Pole and line fishing for skipjack in the Maldives

Management procedures versus traditional fisheries management

How do the approaches differ, and why are global fisheries transitioning to management procedures?

FISHERIES ARE A BILLION DOLLAR BUSINESS, and increasing fishing pressure has led to population declines globally. Almost 40% of all fish stocks are classified as overfished.[1] Growth in worldwide demand for seafood has outpaced all other animal protein foods for over 60 years.

In pursuit of sustainability, regional fisheries management organizations (RFMOs) regulate international fisheries with input and output controls. Input controls dictate how much fishing can take place; for example, managers might set the number of fishing days as a metric of total allowable effort (TAE), how big a vessel can be, or temporal/spatial boundaries of fishing closures. Output controls limit how many fish can be removed, most commonly expressed as a total allowable catch (TAC), which is typically measured in weight.

Traditionally, RFMO scientists have conducted stock assessments to determine scientific advice on appropriate TAC and TAE levels. Stock assessments are modelling exercises

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[1]FAO. 2024. The State of World Fisheries and Aquaculture 2024. Blue Transformation in Action. Rome, FAO. https://doi.org/10.4060/cd0683en

that evaluate the abundance of a fish stock, including whether the stock is overfished or subject to overfishing. These assessments also project the likely impact of potential management options, providing the basis for the scientists to recommend appropriate fishing levels. Fisheries managers then consider this advice when negotiating to reach consensus on the total amount of fishing to be allowed in the following year or years.

Without a framework for consistent decision-making and a frequent focus on maximizing short-term profits, which can lead to deviations from scientific advice, traditional fisheries management has failed too many times. This threatens both fish and fishery. An alternative approach, termed a management procedure (MP), is needed to help fisheries stabilize and/or recover, especially under long-term threats like climate change. When a stock is overfished, RFMOs must reduce the TAC or TAE but often get pressure from fishers to consider socio-economics. Traditionally, RFMOs have been struggling to find a balance between sustainability and socio-economic considerations, but MPs could resolve this long-standing issue.

MANAGEMENT PROCEDURES

A management procedure is a comprehensive, science-based approach to securing long-term sustainability of fisheries. MP development is a participatory process, where managers, with the input of fishery scientists and other stakeholders, come to an agreement on the vision for the future of a fish stock and fishery. Compared to traditional stock assessment-based management, where fishing limits are decided for only the next one or few years, MPs chart a course for achieving the agreed vision in the several years or even decades to come.

Advantages of MP-based management include:

- **Formalizing a longer-term perspective and proactive approach to fisheries management and sustainability.** With MPs, managers pre-agree to a process for setting management measures based on indicators of stock status. Interestingly, that stock status indicator may be determined by stock assessments or, in other cases, by empirical indicators (e.g., catch per unit effort, independent abundance estimates). In both cases, the inputs and model structure for those assessments and/or indicators are pre-agreed as part of the MP.

- **While traditional stock assessment-based management does not fully account for scientific uncertainty, MPs are grounded in a scientifically rigorous process called a management strategy evaluation (MSE).** MSE can test a much broader suite of biological, fishery and environmental factors, finding an MP that will meet objectives regardless of which of those turn out to be correct. In other words, the MSE process helps to identify MPs that will be successful regardless of the uncertainties about the fishery, stock biology, and environment.

MPs are selected based on their likely performance in achieving pre-agreed management objectives, as revealed through MSE testing. Some objectives, such as achieving a target population size and avoiding a dangerously low level of depletion, might be prioritized as minimum required performance standards for sustainability, helping to narrow the MP options. Other objectives, like maximizing catch and fishery stability, might be used to select the final MP from the shortlist of options. This process has allowed managers to strike a balance between environmental and commercial interests when selecting MPs, with fisheries like Southern bluefin tuna able to increase TACs concurrently with stock recovery.

MSEs and climate change

The more holistic accounting of inevitable uncertainty in fisheries that MSE provides is an increasingly valuable benefit in the context of climate change. Climate change leads to an increasingly unpredictable future, posing additional challenges to fisheries management, with several commercially important stocks like Atlantic mackerel and Bering Sea snow crab already experiencing shifts in distribution and collapse from warming waters, respectively. Climate change scenarios are currently being tested in the MSEs for North Atlantic swordfish and Western Atlantic skipjack, among others. MPs also build climate change resilience by including exceptional circumstances protocols that can automatically trigger a response in the event of unforeseen environmental events. Making governance more efficient overall is another key benefit for climate change resilience, allowing managers to respond faster when such impacts occur, and freeing up time and resources to work on other management priorities.

MPs give clarity to decision-making

Western Atlantic bluefin tuna management had been contentious for almost 50 years, in part due to unclear objectives and scientific advice that would list several potential TAC values depending on assumptions about the productivity of the stock, an uncertainty that fishery managers were ill-equipped to decipher. This all changed when a management procedure was adopted in 2022, bringing clear, exact scientific advice to the TAC setting process.

- **Example of scientific advice pre-MP (2008):** "Based on a strict interpretation of the base case projections and the Western Atlantic Rebuilding Plan [Rec. 98- 07], the Commission is faced with TAC options that range between 2,400 t and zero depending on its choice of recruitment scenarios and choice of the probability of rebuilding... In light of the uncertainty about recruitment and other uncertainties not taken into account in the projections, the Committee strongly advises against an increase in TAC."

  ➡ **Management decision:** Reduce TAC from 2100 t to 1900 t for 1 year.

- **Example of scientific advice under the MP (2022):** The MP formula calculated a TAC of 2726 t.

  ➡ **Management decision:** Set the TAC at 2726 t for 3 years.

WHY MPs?

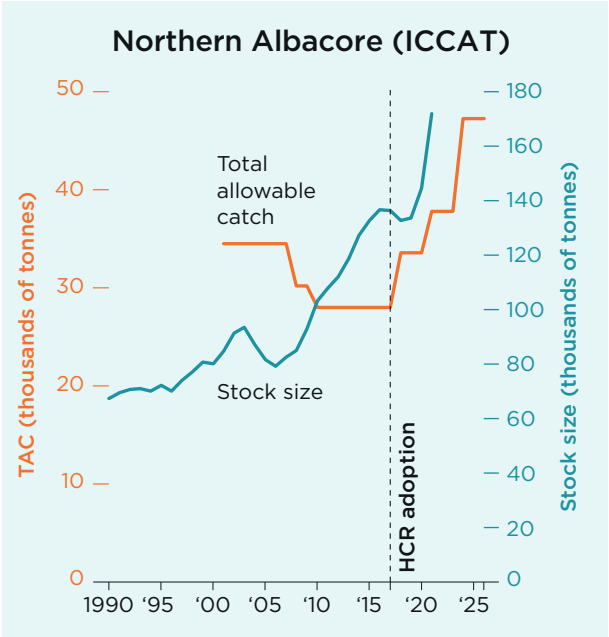
This side-by-side comparison of MPs and stock assessment-based management shows that the MSE-based MP approach outperforms traditional assessment-based management on every point, other than the higher short-term investment required in MSE development.

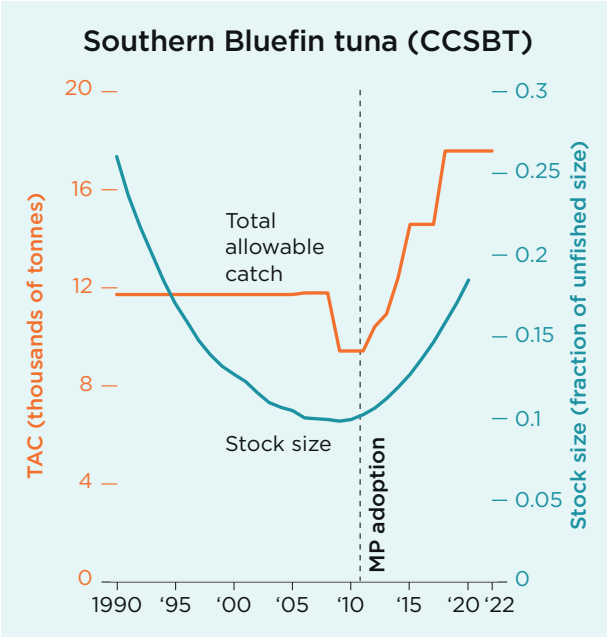
Category	Stock Assessment-based management	Management Procedure
Purpose	Stock assessment provides management advice from the single "best" interpretation of the available data (but we don't know how reliable this advice is).	MSE identifies a robust way to provide management advice – a pre-agreed MP that can achieve management objectives regardless of uncertainties in the fish stock, fishery and environment (including climate change).
Main result	Current overfished and overfishing status; projection of future status relative to reference points.	Time dynamic status relative to reference points and other objectives; fishing opportunities over various time periods; stability of fishing opportunities; account for ecosystem impacts (e.g., bycatch).
Projections	Linear, assuming perfect, fixed implementation of management each year. Relatively simple.	Cyclical, building on prior year's performance, management varies in response to stock status indicator with a feedback loop. More complex.
Adherence to scientific advice	Managers may diverge from assessment-based advice in response to other factors such as allowable catch.	Method for developing advice is pre-agreed by managers in MP and therefore should always be followed.
Inputs/ Methodology	Input data and model (type, assumptions, structure, etc.) might change each assessment.	Input data and method for analyzing those data to estimate stock status indicator are pre-agreed in the MP.
Expected management performance	Varies. Unpredictable.	Tested by simulation and quantifiable. Gives confidence in management approach.
Uncertainty	Uses sensitivity analyses to investigate uncertainty in the *estimated* stock status and fishing mortality. Results in management with unknown robustness to uncertainties.	Uses multiple scenarios for the 'true' fishery system as a testbed for MPs. Don't need to know which scenario is more likely, but rather only to find the MP that performs well across all uncertainties.
Fishery stability	Typically not considered as an output or provided from stock projections.	Can be evaluated as an objective and prioritized.
Stakeholder involvement	Little to none. Scientists develop the assessments; managers consider the outputs.	Stakeholders are central to the process, involved at each stage from development of objectives to MP design and adoption.

Category	Stock Assessment-based management	Management Procedure
Transparency	Since management performance of assessments is unknown, it is not clear how decisions regarding modelling and data were made.	MSE process (e.g., objective-setting, balancing tradeoffs) makes it clear why an MP is chosen.
Typical target period	1-3 years.	5-20 years.
Time and funding needs	Consistent funding requirements.	Initial development of an MSE framework and MP adoption is generally more arduous and technical. Implementation of adopted MP is much easier.
Response to unforeseen circumstances	Conduct another stock assessment (with or without emergency management measures), revise the models and re-run, conduct a peer review.	Exceptional Circumstances Protocols are developed to guide rapid response.
Role of stock assessment	Serves as the basis for management advice.	Used as a "health check" for the MP; not used to provide advice.
Management output	Catch/effort limit, etc., not pre-agreed, more open to protracted negotiations.	MP (HCR, data collection method, stock status estimator), catch/effort limits are clearly specified, MP is pre-agreed.

MSE SUCCESS STORIES

Southern bluefin tuna (SBT) and North Atlantic albacore tuna are the tuna populations that have been managed under MPs the longest. Both have experienced notable stock growth simultaneously with TAC increases under the MP, even when the stock was initially overfished, as was the case for SBT. Another benefit includes a noteworthy ability for SBT to secure business loans, given the predictable, secure future of fishing opportunities.





CONCLUSIONS

Rebuilding, stabilizing, and building resilience for fisheries requires management approaches that set – and stick to – long-term strategies. The traditional management approach of stock assessment-based advice combined with lengthy political negotiations for determining TAC or TAE on a year-to-year basis does not meet these needs. With MSE-based MPs, fishery managers will have a clear blueprint on how to set fishing levels for the following years to achieve their objectives while addressing socio-economic concerns of fishermen.

The bottom line is that stock assessments provide a limited basis for decision-making in an uncertain system with conflicting data sources. MSE, on the other hand, enables the selection of an MP that managers can be confident will achieve their objectives into the future. An MP is all about long-term planning for efficient and results-driven management, which is why MPs are replacing the traditional approach in both international and domestic fisheries worldwide.

Mahi and yellowfin in a purse seine net

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