needed to evaluate stock status to drive the HCR and monitor MP performance, including exceptional circumstances.	If the input data are not specified, the MP will not be run consistently and may not perform as expected.	• Ensure that the final MP includes details for the data collection program/ monitoring strategy (e.g., which indices of abundance will be used and how they will be standardized, etc.).
	Stock status indicator **Lead:** Scientists	The model-based or empirical process used to evaluate stock status using the collected data to drive the HCR management action within the MP.	As above under data collection, if the data processing method for providing an indicator of stock status is not pre-agreed, the MP will not be run consistently and may not perform as expected. If the method uses a type of stock assessment model, the HCR and MP are considered "model-based." If the method is derived directly from data like indices of abundance, the HCR and MP are "empirical.".	• Ensure that the final MP includes details for estimating the stock status indicator (e.g., via a simplified stock assessment model for a model-based MP).
	Exceptional Circumstances Protocol (ECP) **Lead:** Scientists	Pre-agrees the response to rare and unforeseen events that were not tested by the MSE or that the MP was not designed to manage. It also identifies the process to detect these events.	Provides regular reviews of MP performance during implementation and guides the response to any anomalies, or "exceptional circumstances."	• Revise and approve list of exceptional circumstances proposed by scientists. • Adopt ECP, including flowchart for how to respond to detection of exceptional circumstances (e.g., if scientists deem ECs to be "significant," reduce fishing by 20% and update MSE.)
	MP review timeline **Lead:** Managers	Outlines how the MP's performance will be evaluated during implementation, potentially including a timeline for performing a "health-check" stock assessment, thorough evaluation of attainment of the management objectives, and/or an MSE revision/reconditioning.	Even once adopted, an MP is not set in stone. Managers will have frequent opportunities (e.g., every 5-10 years) to reflect on whether the MP is successful and make course corrections, as necessary.	• Agree to the scope of and timeline for MP review. • Consider the results of the reviews, and respond appropriately.

CATEGORIES OF MANAGEMENT OBJECTIVES*

Category	Measure	Example
Status	Likelihood of achieving desired outcome (e.g., target reference point)	There should be a 60% or greater probability of occurring in the green quadrant of the Kobe plot ($B \geq B_{MSY}$ and $F < F_{MSY}$) in every year of the 30-year projection period.
Safety	Likelihood of achieving undesired outcome (e.g., breaching limit reference point)	There should be a 10% or less probability of breaching the limit reference point ($15\% * B_0$) in every year of the 30-year projection period.
Yield	Fishing opportunities, including catch or effort	Maximize catch in the short (1-5 years), medium (6-15 years), and long (16-30 years) terms.
Stability	Change in allowable fishing over time	Any change in total allowable catch between consecutive management periods should be no more than 15%.
Abundance	Catch rate as indicator of abundance and fishery profitability	Maintain catch per unit effort in the longline fishery over the 2020 level.
Ecosystem	Impact on other species and broader environment	The overall selectivity of the fisheries should ensure that the yield at MSY and SSB at MSY is equal to the values in the 2000s.

*The examples represent one of many potential options, and the metrics, probabilities and time periods can vary widely by stock.

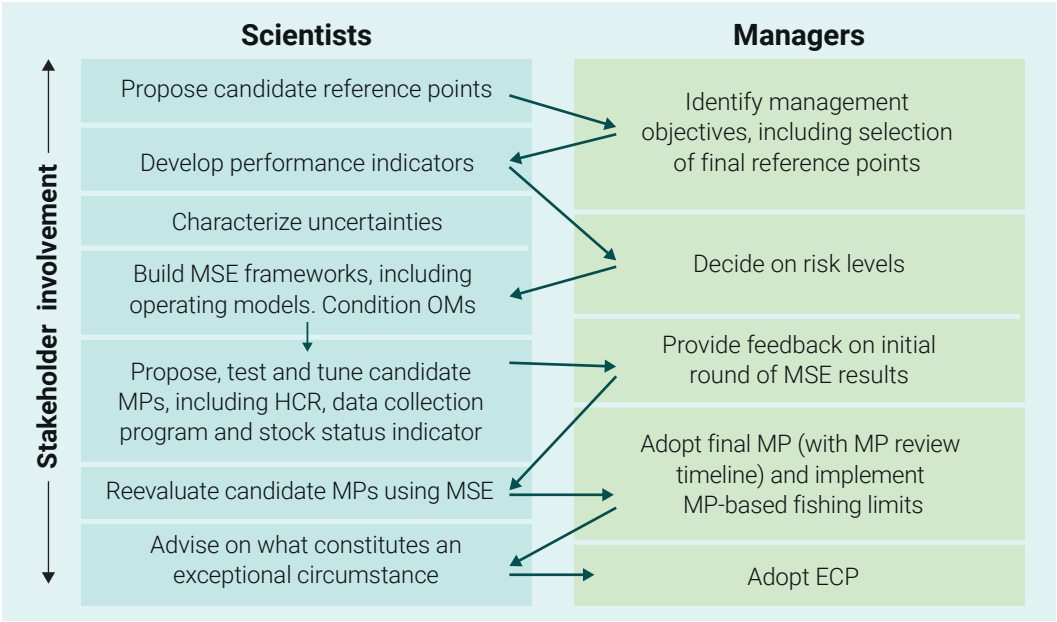
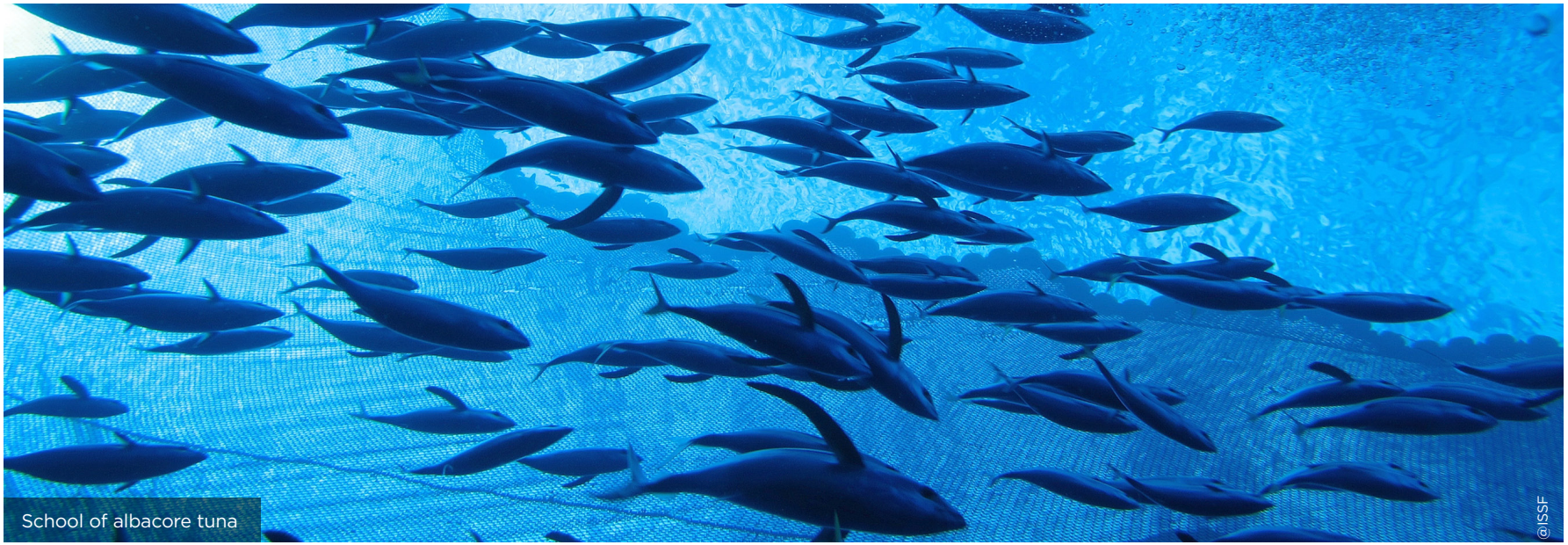


Figure 1. General flowchart of the MP development process, showing the iterative exchange between scientists and managers, with stakeholder engagement throughout. There is flexibility in the order of steps, and some steps may need to be revisited as perceptions evolve.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