A net full of skipjack tuna is hoisted over the side of a purse seine vessel.

How to Efficiently Craft a Management Procedure

A Review of Steps and Timelines for MP Development and Adoption

MANAGEMENT PROCEDURES (MPs), ALSO KNOWN AS HARVEST STRATEGIES, are decision-making frameworks that integrate long-term planning into fisheries management. For MPs, fishery managers, scientists, industry representatives, environmental organizations, and other stakeholders come together to form a shared vision for what they want a fishery to look like in the long-term, and then agree to the fishing rules that will guide it there.

MPs can provide many benefits and be designed to meet specific objectives, including recovering depleted stocks or proactively ensuring stability of healthy stocks and fisheries, while taking uncertainties, such as stock productivity or climate change, into account. MPs streamline decision-making processes via pre-agreed rules that set fishing levels based on stock status indicators, thereby clarifying scientific advice and increasing transparency

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and efficiency of management. This contrasts with the politically contentious and time-consuming negotiations associated with traditional, reactive fisheries management. But as with any major reform, the collaborative and technical process of MP development may, at first, be a significant investment of time and resources.

Because stakeholder involvement is a major hallmark and strength of MP development, crafting MPs requires an iterative exchange among scientists, managers, and stakeholders. This necessitates a stepwise, inclusive process to select candidate and final options for each MP element, from objectives to harvest control rules (HCRs) and everything in between.

While MP development has been slow to progress in some cases, that does not need to be the norm. Delays to date have been caused by issues ranging from budget constraints and technical challenges to blocked consensus on key decisions, or an inability to convene dialogue meetings as a forum for the required iterative exchange. To minimize such delays, it is important to understand and plan for the timeline and processes for MP development in advance, including capacity building for key stakeholders. And critically, the resulting workplan should be adequately resourced and adhered to.

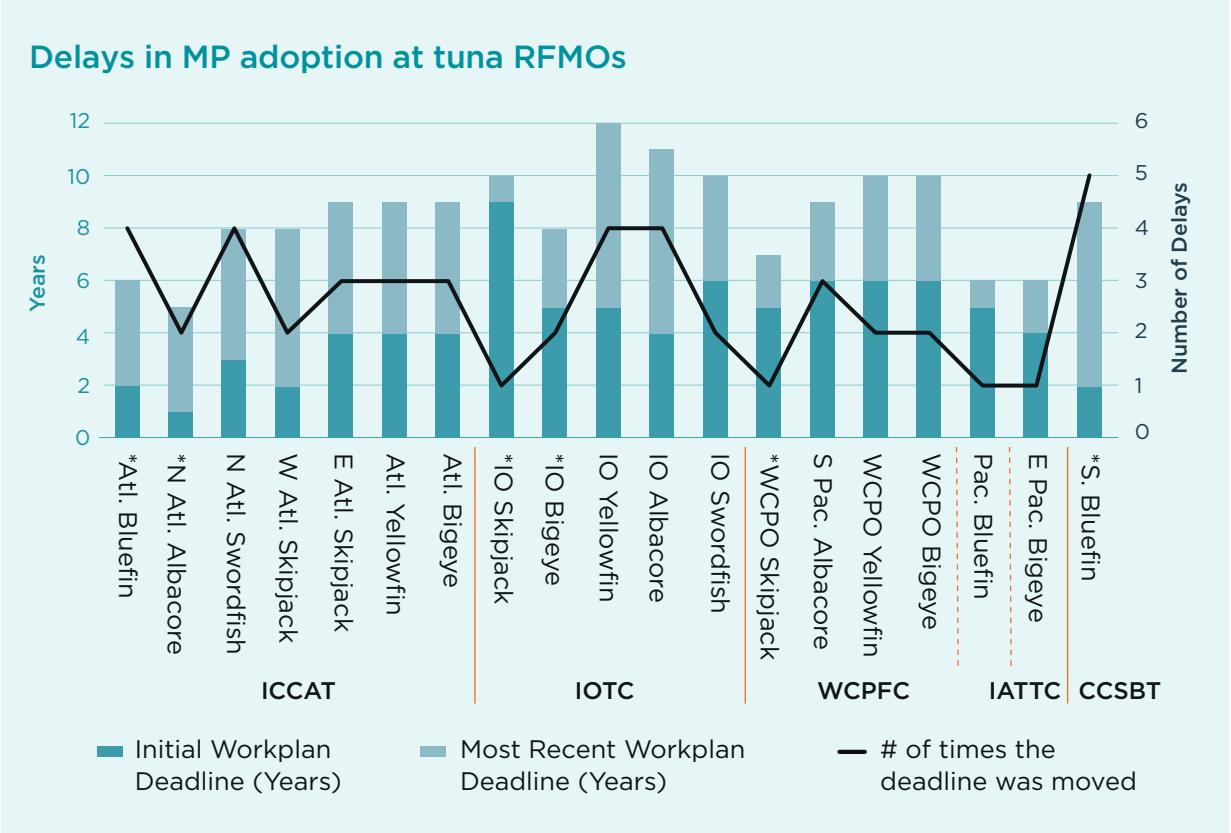

Figure 1. Delays in MP adoption at the tuna RFMOs based on deadlines set in the initial workplans compared to the most recent workplans, organized by RFMO, showing that each of the original workplans (dark teal) was extended at least once (black line) by one or more years (light teal). Dashed lines indicate MPs for trans-Pacific stocks with joint MPs for WCPFC and IATTC. * Indicates stocks that have adopted MPs. North Atlantic albacore and Indian Ocean skipjack values are based on MP adoption rather than the interim HCR adoption for both stocks.

From initial conception through preparation, analysis, and political negotiations, some MPs, such as that for Atlantic bluefin tuna, have required up to a decade of work before being fully implemented. Others like Greenland halibut at the Northwest Atlantic Fishery Organization (NAFO) have taken as little as a year. Why the difference, and how can MP development steps be made more efficient? Now that each of the regional fisheries management organizations that manage tuna and related species (tRFMOs) has adopted at least one MP, the roadmap to adoption should be clearer, and positive steps can be taken to streamline the process.

STEPPING STONES FROM MP CONCEPTION TO ADOPTION

MP DEVELOPMENT IS A MULTI-STEP, COLLABORATIVE PROCESS (Figure 3). A rigorous management strategy evaluation (MSE) is the centerpiece of the exercise, and some even consider the term 'MSE' to describe the full MP development process. In MSEs, different management approaches are evaluated by scientists using computer simulations and presented to managers, who select options for further testing or adoption based on their ability to achieve objectives. MSEs assess candidate MPs across a range of possible future conditions to select the one that is most likely to achieve the agreed vision for the future of the fishery in the face of various uncertainties.

A fully specified MP typically includes 1) a data collection program, 2) a model-based or empirical method for using the collected data to obtain an indicator of stock status, and 3) a harvest control rule (HCR), the pre-agreed rule that governs how harvest is managed depending on the indicator estimate of stock status. Another critical element that accompanies these three core MP components is an 'exceptional circumstances protocol' that provides guidance in the event of unforeseen or unlikely circumstances that may require additional management actions or review of the MP. This protocol may be formalized after MP adoption, if necessary.

Here, we break down the MP development process into 3 steps.

Step 1: Initiation and scoping

The first step is to build consensus within a management body to pursue an MSE-tested MP. This requires consideration of a fishery's unique threats or challenges and how MPs can address them. Once it is agreed to develop a management procedure, initial scoping should include comprehensive outreach and capacity building on MSEs and MPs to relevant stakeholders and decision-makers who are new to the approach.

Next, the vision for the fishery, expressed as management objectives, must be discussed and understood to set bounds and direct the MSE. Most importantly, managers, taking stakeholder input into account, should agree on reference points that define optimal levels of stock abundance (target reference points) and critically low levels of abundance (limit reference points). These target and limit reference points, in conjunction with the acceptable odds of achieving or breaching them, respectively, over a specific time period will help focus the MSE when testing candidate management procedures. Other objectives

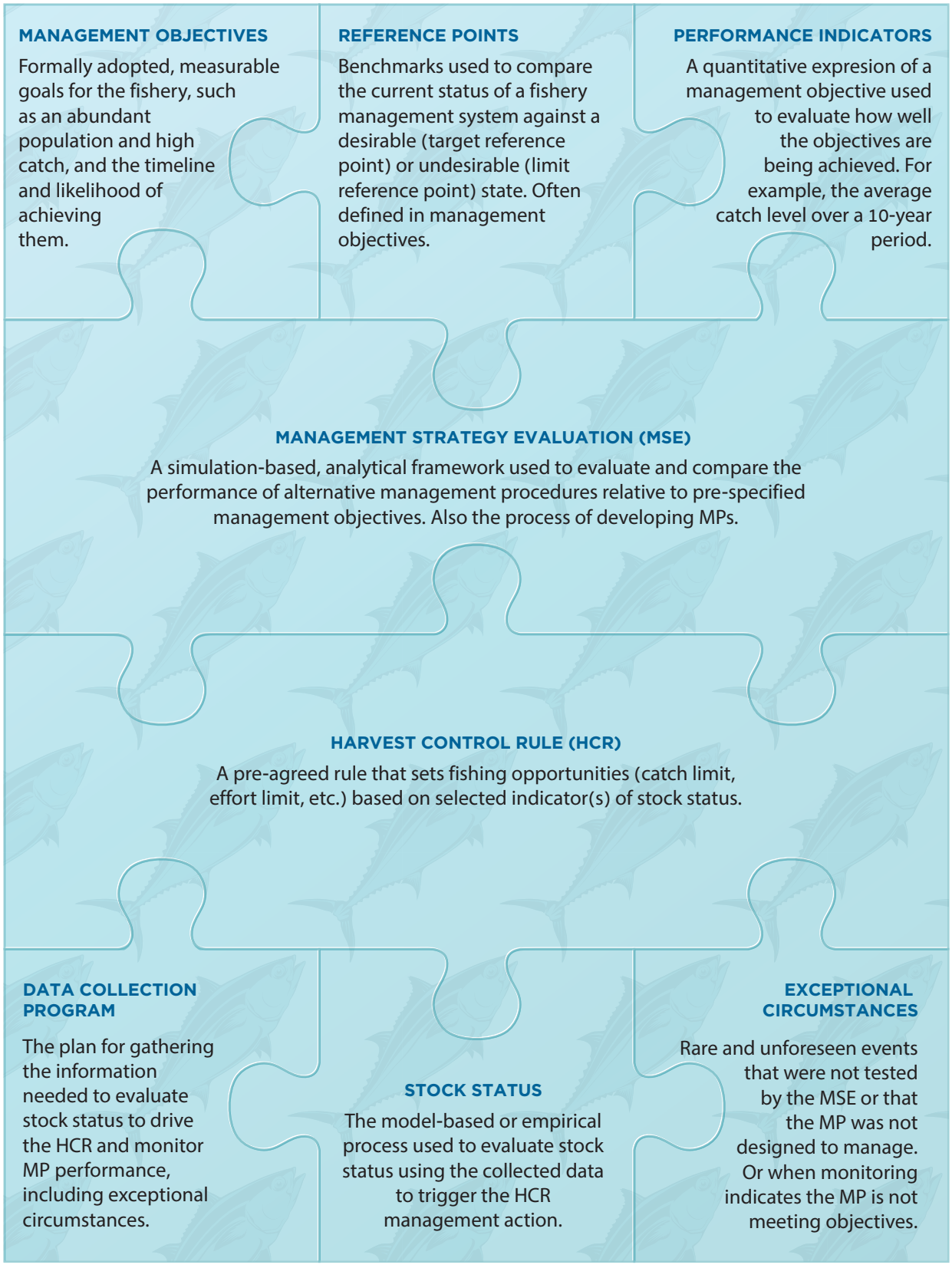

Figure 2. The puzzle piece elements that join together to create a management procedure.

can include fishery performance such as maximizing yield, achieving a target catch rate, and stability in the fishery, among others.

The initiation and scoping phase is also an opportunity to provide input on an MSE workplan. This can include agreement on how discussions will proceed and formation of any specialized working groups to serve as a forum for those discussions, such as a dedicated science-management dialogue group (SMD). Other considerations can include how human resources will be deployed to develop and conduct the MSE, whether they be internal full-time positions or externally hired consultants, and a process to review the technical work so stakeholders and managers can have confidence in the MSE outputs.

The initial scoping phase for MSEs can be achieved through one or a series of workshops. However, SMDs can be a more effective means of advancing coordination among managers, scientists, industry representatives, and other stakeholders to progress MSEs by fostering structured discussions, especially when financial resources are limited.

Step 2: First round of results and consultation

The first round of the MSE will test the performance of multiple candidate MPs against the management objectives identified during Step 1. Major decisions during this phase include the suite of uncertainties and types of candidate MPs to test. During this period, the initial MSE results are presented by the scientists to managers and stakeholders for their review. From here, a subset of candidate MPs are typically re-run with a more refined, targeted analysis to reflect the feedback given by managers and stakeholders. The complexity of the analysis, capacity to convene scientists, managers, and other stakeholder groups to review and provide feedback, and the quality of feedback provided will dictate how long it will take to complete the initial MSE during Step 2. The MSE workplan and next steps should be reviewed regularly during this time to help ensure the process stays on schedule. The MSE methodology may also receive review by independent technical experts during this stage.

Step 3: Second round of results and final recommendations

The results of the final MSE analysis are reviewed first by the fishery scientists, and then presented to managers and other stakeholders. These groups then discuss the relative performance of the final set of candidate management procedures and are expected to choose one or some of them to forward to the decision-making body for adoption.

However, if participants cannot agree on which MP to recommend for adoption, or if further analysis is requested, then another round of refinement of MP parameters and testing may be called for. These additional rounds of review can be important for ensuring that an MP is well designed, scientifically robust, and adequately reflective of the various objectives of different parties. But further reviews should only be conducted if there is a compelling need since they add further time to development. Agreement on a revised workplan and next steps should accompany any such extensions.

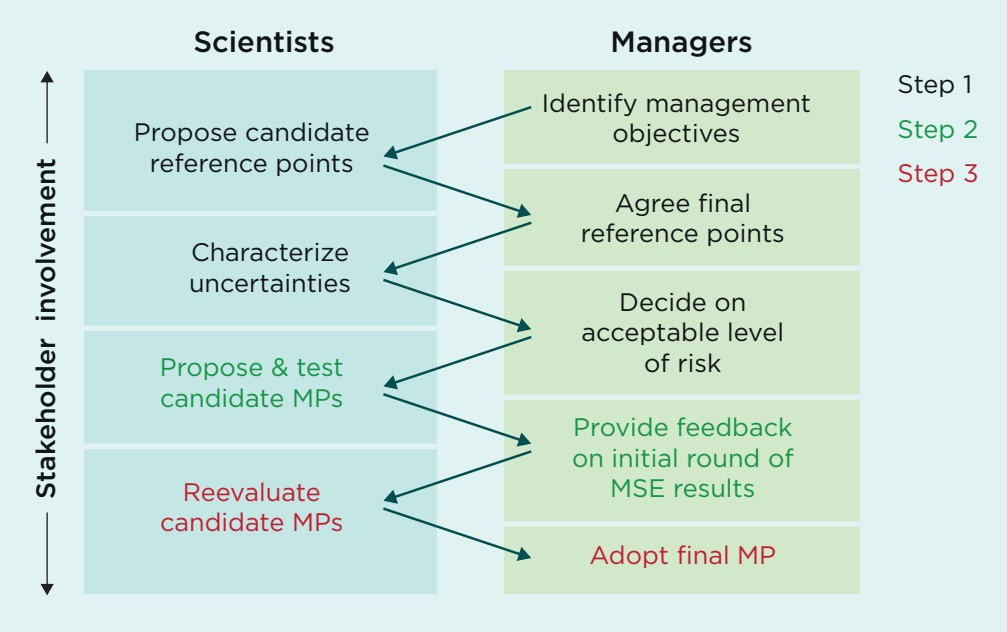

Figure 3. Flowchart of MP development showing an example of the iterative exchange of information during the 3 steps.

CASE STUDIES OF MP DEVELOPMENT TIMELINES

Greenland halibut

Managed in the waters between Greenland and Canada by the Northwest Atlantic Fisheries Organization (NAFO), the Greenland halibut fishery experienced historical overfishing that encouraged managers to seek alternative approaches to rebuild the stock. In 2009, after seeing the preliminary MSE work done over the prior two years, managers decided to pursue an MSE-based MP. The MP was finalized in one year, making Greenland halibut a commonly referenced case study for efficient MP development and adoption.

Many of the best practices highlighted here for MP development were utilized for Greenland halibut to help advance the process. One of the most significant steps was the formation of a science-management dialogue (SMD) at the onset of the process. The SMD for Greenland halibut, considered by some experts as a major element of the MP's successful development, was especially effective in this case because SMD meetings were scheduled regularly and in-sync with key phases of MP development.

The first meeting in January 2010 focused on capacity development and introduced the concept of MSE and MPs to stakeholders and decision-makers to help them understand how the approach is used and how to interpret results. The second meeting in May of that year included presentation of advice from the Scientific Council. And the third meeting in September 2010 included presentation of final MSE results and finalization of recommendations to the Commission. Opportunities for input from dialogue group members were key features of these meetings. The SMD also set ambitious timelines and goals for itself which have also been credited with its success.

The situation was similar when the MP was revised in 2017 after exceptional circumstances had been triggered in most years under the original MP. Again, an SMD served as the forum for iterative exchange about the MSE, and over an 8-month period, six meetings were convened to develop and adopt the new MP.

Atlantic bluefin tuna

As the largest and historically most coveted species of tuna, management of Atlantic bluefin tuna is notoriously contentious. With the International Commission for the Conservation of Atlantic Tuna's (ICCAT) 52 members, compared to NAFO's 13, reaching consensus on any decision is a challenge. After fishing was nearly banned in 2009, recovery efforts for this species, divided across two stocks in the eastern and western Atlantic, began to take hold. In 2013, ICCAT agreed to pursue a single management procedure for both stocks.

As a multi-stock MSE, the MSE for Atlantic bluefin tuna had unique scientific and management complexities that challenged its development. Meetings began in 2014 with ICCAT's Standing Working Group to Enhance Dialogue Between Fisheries Scientists and Managers (SWGSM). However, decision-makers were not able to agree on the long-term vision for the stock until the end of the process, requiring the MSE scientists to model, assess, and communicate a much larger array of results throughout the development than they would have if given more direction by the managers at the onset. A focus on stock assessments to inform immediate management requests also took time and energy away from the MSE process.

Nevertheless, momentum improved once discussions transitioned in 2018 to a species-specific subgroup that met up to four times per year for the purposes of MSE discussions. Similar to SMDs, these meetings were also open to stakeholder input and participation, which was instrumental to developing management objectives and other specific MP elements to help advance the process. The frequency, focus, and open collaboration of these meetings helped complete the MSE and led to MP adoption for Atlantic bluefin tuna in 2022 after eight years of work.

Expected vs. actual durations for Greenland halibut and Atlantic bluefin tuna MP development

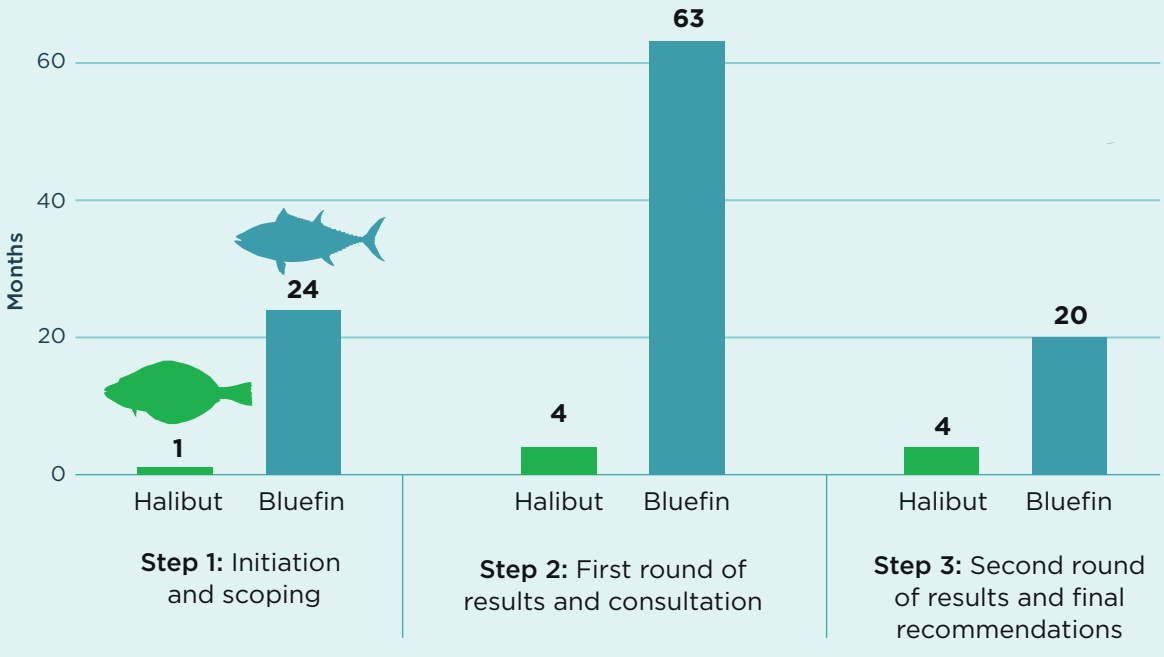

Figure 4. The actual time needed for each step in the Greenland halibut (green) versus Atlantic bluefin tuna (blue) case studies. Note that Greenland halibut had an additional two years of MSE development prior to the broader MP discussions highlighted here.

BEST PRACTICES AND IMPORTANT LESSONS FOR TIMELY AND EFFICIENT COMPLETION OF MSE AND MP ADOPTION

Several key strategies can have major impacts for making the MSE process as efficient as possible (Table 1). Some of these best practices and lessons learned to avoid delays are described here, including examples of how their inclusion (or omission) impacted the case studies for Greenland halibut and Atlantic bluefin tuna.

a. Sufficient and organized data

Although MSEs can be conducted for data-limited stocks, more complete and comprehensive data allow for a narrower range of uncertainty to be considered and a more robust result when it comes to MP selection. Timely provision of data also serves to facilitate an efficient process since waiting for data submission and processing, for example of indices of abundance, can cause significant delays. Fisheries that already have more complete and organized data on catch and effort, as well as better substantiated assumptions about biology (for example, maturity and productivity), will experience a smoother MSE process.

In addition, data submission deadlines, or data "guillotines" should be used to prevent late submissions of data from confounding results. Furthermore, it will sometimes be necessary to incorporate data lags of 2-3 years (that is, data from 2 years prior will be considered "current" in the MP) given oftentimes slow catch and effort reporting in international fisheries.

b. Science-management dialogue groups (SMDs)

One of the greatest strengths of MPs is that they are developed via open and transparent processes that maximize stakeholder inclusion in decision-making. However, that engagement does not happen organically, and steps need to be taken in the workplan to foster discussions across different stakeholder groups. One practice for achieving that goal is establishing SMDs that provide opportunities for managers, industry representatives, environmental organizations, and other stakeholders to converse directly with scientists conducting the MSE to allow for input and feedback throughout the MSE and MP development process. These conversations are important for helping increase knowledge and capacity among managers and stakeholders, as well as for allowing them to communicate to scientists what they want to see from the fishery and potential candidate management procedures they think could be viable. It should be noted, however, that the degree of understanding about the MSE is usually different between scientists and others. Capacity building efforts at the onset can help managers and other stakeholders understand the importance of measures such as establishing management objectives. This education can also prepare managers and other stakeholders to understand the MSE results more easily.

Importantly, MPs are driven by managers at both the front and back ends, by their selection of management objectives and adoption of the final MP, respectively. These iterative exchanges therefore help the scientists to deliver what the managers seek.

Regular interactions also help to identify and resolve any potential concerns or practical hurdles as they arise.

As separate, dedicated discussions, SMDs also provide fishery management bodies more time to work specifically on MP development without interfering with other scheduled priorities and standard meeting agendas, subsequently helping to mitigate the potential for delays. One particularly notable example is Greenland halibut, where an SMD was highly effective because it was able to meet regularly and in coordination with major steps in the MSE and MP development process. A focus on capacity building in the early stages of the development process has also helped SMDs make lasting progress.

c. Clear and detailed workplans

Members should also agree to a structured workplan for the MSE that clearly outlines tasking timelines and the roles for different stakeholder groups. In considering the timeline, participants should not underestimate the complexity of the MSE. Meetings, research, and other needs must be taken into account and formed into a detailed – and eventually funded – project budget that is agreed upon by all parties. Human resources are particularly important to support these tasks.

d. Contributions and support from external experts

MSE development can be intensive at times, but there are ways to ensure that the process is completed in a reasonable amount of time. Since the work is highly specialized, additional expertise may be required to advance the effort. Fishery management organizations that may not have the budget for a full-time MSE position(s) can enhance their capacity by hiring outside experts with a specialization in performing MSEs on a contracted

A tuna purse seiner

Jeff Muir ©ISSF

basis. This can help leverage necessary skillsets in a manner that also balances time and financial resources available. Hiring independent facilitators to chair the process can also be valuable, ensuring that every voice is heard and that workplans and deadlines are respected. Contracted experts have the additional benefit of being able to allocate specific time to MSE development without conflicting priorities, and with no country affiliation, they can balance the interests of all parties with no perception of bias. The Atlantic bluefin tuna MSE hired both an external facilitator and an experienced MSE analyst; once these two were onboard, the pace of development accelerated significantly.

Challenge	Best practice solution
Lack of understanding of MP approach	Fund hands-on, targeted capacity building workshops. Convene informal discussions about general and stock-specific MP issues.
Lack of stakeholder involvement	Establish MSE dialogue groups to ensure active stakeholder involvement in iterative exchange between scientists and managers.
Vague management objectives	Adopt specific and measurable management objectives in initial stages of MP development. If this is difficult, interim objectives should be established.
Concerns that MSE is a 'black box' that is difficult to understand.	Ensure scientific transparency. Have technical work reviewed by independent experts.
Lack of understanding of MSE results	Communicate results in multiple forms (e.g., graphs, tables, interactives) to appeal to different backgrounds and learning styles. Fund hands-on, targeted capacity building workshops.
Shortage of MSE experts	Offer technical MSE trainings to governmental and other interested scientists.
Inadequate funding	Seek additional financial support from governments, industry, and the non-profit sector.

Table 1. Recommended solutions to common issues that cause delays during the management procedure (MP) development process using management strategy evaluation (MSE). Modified from Pipernos et al. 2023, Fisheries, "Tuna Regional Fisheries Management Organizations Need to Prioritize Transition to Management Procedures".

e. Other lessons and best practices

As a complex process, MSE and MP development can fall behind schedule when there is no clear direction. Specific and measurable operational management objectives on which to base interpretation of MSE results are critical, the lack of which has caused MPs for fisheries like Atlantic bluefin tuna to be significantly delayed. It is also true, however, that agreeing to the operational management objectives is not easy as they will dictate the actual outcomes of the MP (e.g., catch limit), and managers and other stakeholders tend to be cautious since they are not sure about the results when setting the objectives. The problem could be solved by stressing that the process is iterative.

Clearly demonstrating the benefits of MPs to the fishing industry can also help to keep the process on schedule. Engagement from seafood markets, for example, has the potential to create economic incentives for fishers in the form of sourcing requirements, sustainability certifications (for example, the Marine Stewardship Council, MSC), or other actions, which can (and have) included MP adoption as a criterion. And a wider diversity of expert input from other scientific fields, including social sciences, can also be beneficial for addressing a wider range of objectives, including socio-economic goals.

Lastly, MPs can be expensive to produce. If funding runs out, this can delay the process indefinitely. Financial support from governments, industry, and the non-profit sector can help ensure that the work will be completed on schedule.

CONCLUSIONS

As a transparent, inclusive and iterative process that takes a long-term approach to management, MSE-tested MPs have proven to be effective tools for recovering and stabilizing important fish stocks. They can also streamline the management process, freeing up capacity among fishery management bodies to work on other issues, like compliance and ecosystem-based fisheries management. But effectively implementing and utilizing an MP requires significant investment, particularly in the early stages, to ensure a smooth development and adoption process. It is vital that fishery managers, scientists, NGOs and industry stakeholders understand the steps, timeline, and best practices when initiating the process so that they can plan accordingly to ensure an efficient and well-designed process and minimize disruptions that may cause delays. In doing so, the initial investment in MSE development pays off with an effective long-term MP that will achieve an abundant and sustainable fishery across a breadth of potential futures.

A school of yellowfin tuna in a purse seine net.

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