



Management strategy evaluation in regional fisheries management organizations – How to promote robust fisheries management in international settings



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ABSTRACT

Management Strategy Evaluation (MSE) is a process to develop a management strategy that is robust to uncertainties and appropriately reflects the trade-offs among the management objectives of stakeholders. It is widely recognized as best practice to develop a management strategy for fisheries management and has been implemented in a number of domestic fisheries. In contrast, implementation of MSE in the international fisheries management is limited. In this study, the development of MSE in various (five tuna related and eight other) regional fisheries management organizations (RFMOs) is reviewed and common features among RFMOs that have been either successful or not so successful are studied, mainly from the viewpoint of a decision-maker. Furthermore, challenges specific to RFMOs to implement MSE are discussed. It is found that the complex nature of the governance by RFMOs as an international institute poses unique challenges for implementing MSE, which is not easy even in much simpler domestic fisheries. In addition to further efforts to improve communication with stakeholders to obtain their understanding and commitment to the MSE process, it is suggested that RFMOs take a more practical approach to advance work on MSE, which is to discuss and decide the elements of MSE such as management objectives, their associated performance indicators and the harvest control rules as a package which includes examples of practical options and their differences in performance, rather than having an initial focus on conceptual aspects such as early clarification of objectives, to improve management as soon as practicable.

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1. Introduction

In fisheries management, specific control measures for fishing activities (“management measures”) need to be developed based on scientific evaluations such as stock assessments and future projections (Hilborn and Walters, 1992). In the traditional approach for the provision of scientific advice, scientists will develop their best estimate of stock status using a base-case model among numerous possible model settings, and build their scientific advice to fisheries managers, such as recommended total allowable catch (TAC) or total allowable effort, based on the results of their best estimate (Butterworth, 2007). Fisheries managers will then decide management measures based on such advice from the scientists. Butterworth (2007) noted several disadvantages associated with the traditional approach, such as variability of best assessments from year to year, lengthy discussions for deciding management measures and the risk of the best assessment being wrong.

Fueled by the wider acceptance of precautionary approach in fisheries management as manifested in the United Nations FAO Code of Conduct for Responsible Fisheries (FAO, 1995), and to overcome the challenges related to the traditional approach for providing scientific advices, management strategy evaluation (MSE, synonym of “management procedure approach”; Rademeyer et al., 2007), is now considered a more robust approach for establishing management strategies for fisheries. This involves identification of management objectives, simulation testing of various candidate management strategies to understand the trade-offs possible among the management objectives, selection of a management strategy and its implementation, and feedback of monitoring data to the simulation model (e.g. Punt, 2006). This approach treats uncertainties effectively and involves all the stakeholders in decision-making. In fact, MSE is now widely acknowledged as the most appropriate way to compare different management strategies (Punt et al., 2016) and has been widely used in either or both a broad strategic sense or to provide specific tactical advice for individual fisheries domestically in countries such as South Africa, the U.S.A, New Zealand, Australia (Punt, 2006) and European Union (ICES,

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2013). As Schnute et al. (2007) suggested, MSE is revolutionizing fisheries management in some areas.

The application of MSE is not confined to domestic fisheries but it has also been used in international fisheries management by regional fisheries management organizations (RFMOs); indeed the first practical application of a MSE to resource management was the development of the Revised Management Procedure by the International Whaling Commission (IWC), where the problems of management decisions relying only on the “best” assessment of a stock at a particular time had become particularly evident (Punt and Donovan, 2007). In addition to IWC, an MSE has been successfully used for southern Bluefin tuna (*Thunnus maccoyii*) in the Commission for the Conservation of Southern Bluefin Tuna (CCSBT) (Kurota et al., 2010) and Greenland halibut (*Reinhardtius hippoglossoides*) in the Northwest Atlantic Fisheries Organization (NAFO) (NAFO, 2010d). Further to those two examples, participants to the tuna RFMOs recognized that MSE needs to be widely implemented in the tuna RFMOs to implement a precautionary approach for tuna fisheries management at the third meeting of Kobe Process (Anon., 2011), which was initiated with an intention to better coordinate conservation efforts among the five tuna RFMOs (Inter-American Tropical Tuna Commission (IATTC), International Commission for the Conservation of Atlantic Tunas (ICCAT), Indian Ocean Tuna Commission (IOTC), CCSBT, and Western and Central Pacific Fisheries Commission (WCPFC)) (Anon., 2007). However, after more than five years since the Kobe III meeting in 2011, and despite the widely recognized benefits of MSE and many successful examples, particularly in domestic fisheries, the application of MSE in RFMOs are limited to above three examples including IWC, which contrasts with the more rapid progress in domestic fisheries globally.

The objective of this study is, therefore, to review, from the viewpoint of a decision-maker, the successful examples of MSEs in the RFMOs, namely, in CCSBT and NAFO (the case of IWC is not considered in detail here since that organization is different from a typical RFMO due to its highly political nature as well as very simple structure of harvesting stakeholders compared to RFMOs), and the progress of MSE application in other RFMOs to investigate challenges to implement MSE in the RFMOs. Then, possible approaches to deal with those challenges are discussed. The study focuses on how to improve governance processes to advance MSE in international settings primarily from manager's perspective, rather than to discuss technical aspects of MSE, which has been done in many studies (e.g. Butterworth, 2007; Punt et al., 2016; ICES, 2013).

2. Materials and methods

The principles of management of fish stocks that occur in or migrate through the EEZs of multiple countries and/or high seas are stipulated in United Nations Convention on the Law of the Sea and more specifically United Nations Fish Stock Agreement. Based on those principles, many RFMOs were established to manage international fisheries regionally. They can be conveniently divided into the tuna RFMOs managing highly migratory species and the RFMOs managing other species. These RFMOs usually have Commission meetings to make decisions and a subordinate scientific body to provide scientific advice to the Commission, as necessary for their decision-making.

For this study, the reports of the Commission meetings, scientific committee meetings and other relevant meetings of all of the five tuna RFMOs (IATTC, ICCAT, IOTC, CCSBT and WCPFC) and the other eight major RFMOs (Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR),¹ International Pacific

Halibut Commission (IPHC), NAFO, North East Atlantic Fisheries Commission (NEAFC), North Pacific Fisheries Commission (NPFC), South East Atlantic Fisheries Organization (SEAFO), South Indian Ocean Fisheries Agreement (SIOFA) and South Pacific Regional Fisheries Management Organization (SPRFMO)) were reviewed, and discussions related to MSE development were extracted and then compared to find common aspects.

3. Results

3.1. Current status of MSE development in the RFMOs

A summary of the MSE development in the RFMOs is provided in Table 1. At least some work related to MSE has been in progress in all the tuna RFMOs, CCAMLR, IPHC, NAFO, and SPRFMO. On the other hand, no MSE-related progress was found for NEAFC, NPFC, SEAFO and SIOFA from the literature search.

3.2. Review of the two RFMOs which had successfully completed an MSE (CCSBT and NAFO; Table 1a and b, respectively)

Both of the two fish stocks for which an RFMO had completed MSE, namely, southern bluefin tuna and Greenland halibut, had faced a severe challenge of international fisheries management before the development of an MSE commenced. In case of CCSBT, a difference of views on the interpretation of indices of abundance which were key to the stock assessment and estimated stock status resulted in a failure to agree on the catch limit for many years, eventually rendering the matter an international legal dispute to be handled at the International Tribunal of the Law of the Sea and then an Arbitral Tribunal (Kurota et al., 2010). As a result of the ruling by the Tribunal that the matter should be resolved within CCSBT, the members of CCSBT (guided particularly by an independent scientific panel they had appointed to assist their scientific committee in achieving consensus) decided to start the process of developing management procedure (CCSBT, 2000a),² which was in effect an MSE. In case of Greenland halibut in NAFO,³ the Commission had adopted a rebuilding plan for the stock because its status had reached a historic low level (NAFO, 2003). However, the TAC for this stock had been exceeded substantially thereafter for many years although fishing effort had been reduced (NAFO, 2007b). NAFO consequently decided to use MSE for Greenland halibut to conduct a comprehensive analysis of the performance of rebuilding strategies for the stock, including the one in place at the time (NAFO, 2008). Therefore, in case of those two RFMOs which were confronted with major challenges in international fisheries management, it can be said that the decision-making body of the RFMO (the Commission), needed a novel way to overcome such challenges, which resulted in the implementation of a MSE.

Another shared aspect of the MSE in CCSBT and NAFO is that the both MSEs were conducted to evaluate various management strategies to achieve a stock rebuilding program (Kurota et al., 2010; Butterworth and Rademeyer, 2010). As discussed further later, determination and operationalization of management objectives is a critical part of an MSE but it can be a difficult task particularly in the RFMOs. In the case of the two successful examples, how-

role for the management of fisheries activities in the Antarctic, in this study it is treated as an RFMO.

² “Management strategy”, “management procedure” and “harvest strategy” are treated as inter-changeable in this study. The term “management strategy” is used primarily but the other terms are also used if that is the specific term used in a particular organization.

³ In Subarea 2 and Divisions 3KLMNO.

¹ According to its website, CCAMLR's objective is to conserve Antarctic marine life and its characteristics may be different from other RFMOs. However, considering its

Table 1

Summary of discussions on management strategy evaluation (MSE) at the regional fisheries management organizations.

(a) Commission for the Conservation of Southern Bluefin Tuna (CCSBT)		
Date	Forum	Content of discussion
March 2000	Commission	Agreed to hold a management strategy workshop (CCSBT, 2000a).
May 2000	Management Strategy Workshop	Basic concept of management strategy was discussed. Target was agreed to achieve the spawning biomass in 1980 by 2020.
November 2000	Special Meeting of Commission	Agreed a schedule of developing a Management Procedure (MP) (CCSBT, 2000b).
August 2001	Scientific Committee	Basic concept of the MP and schedule was developed (CCSBT, 2001b).
October 2001	Commission	The plan of MP development by the Scientific Committee was adopted (CCSBT, 2001a).
March 2002	MP Workshop	Discussed basic components of MP and developed a time schedule to complete MP by 2004 (CCSBT, 2002a).
September 2002	Scientific Committee	Further developed the MP (CCSBT, 2002c).
October 2002	Commission	Approved the MP work plan and extension of the expert panel contract (CCSBT, 2002b).
April 2003	MP Workshop	The MP candidates were tested using the updated operating model. Industry consultations were also held (CCSBT, 2003b).
October 2003	Commission	Various aspects of the MPs were discussed. The original target (spawning biomass in 1980 by 2020) was abandoned (CCSBT, 2003c).
April 2004	MP Workshop	Development of the MPs continues (CCSBT, 2004d).
April 2004	Special Meeting of Commission	Status of MP development was reported to the Commission. Commission made further requests to improve the MPs (CCSBT, 2004c).
September 2004	Scientific Committee	Development of the MPs continues (CCSBT, 2004b).
October 2004	Commission	Remaining problems related to the MPs were reported and the Commission decided to delay the completion of the MP by 2005 (CCSBT, 2004a).
May 2005	MP Workshop	Development of the MPs continues (CCSBT, 2005a).
May 2005	MP Special Consultation	Managers were explained the candidate MPs and made final requests. The results were to be provided to the next Commission (CCSBT, 2005b).
August 2005	Scientific Committee	Development of the MPs continues (CCSBT, 2005c).
October 2005	Commission	An MP to achieve 2002 spawning biomass by 2022 with 90% probability was adopted, to be implemented from 2009 (CCSBT, 2005d).
October 2006	Commission	A long-term under-reporting of catch was identified and it was decided that the original MP needed to be re-evaluated (CCSBT, 2006).
(October 2011)	Commission	The "Bali-Procedure" was adopted (CCSBT, 2011).
(b) Northwest Atlantic Fisheries Organization (NAFO)		
Date	Forum	Content of discussion
September 2003	Fisheries Commission	Rebuilding Plan for Greenland halibut in Subarea 2 and Divisions 3KLMNO, including a substantial reduction of TAC, was adopted (NAFO, 2003).
June 2007	Scientific Council	Concern was raised that TAC was exceeded for 2004–2006 by more than 20% and recommended a reduction of effort or TAC (NAFO, 2007b).
September 2007	Scientific Council	It was agreed to hold Study Group on Rebuilding Strategies for Greenland Halibut (NAFO, 2007c).
September 2007	Fisheries Commission	Commission maintained the TAC and USA reserved its position due to inconsistency with scientific advice (NAFO, 2007a).
February 2008	Rebuilding Strategies Study Group	Involving scientists, managers and industry, models to assess the outcomes of various management strategies were developed and the Group recommended to continue work on MSE (NAFO, 2008).
June 2008	Scientific Council	Recommended MSE results to be provided to Fisheries Commission in 2009 (NAFO, 2008).
June 2009	Scientific Council	MSE was conducted to evaluate 7 management strategies applied to 8 different operating models (NAFO, 2009b).
September 2009	Fisheries Commission	The results of the MSE were presented. The Fisheries Commission established a Working Group to refine the current MSE framework to help inform management of this stock (NAFO, 2009a).
January, May and September 2010	MSE Working Group	MSE was further developed and final presentation was prepared (NAFO, 2010a,b,c).
September 2010	Fisheries Commission	A management strategy was adopted based on the MSE (NAFO, 2010d).
(c) Inter-American Tropical Tuna Commission (IATTC)		
Date	Forum	Content of discussion
May 2014	Scientific Advisory Committee	A preliminary MSE for Pacific bluefin tuna was presented by the IATTC Secretariat (Maunder, 2014).
May 2015	Scientific Advisory Committee	A preliminary MSE to evaluate the IATTC interim reference points and proposed HCRs was presented by the IATTC Secretariat (Maunder et al., 2015).
May 2016	Scientific Advisory Committee	An exploratory MSE for dorado (Valero et al., 2016) and future plan on MSE research (Maunder et al., 2016) were presented by the IATTC Secretariat.
(d) International Commission for the Conservation of Atlantic Tunas (ICCAT)		
Date	Forum	Content of discussion
September 2013	Standing Committee on Research and Statistics	Suggested to test HCRs and interim limit reference point for albacore using MSE framework. Working Group on Stock Assessment Method will further develop MSE for albacore and swordfish as examples (ICCAT, 2013b).
May 2014	Standing Working Group to enhance dialogue between fisheries scientists and managers	Explanation of MSE was presented and progress of MSE works for northern albacore, north Atlantic swordfish and Mediterranean Bluefin tuna were introduced (ICCAT, 2014a, 2015d).
June 2015		

Table 1 (Continued)

(d) International Commission for the Conservation of Atlantic Tunas (ICCAT)		
Date	Forum	Content of discussion
September 2015	Standing Committee on Research and Statistics Commission	Endorsed Bluefin core modelling group to continue develop MSE framework (ICCAT, 2015c).
December 2015		Adopted the Recommendation to instruct establishing HCRs for north Atlantic albacore, which includes the management objectives (ICCAT, 2015b).
July 2016	Commission Panel 2 Meeting	Work on MSE to date was presented. Performance indicators were agreed and feedback were given by managers (ICCAT, 2016).
(e) Indian Ocean Tuna Commission (IOTC)		
Date	Forum	Content of discussion
March 2010	Commission	Supported the development of an MSE by the Scientific Committee as a tool to evaluate conservation and management measures (IOTC, 2010a).
December 2010	Scientific Committee	Supported the development of an MSE and recognized that the Methods Working Group should be used to coordinate IOTC MSE activities (IOTC, 2010b).
March 2011	Commission	Endorsed development of an MSE (IOTC, 2011a).
December 2011	Scientific Committee	Recommended that the Commission provide clear guidance regarding management objectives and developed a roadmap for the implementation of MSE (IOTC, 2011b).
April 2012	Commission	Endorsed the proposed roadmap but no guidance was provided regarding management objectives (IOTC, 2012b).
October 2012	Working Party on Methods	Prepared a workplan to develop an MSE (IOTC, 2012a).
December 2013	Scientific Committee	Progress by the Working Party on Methods was presented and further workplan was endorsed (IOTC, 2013).
May 2014	Management Procedure Dialogue	Stakeholders were involved and possible management objectives were discussed (IOTC, 2014b).
December 2014	Working Party on Methods	Progress reports on MSE for albacore, skipjack, yellowfin and bigeye tunas were presented. Recommended Scientific Committee to review possible management objectives (IOTC, 2014a).
December 2014	Scientific Committee	Acknowledged the progress on MSE at Working Party on Methods and recommended the Commission to specify long term objective (IOTC, 2014c).
April 2015	Management Procedure Dialogue	Progress on MSEs at Working Party on Methods was reviewed and candidate operational objectives were discussed (IOTC, 2015a).
June 2015	Commission	Progress on MSEs was presented (IOTC, 2015c). Adopted a Resolution to request Scientific Committee to evaluate HCRs through MSE, including a request to provide list of potential performance statistics (IOTC, 2015d).
December 2015	Scientific Committee	Recommended to establish Technical Committee on MP for further dialogue between managers and scientists and developed a list of possible performance statistics. Reviewed the progress of MSE development (IOTC, 2015b).
May 2016	Management Procedure Dialogue	Prototypes of Management Procedures for albacore, skipjack, yellowfin and bigeye were presented. Further development of Management Procedures was requested (IOTC, 2016a).
May 2016	Commission	Adopted a resolution to establish a technical working group on MSE (IOTC, 2016c) and a resolution to establish an HCR for skipjack (IOTC, 2016b).
(f) Western and Central Pacific Fisheries Commission (WCPFC)		
Date	Forum	Content of discussion
August 2006	Scientific Committee	MSE was mentioned as part of research priorities as a way to evaluate management options (WCPFC, 2006).
August 2008	Scientific Committee	Recommended Commission to establish a parallel/joint process for establishing key management objectives for each target species including the possibility of holding an intersessional workshop on management objectives in 2009 (WCPFC, 2008a).
December 2008	Commission	Agreed that WCPFC6 (in 2009) should consider the possibility of holding a dedicated workshop on management objectives in 2010 (WCPFC, 2008b).
December 2010	Commission	Directed the Secretariat to prepare terms of references for the Management Objectives Workshop, which is to be held in 2012 (WCPFC, 2010).
March 2012	Commission	Approved terms of references for Management Objectives Workshop to assist the Commission to understand the purpose and implications of management objective (WCPFC, 2012a).
November 2012	Management Objectives Workshop	MSE was introduced as a way to achieve an agreement on management strategy (WCPFC, 2012b).
November 2013	Management Objectives Workshop	Discussed possible management objectives and reference points for priority species. MSE was considered a future work to be used for evaluation of HCRs (WCPFC, 2013).
November 2014	Management Objectives Workshop	Options for HCRs for priority species were presented and MSE was mentioned as an option to evaluate them (WCPFC, 2014c).
December 2014	Commission	Developed a conservation and management measure about establishing a harvest strategy for key fisheries including a provision for possible use of MSE (WCPFC, 2014a,b).
April 2015	ISC MSE Workshop	The ISC held a workshop on MSE to further the understanding of MSE by managers and stakeholders attending Northern Committee (ISC, 2015).
September 2015	Northern Committee	Agreed to advance an MSE for north Pacific albacore by the ISC (WCPFC, 2015b).
December 2015	Harvest Strategy Workshop	Discussed various elements of harvest strategy (WCPFC, 2015c).
December 2015	Commission	Agreed that the harvest strategy-related issues will be included on the WCPFC13 agenda in 2016 (WCPFC, 2015d).

Table 1 (Continued)

(f) Western and Central Pacific Fisheries Commission (WCPFC)		
Date	Forum	Content of discussion
May 2016	ISC MSE Workshop	Workshop to further the understanding of managers and stakeholders on MSE of north Pacific albacore was held (ISC, 2016a)
August 2016	Northern Committee	The results of ISC MSE Workshop were presented and the Committee encouraged further work (WCPFC, 2016b).
(g) Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR)		
Date	Forum	Content of discussion
July 2005	Workshop on Management Procedures	Aimed to evaluate options to subdivide trigger level for krill. Considered performance indicators and models to evaluate harvesting options (CCAMLR, 2005).
July 2006	Workshop on Management Procedure	Results of evaluation of by management strategies by various models were presented (CCAMLR, 2006a).
October 2006	Scientific Committee	Requested Ecosystem Monitoring and Management Working Group (WG-EMM) to conduct further analysis (CCAMLR, 2006b).
October 2008	Scientific Committee	Could not reach a consensus to provide advice based on the simulation results by the WG-EMM (CCAMLR, 2008).
October 2009	Scientific Committee	Recommended the Commission with various options to allocate trigger level of krill based on the simulation work conducted by the WG-WMM (CCAMLR, 2009c).
October 2009	Commission	Adopted the Conservation Measure to subdivide the trigger level of Krill (CCAMLR, 2009a), which does not necessarily follow the advice of the Scientific Committee (CCAMLR, 2009b).
(h) International Pacific Halibut Commission (IPHC)		
Date	Forum	Content of discussion
January 2013	Commission	Formed Management Strategy Advisory Board (MSAB) to oversee the development of MSE (IPHC, 2013a).
2013–	MSAB	MSAB held several meetings to develop MSE (IPHC, 2013b, 2014a, 2014b, 2015a, 2015b, 2016).
(i) South Pacific Regional Fisheries Management Organization (SPRFMO)		
Date	Forum	Content of discussion
September 2015	Scientific Committee	Agreed to consider the MSE framework for the integration of biological information and stock assessment methods (SPRFMO, 2015).

ever, their main management objective for the MSE was agreed in advance as to recover the stock to a certain level.

Furthermore, the structures of fisheries for those two stocks were relatively simple in comparison to the most of internationally-managed fisheries. In case of southern bluefin tuna, only six countries had an established interest in the fishery when the MSE was being developed (CCSBT, 2001b). The TAC for Greenland halibut was allocated amongst just six countries after the completion of the MSE (NAFO, 2010d). Most of the fleets involved in those fisheries were industrialized and from developed countries. It is also worth noting that the both organizations contracted independent experts to facilitate the MSE process (CCSBT, 1999; NAFO, 2008). Their critical contributions to the MSE process were fully acknowledged in both organizations (Kurota et al., 2010; NAFO 2008). Note that most of the aspects mentioned above are also applicable to IWC (Punt and Donovan, 2007).

As to the time required to complete the MSE, CCSBT agreed to develop a management procedure in 2000 (CCSBT, 2000a) and finally adopted the “Bali procedure” in 2011 (CCSBT, 2011). However, the MSE was originally completed in 2005 (CCSBT, 2005d), but immediately thereafter the management procedure developed by the MSE was considered not to be appropriate for implementation because substantial underreporting of historical catches was identified (CCSBT, 2006). In reality then, CCSBT needed five years to develop its original MSE (2000–2005). In case of NAFO Greenland halibut, a working group on management strategies was established in 2007 to start working in 2008 (NAFO, 2007c) and a management strategy was adopted in 2010 (NAFO, 2010d), thus taking three years to complete the MSE. In comparison, Butterworth (2008) reports that it typically takes 15 months to

complete an MSE in South African domestic fisheries, showing a general trend that MSEs in RFMOs take longer to develop.

3.3. Progress of MSE in the other tuna RFMOs

All the other tuna RFMOs are striving to implement MSEs to develop robust management strategies as a result of Kobe Process (Anon., 2011) and possibly the success in CCSBT. However, the progress and the level of sophistication of MSEs among the tuna RFMOs are not even.

3.3.1. IATTC (Table 1c)

No formal decision has been made by the IATTC to conduct MSE on any particular species, but MSE-related work is being conducted by the Secretariat voluntarily. IATTC is a unique tuna RFMO in the sense that it has a secretariat that includes a large team of scientists, and the main scientific advice provided to IATTC is prepared by the Secretariat, not by its scientific body. The IATTC Secretariat sometimes employs MSE to evaluate possible harvest control rules (HCRs) for certain species (Maunder, 2014; Maunder et al., 2015; Valero et al., 2016).⁴ The Secretariat reports further that it will con-

⁴ An HCR is a set of well-defined rules used for determining management actions (Rademeyer et al., 2007) and usually an HCR, analysis method (assessment) and monitoring of data comprise a management strategy (Punt et al., 2016). In this study, the term HCR is used according to the use by RFMOs but it is unclear if respective RFMO distinguishes management strategy and HCR or considers them synonymous because usually the managers' discussions in RFMOs tend to concentrate on the HCR component of a management strategy. Better explaining the analysis as well as monitoring components of a management strategy may help understanding of managers.

tinue MSEs to evaluate limit reference points and HCRs adopted by IATTC (Maunder et al., 2016).

3.3.2. ICCAT (Table 1d)

In ICCAT, MSEs are in progress for north Atlantic albacore (*Thunnus alalunga*), north Atlantic swordfish (*Xiphias gladius*) and Atlantic bluefin tuna (*Thunnus thynnus*) (ICCAT, 2014a, 2015c). In case of north Atlantic albacore, a preliminary assessment of candidate HCRs was conducted using an MSE and the results were presented to managers (ICCAT, 2015d). The Commission Panel 2 meeting gave some feedback for further work by the scientists (ICCAT, 2016). In case of Atlantic bluefin tuna, an expert group is working to develop an MSE framework for the species (ICCAT, 2015c). ICCAT has also held a series of meetings of the Standing Working Group to Enhance Dialogue between Fisheries Scientists and Managers to improve communication and foster mutual understanding between fisheries managers and scientists, and to support the further development and implementation of science-based management strategies (ICCAT, 2015d). MSE is one of important topics discussed in this Standing Working Group.

3.3.3. IOTC (Table 1e)

In IOTC, the Commission supported the development of an MSE by the Scientific Committee as a tool to evaluate conservation and management measures (IOTC, 2010a). As of 2016, MSEs for albacore, skipjack tuna (*Katsuwonus pelamis*), yellowfin tuna (*Thunnus albacares*) and bigeye tuna (*Thunnus obesus*) are under development (IOTC, 2016a). In addition, a series of meetings to facilitate the dialogue between scientists and fishery managers in developing management procedures for IOTC stocks has been held (IOTC, 2014b, 2015a, 2016a). The Commission also adopted a resolution to establish a technical working group on management procedures (IOTC, 2016c).

3.3.4. WCPFC (Table 1f)

In WCPFC, MSE was mentioned as one of research priorities in 2006 as a way to evaluate management strategies (WCPFC, 2006). Afterwards, the focus of the discussions moved to agreement on management objectives (WCPFC, 2008a,b) and the first Management Objectives Workshop was held in 2012 to assist the Commission to understand the role of and the process to evaluate management objectives, reference points and HCRs (WCPFC, 2012b) and in total four Workshop meetings were held. In the third Workshop meeting in 2014, possible HCRs for several species were presented and MSE was mentioned as a tool to evaluate them (WCPFC, 2014c). In addition, a conservation and management measure that stipulated principles for developing harvest strategies was adopted, which also mentions the possibility of implementing MSE for selecting a harvest strategy (WCPFC, 2014a). For the northern stocks (north Pacific albacore, Pacific bluefin tuna (*Thunnus orientalis*) and north Pacific swordfish), management strategies are being discussed in Northern Committee, a subsidiary body of WCPFC, based on the scientific advice from International Scientific Committee for Tuna and Tuna-Like Species in the North Pacific Ocean (ISC). ISC held two workshops to advance discussions on MSE (ISC, 2015, 2016a) and now focuses on the development of an MSE for north Pacific albacore. Candidate management objectives for north Pacific albacore have been discussed in the ISC albacore working group (ISC, 2016b) and they were presented to Northern Committee for further discussion among fisheries managers (WCPFC, 2016b). Similarly, candidate management objectives for tropical tunas and south Pacific albacore are scheduled to be discussed in the Commission (WCPFC, 2016a).

3.3.5. Summary – progress in the tuna RFMOs

Tuna RFMOs are striving to adopt precautionary approaches in their management framework (De Bruyn et al., 2013). The tuna RFMOs are making progress on the development of management strategies using MSE, but it is difficult to predict which will be the next to complete the process after CCSBT. In case of IATTC, its Commission has not made a formal decision to develop MSEs. In ICCAT, IOTC and WCPFC, the Commission started discussion on MSE three, six and ten years ago, respectively. However, all of them still seem to be in a learning process and some more time would be required until actual management strategies based on MSE will be developed, agreed and implemented based in those organizations.

3.4. Progress of MSE in other RFMOs

In addition to the tuna RFMOs, discussions on MSE are taking place in CCAMLR, IPHC and SPRFMO (Table 1g, h, i, respectively). CCAMLR used MSE to evaluate options for possible subdivision of the trigger level for krill (*Euphausia superba*),⁵ but the results of model simulations were not fully reflected in the resulting conservation measure (CCAMLR, 2009b). MSE is not considered a priority for the toothfish (*Dissostichus* spp.) fishery, given its relatively healthy status and established HCR (Hanchet et al., 2015). The IPHC decided to form a Management Strategy Advisory Board to oversee the development of an MSE (IPHC, 2013a) and the work is underway (IPHC, 2016). In case of SPRFMO, although its Scientific Committee agreed to consider an MSE framework for the integration of biological information and stock assessment methods (SPRFMO, 2015), the actual application seems to have not started.

4. Discussion

4.1. Challenges specific to the RFMOs to implement MSE

The merits of implementing MSE are widely acknowledged among scientists. As noted, MSE has been applied to a number of domestic fisheries, which also proves the practicability of the process in actual fisheries management. However, given the rather slow progress in applying MSE in international fisheries management, there may be challenges to implement MSE specific to the RFMOs, which have not been fully discussed in past reviews, authored mainly by scientists. The analysis here focuses mainly on governance aspects of the tuna RFMOs, since they tend to be good representatives of the RFMOs due to their long history and large membership, and they are in the process of active discussions on MSE.

An important benefit of MSE is that it requires engagement of all the stakeholders, namely, fisheries managers, scientists, industry stakeholders and civil society, in the decision-making process and as a result promotes their mutual understanding and buy-in to management strategies (Butterworth, 2008); i.e. fostering a shared ownership among stakeholders (IPHC, 2016). Punt et al. (2016) summarized best practice to implement an MSE and clarified the tasks of fisheries managers and those of scientists to advance MSEs. The managers' tasks include the selection of management objectives and corresponding performance indicators, identification of candidate management strategies and the selection of the management strategy to implement (Fig. 1). Those tasks require a good understanding of fisheries science and resource management, and may be more complex than the usual decisions made annually in the RFMOs. Therefore, unique challenges may exist from a practical point of view to accomplish those tasks in RFMOs. Smith et al.

⁵ An interim catch limit in force until the allocation of TAC into smaller areas are agreed.

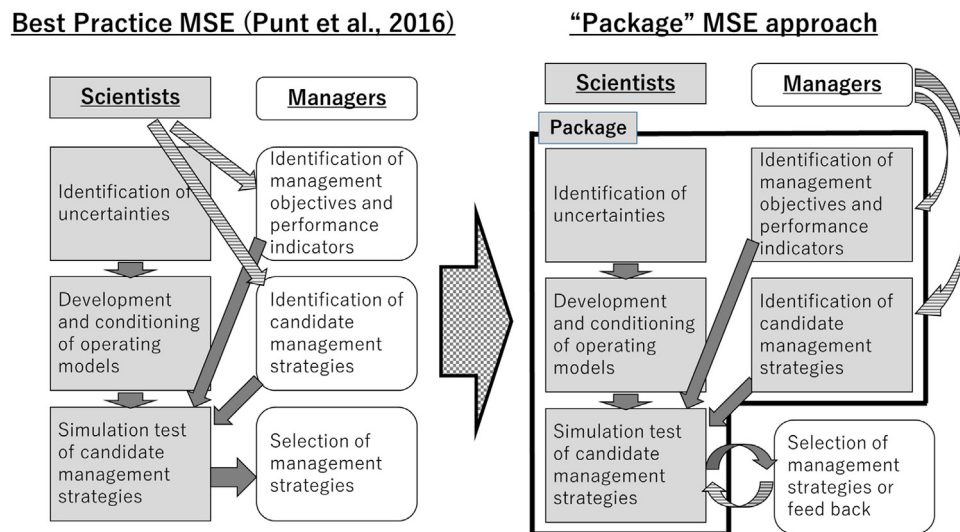


Fig. 1. Flowchart of best practice MSE and suggested "Package" MSE. Shaded boxes indicate the tasks primarily conducted by scientists and white boxes indicate those by managers. Striped arrows indicate advice or comments.

(1999) listed some of the general challenges regarding the implementation of MSE based on experiences in Australian domestic fisheries. Here the challenges for stakeholders, mainly managers, are reviewed with a particular emphasis on the circumstances in the tuna RFMOs.

4.1.1. Difficulty for non-scientists to understand the concept of MSE

The MSE concept is still new to many participants in the RFMOs from even the most-developed as well as some of the least-developed countries, regardless of whether a participant is a fisheries manager or scientist, and the level of understanding of MSE among them differs greatly. Many of the RFMOs which are developing MSEs therefore hold workshops for fisheries managers, scientists and other stakeholders to deepen their understanding of MSE. However, the larger the number of member countries and the more diverse their developmental level and fisheries, the more difficult it is to achieve a common basic understanding about MSE. In addition, a language barrier, frequent changes of the managers appointed and participating from some countries, and non-harmonized use of MSE jargon among different RFMOs,⁶ all of which are not usually a problem in domestic fisheries management, make the challenge of understanding the MSE concept even greater. Since the results of an MSE could have a long-term implication for countries' fishing opportunities, any participant who is not familiar with the concept of MSE might choose to slow the process in the RFMOs. Bear in mind that those managers will need to be able to explain the implications of MSE when back in their home countries. Unfortunately, it is common in the RFMOs that decisions cannot be made in a timely fashion due to the opposition by a small number, sometimes only one, of member countries because of the fundamental consensus oriented-decision-making process.

4.1.2. Fear of a loss of flexibility in management measures

Butterworth (2007) noted one benefit of MSE as providing a default management measure in case no agreement is reached on modifying an existing measure (such as a TAC). This means that the management strategy chosen as a result of an MSE could be applicable for a lengthy period unless an unexpected situation arises. This

is probably a strength for fisheries management as a whole, but may not necessarily appear so for fisheries managers participating in the RFMOs. Fisheries managers may fear MSE as a management strategy resulting from MSE could be difficult to be re-negotiated even when in the future their country may consider that the resulting measures are not appropriate. Such a fear will be even greater if there is an inadequate understanding of MSE.

Furthermore, some managers are concerned that they would have fewer options for management measures as a way to form a consensus in RFMOs when MSE is conducted (based on oral presentation). For example, "innovative" management measures currently used by RFMOs might become difficult to adopt after MSE such as the one with the sum of country-specific allocations exceeding the TAC, assuming not every country would exhaust their allocation (ICCAT north Atlantic swordfish resolution; ICCAT, 2013a), time-area closures that are not scientifically tested (ICCAT tropical tuna resolution; ICCAT, 2015a), or a very complex measure with many exemptions (WCPFC tropical tuna measure; WCPFC, 2015a). MSE does not solve the issue of allocation, which is usually most contentious part of international fisheries negotiation, and such innovative measures are a necessary evil for achieving consensus from managers' perspective. Although those measures might not perfectly be in line with scientific advice, the efforts by managers to avoid a worse situation of not having an agreement also need to be recognized.

4.1.3. Difficulty of the tasks required for fisheries managers

It may be hard in RFMOs to reach consensus on some of the tasks of an MSE required to be completed by fisheries managers (Punt et al., 2016). In particular, the decisions on the operationalization of management objectives including the selection of performance indicators and associated risk levels can influence how the eventual management strategy would be constructed, which makes them difficult to be agreed. Many organizations seem to be stumbling over this first hurdle. Moreover, in the RFMOs, objectives of managers can be diverse from country to country and they may change due to the changes in its government (Punt, 2006).

In IOTC, the Scientific Committee has been asking the Commission to select management objectives since 2011 (IOTC, 2011b), but the Commission has not responded as of 2015 (IOTC, 2015b). WCPFC started discussion on management objectives in 2008 and has held four Management Objectives Workshops since 2012 (WCPFC, 2012b, 2013, 2014c, 2015c). Candidate management

⁶ The tuna RFMOs are trying to harmonize their MSE related works through coordination. See joint tuna RFMOs' website (<http://www.tuna-org.org/mse.htm>).

objectives for tropical tunas and south Pacific albacore are scheduled to be discussed by managers in 2016 (WCPFC, 2016a). ICCAT has established management objectives for north Atlantic albacore (ICCAT, 2015b) and more specific working performance indicators have been developed recently through dialogue between scientists and managers to be used for an MSE (ICCAT, 2016).⁷ As stated above, the only two completed MSEs by the RFMOs were conducted to evaluate harvest strategies to achieve stock recovery, thus they had fairly clear management objectives for MSE from the outset.

4.1.4. Challenges related to the organizational structure of an RFMO

There are several challenges to conduct MSE that are related to the organizational structure of an RFMO as an international institution, when compared to a domestic process. First, the communication between fisheries managers and scientists in an RFMO is generally difficult and the opportunities are scarce. For an RFMO, it is usually the case that its scientific body, sometimes consisting of more than hundred participants, holds a meeting only once a year, and reports its results again only once a year to a Commission meeting, consisting of several hundred participants, where decisions are made. The report from the scientific body is usually presented to the Commission by the chair of the scientific body, and the commissioners, who represent member countries, will engage in the negotiation of specific management measures or instruct the scientific body further work, taking note of the report. Therefore, under a usual schedule and structure of an RFMO, the communication between fisheries managers and scientists happens only once a year by way of exchanging reports. Therefore, a smooth and extensive communication between fisheries managers and scientists, which is the premise of a successful MSE and is not so difficult to realize in domestic fisheries (Smith et al., 1999; Cox and Kronlund, 2008), is logistically and practically difficult in RFMOs. In order to overcome such a communication challenge, CCSBT held four Management Procedure Workshops involving all the stakeholders (CCSBT, 2002a, 2003b, 2004a, 2005a) and two special meetings of the Commission (CCSBT, 2004b, 2005b) during the five years of development of its first MSE, in addition to the usual annual meetings of the Commission. NAFO also held three additional MSE working group meetings in 2010 to develop its Greenland halibut MSE (NAFO, 2010a, 2010b, 2010c). IPHC held a series of Management Strategy Advisory Board meetings, where participants were split into several groups and actually allowed to test candidate management strategies on computer to understand how the MSE tools work (IPHC, 2016). This is probably an excellent way to promote the understanding of stakeholders on MSE, but such a fine-tuned approach may only be feasible in IPHC because it is an RFMO consisting of just two countries (Canada and the U.S.A.).

Secondly, it is unrealistic to expect full inclusiveness for all the stakeholders in case of an MSE development in RFMOs. A great strength of MSE is the inclusiveness of the stakeholders, which will lead to the ownership of management by them. This is evidently successful in many domestic cases (Smith et al., 1999) and even in CCSBT (Kurata et al., 2010). However, fisheries under the management of RFMOs can be very complex, if not too complex for MSE. For example, in case of Atlantic bluefin tuna the stakeholders are very diverse and from a large number of countries (about 20) (ICCAT, 2014b) and clearly not all of them can afford to send a representative to every Commission meeting. Is MSE capable of dealing with this level of complexity so that all the stakeholders can have own-

ership of the management of species like Atlantic bluefin tuna? This remains to be seen.

4.1.5. Costs related to MSEs

Poorly conducted MSEs will do more harm rather than good (Butterworth et al., 2010) and scientific work related to an MSE is not only highly technical but also time-consuming. It is therefore common for there to be dedicated experts for MSE analyses in addition to those who are responsible for the routine stock assessment of the species. Furthermore, in addition to the cost to hire additional scientists to conduct the MSE, the cost to hold a longer or extra-ordinary meetings and the time required for the discussion on MSE during a Commission meeting, can pose a great difficulty for the RFMOs to conduct MSEs. Money and time are both very limiting for the RFMOs nowadays; their budgets are always tight and Commission meetings usually have full agendas, often with more than can be completed. When an MSE is proposed for a certain species, the anticipated merit of the MSE must be demonstrated to surpass the expected cost, both monetary and timewise, for the RFMO in order for the MSE to gain support. A difficulty here is that though in the longer run application of a MSE will save costs (Butterworth, 2007), for the initial development years costs will be higher.

4.2. How to advance MSEs in the RFMOs further

4.2.1. Achieving better communication among stakeholders

It is clear that one of the largest challenges for implementing MSE in the RFMOs is communication, related to the difficulty in having stakeholders understand the merits/demerits, the actual process and expected impacts of MSE. These points are well appreciated by the RFMOs, and they are trying to improve the situation by, most notably, holding workshops involving all stakeholders. However, considering the intensive meeting schedules leading to the completion of the MSEs in CCSBT and NAFO, further effort and time are likely to be needed to garner sufficient understanding of and support for MSE from the relevant stakeholders, possibly including workshops in respective countries for a broader participation by stakeholders as done by CCSBT (CCSBT, 2003a).

In addition, one should first try to understand the mind-set of the counterpart to improve the mutual understanding (Culbert, 1996), though this is not necessarily limited to RFMOs. For example, what for scientists is the strength of MSE may not be so for fisheries managers as indicated above. Managers in the RFMOs are at the same time negotiators to represent their national interest; they may not be appreciated for agreeing to a good management measure if the interest of their country is disproportionately undermined. As long as some managers are concerned about such a possibility as a result of management strategy developed by MSE, discussions in RFMOs would be difficult. On the part of scientists, they may need to reflect amongst themselves whether or not they promote MSE for more than a purely scientific motive. Maybe their support for MSE is strengthened because they understandably feel more comfortable in the MSE world where they can likely avoid a situation arising all too frequently: scientists are criticized for their conservation advice being not entirely correct, when they knew that not all uncertainties had been properly taken into account due to lack of sufficient information but they had to provide advice anyway because no advice would have invited even greater criticisms. Note that in most cases MSE is first raised by science side (Table 1). These mind-set gaps among stakeholders can be wider and more diverse in RFMOs. Understanding those gaps will fundamentally help communication, and open discussions on mind-set gaps at the outset of an MSE may help the whole process. Indeed MSE might well be used to assist bridge such gaps.

⁷ To maintain the stock in the green zone of the Kobe plot with a probability of 60% or more while maximizing long-term yield and recover the stock as soon as possible when the stock decreases below biomass to produce maximum sustainable yield.

4.2.2. Obtaining commitment from the Commission

In any policy area, changing the status quo is not easy and generates fear among some of the key players. Fisheries managers and other stakeholders need to understand the benefit *they* get (and cost *they* will need to pay) as a result of MSE to obtain a level of commitment necessary to move MSE. It might be difficult for fisheries managers to envisage how much better the management framework would become in practice by simply hearing theoretical benefits of MSE from scientists. Instead, what the problems with current management practice are, and how these can be addressed and operations would be improved through MSE, need to be demonstrated in a tangible manner, preferably species by species. The MSE process will not progress by only scientists simply moving ahead and then saying: “you (fisheries managers) must decide management objectives, performance indicators and candidate management strategies in order for an MSE to advance”. A strong dissatisfaction with the existing management can be an incentive for MSE as in the case of CCSBT and NAFO, but without such a dissatisfaction, cost-benefit analysis would be indispensable to gain a wide commitment to MSE from stakeholders. In doing so, scientists must provide realistic indications of what should be expected from an MSE in a term understandable for managers and other stakeholder. In addition, limitations of MSE need to be communicated candidly; if for example there is no reliable abundance index or there are conflicts among the abundance indices, the MSE process can prove more difficult (Punt, 2006). Furthermore, a management strategy developed through MSE could be more stringent than existing measures for species that are currently considered well managed, because the more uncertainties are added in the process, the more pessimistic the projection would likely become since a risk such as being lower than the limit reference point will tend to increase. It is also true that an HCR can be developed without an MSE. For example, CCAMLR considers that MSE is not indispensable to develop a satisfactory HCR in certain cases (Hanchet et al., 2015). IOTC has adopted a resolution to establish an HCR for skipjack (IOTC, 2016b) without waiting for the completion of MSE (IOTC, 2015b). Eventually though, stakeholders would need actual numbers such as TAC and expected catch to decide if they can support a management strategy developed through MSE.

4.2.3. Possible improvements of decision-making process

The complex structure and time-consuming decision-making processes of the RFMOs could prove an obstacle for the completion of a MSE even with sufficient commitment from fisheries managers. In that regard, it might be necessary to apply the best practice MSE in a flexible manner for the sake of swift introduction of more robust management frameworks. Rather than waiting for responses from the commissioners to conceptual questions related to MSE, scientists can come up with candidates for management objectives, their associated performance indicators and HCRs and present the simulation results as alternative packages to the Commission, and then ask the Commission which of the packages best meets their vision of the management (Fig. 1). In other words, the involvement of managers and other stakeholders is reduced compared to best practice in a strict sense. It would certainly be better first to have clear management objectives at the outset of an MSE process. However, an alternative needs to be considered if that requires too much time for the RFMOs to reach agreement upon. The RFMOs usually have broad objectives stipulated in their conventions and scientists can develop possible operational management objectives based on the convention objectives and any discussion in the RFMO in the past. Butterworth (2008) noted that the management objectives do not need to be articulated at the start of the process. By providing a package of possible sets of relatively specific management objectives, a possible HCR to achieve them and the expected impact, the fisheries managers and industry in particular would be able

to better envisage the management strategy after an MSE, rather than being asked conceptual (or abstract) questions, such as what should be the management objectives for a particular species. Also, by knowing the possible outcomes from a MSE, the domestic preparation for RFMO negotiations could be smoother than getting ready for the unknown consequences, which will lead to inclusiveness in domestic process and thus more positive attitudes by delegations. This approach would also ease the tension in the discussion by treating the decisions by the Commission on the elements of MSE, such as performance indicators, associated risks, limit and target reference points interim until the whole package is agreed. The approach commonly referred to as “nothing is agreed until everything is agreed” in international trade negotiation in the World Trade Organization. In fact, some of the approaches taken by the RFMOs, such as for certain species under the purview of IOTC and ICCAT seem to be following this kind of approach. In response, the Commission may require revisions of a MSE, saying, for example, that a performance indicator is not appropriate or acceptable risk should be set at a different value and that scientists have to work further. By taking such a package approach, managers may be more comfortable dealing with explicit examples and eventually more robust management may be achieved faster. Is this too much of scientists driven? Given that most of MSE is first suggested by scientists, it seems natural for scientists to take the lead, while seeking for the commitment of other stakeholders.

5. Conclusions

The need for MSE is likely to increase further now that the adoption of a management strategy is becoming a standard expectation for fisheries management, particularly to be recognized as well managed, for example to obtain ecolabels (e.g., Indian Ocean purse seine fisheries (Marine Stewardship Council, 2015)). However, for various reasons as discussed here, the governance of fisheries, and hence associated MSEs, are usually more complex in RFMOs than those for domestic fisheries. The whole purpose of MSE is to develop a management strategy that is robust to uncertainty, rather than finding the best strategy under assumptions that such uncertainty is resolved, in a collective manner involving all stakeholders. In that sense, the process of an MSE may be flexible so long as that leads to robust management. Due to the complexity of international policy making, it is very common for an RFMO to postpone a decision on a difficult matter until future meetings. It would be easier for the commissioners of the RFMOs to make a decision on specifics rather than concepts. Therefore, the goal of MSE in the RFMOs may better be the fastest achievable robust management, regardless of strict adherence to best practice, to achieve outcomes from good implementations of MSE sooner, rather than the best possible later. It is therefore suggested that RFMOs take a more pragmatic MSE approach to discuss and decide the elements and results of MSE as a package, including performance indicators, associated risks and expected implications to fisheries operation rather than constructing MSE part by part.

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References

- Anonymous, 2007. Report of the Joint Meeting of Tuna RFMOs, <http://tuna-org.org/Documents/other/Kobe%20Report%20English-Appendices.pdf> (Accessed 21 November 2016).
- Anonymous, 2011. Kobe III recommendations, <http://tuna-org.org/Documents/TRFMO3/K3-REC.ENG.pdf> (Accessed 21 November 2016).
- Butterworth, D.S., Rademeyer, R.A., 2010. Greenland Halibut MSE Results for Updated SCAA Reference Case and Robustness Test Operating Models, <http://webwork.uct.ac.za/maram/pub/2010/wgmsewp10-13.MSE.update.pdf> (Accessed 21 November 2016).
- Butterworth, D.S., Bentley, N., De Oliveira, J.A.A., Donovan, G.P., Kell, L.T., Parma, A.M., Punt, A.E., Sainsbury, K.J., Smith, A.D.M., Stokes, T.K., 2010. Purported flaws in management strategy evaluation: basic problems or misinterpretations? *ICES J. Mar. Sci.* 67, 000–000.
- Butterworth, D.S., 2007. Why a management procedure approach? Some positives and negatives. *ICES J. Mar. Sci.* 64, 613–617.
- Butterworth, D.S., 2008. Some Lessons from Implementing Management Procedures. Tsukamoto, K., Kawamura, T., Takeuchi, T., Beard, T.D. Jr., Kaiser, M.J., eds. Fisheries for Global Welfare and Environment 5th World Fisheries Congress, pp. 381–397.
- CCAMLR, 2005. Report of the Working Group on Ecosystem Monitoring and Management, <https://www.ccamlr.org/en/system/files/e-sc-xxiv-a4.pdf> (Accessed 21 November 2016).
- CCAMLR, 2006a. Report of the Second Workshop on Management Procedures, <https://www.ccamlr.org/en/system/files/e-sc-xxv-a4-appD.pdf> (Accessed 21 November 2016).
- CCAMLR, 2006b. Report of the Twenty-Fifth Meeting of the Scientific Committee, <https://www.ccamlr.org/en/system/files/e-sc-xxv.pdf> (Accessed 21 November 2016).
- CCAMLR, 2008. Report of the Twenty-Seventh Meeting of the Scientific Committee, <https://www.ccamlr.org/en/system/files/e-sc-xxvii.pdf> (Accessed 21 November 2016).
- CCAMLR, 2009a. Conservation Measure 51-07 (2009): Interim Distribution of the Trigger Level in the Fishery for Euphausia Superba in Statistical Subareas 48.1, 48.2, 48.3 and 48.4, <https://www.ccamlr.org/sites/drupal.ccamlr.org/files/51-07.0.pdf> (Accessed 21 November 2016).
- CCAMLR, 2009b. Report of the Twenty-Eighth Meeting of the Commission, <https://www.ccamlr.org/en/system/files/e-sc-xxviii.pdf> (Accessed 21 November 2016).
- CCAMLR, 2009c. Report of the Twenty-Eighth Meeting of the Scientific Committee, <https://www.ccamlr.org/en/system/files/e-sc-xxviii.pdf> (Accessed 21 November 2016).
- CCSBT, 1999. Report of the Sixth Annual Meeting, https://www.ccsbt.org/sites/ccsbt.org/files/userfiles/file/docs.english/meetings/meeting_reports/ccsbt.06/report_of_ccsbt6.Part1.pdf (Accessed 21 November 2016).
- CCSBT, 2000a. Report of the Sixth Annual Meeting, https://www.ccsbt.org/sites/ccsbt.org/files/userfiles/file/docs.english/meetings/meeting_reports/ccsbt.06/report_of_ccsbt6.Part2.pdf (Accessed 21 November 2016).
- CCSBT, 2000b. Report of the Special Meeting, https://www.ccsbt.org/sites/ccsbt.org/files/userfiles/file/docs.english/meetings/meeting_reports/ccsbt.06/report_of_special_meeting.pdf (Accessed 21 November 2016).
- CCSBT, 2001a. Report of the Eighth Annual Meeting, https://www.ccsbt.org/sites/ccsbt.org/files/userfiles/file/docs.english/meetings/meeting_reports/ccsbt.08/report_of_ccsbt8.pdf (Accessed 21 November 2016).
- CCSBT, 2001b. Report of the Sixth Meeting of the Scientific Committee, https://www.ccsbt.org/sites/ccsbt.org/files/userfiles/file/docs.english/meetings/meeting_reports/ccsbt.08/report_of_sc6.pdf (Accessed 21 November 2016).
- CCSBT, 2002a. Report of the First Meeting of the Management Procedure Workshop, https://www.ccsbt.org/sites/ccsbt.org/files/userfiles/file/docs.english/meetings/meeting_reports/ccsbt.09/report_of_mpws1.pdf (Accessed 21 November 2016).
- CCSBT, 2002b. Report of the Ninth Annual Meeting of the Commission, https://www.ccsbt.org/sites/ccsbt.org/files/userfiles/file/docs.english/meetings/meeting_reports/ccsbt.09/report_of_ccsbt9.pdf (Accessed 21 November 2016).
- CCSBT, 2002c. Report of the Seventh Meeting of the Scientific Committee, https://www.ccsbt.org/sites/ccsbt.org/files/userfiles/file/docs.english/meetings/meeting_reports/ccsbt.09/report_of_sc7.pdf (Accessed 21 November 2016).
- CCSBT, 2003a. Report of the Fourth Meeting of the Stock Assessment Group, https://www.ccsbt.org/sites/ccsbt.org/files/userfiles/file/docs.english/meetings/meeting_reports/ccsbt.10/report_of_sag4.pdf (Accessed 21 November 2016).
- CCSBT, 2003b. Report of the Second Meeting of the Management Procedure Workshop, https://www.ccsbt.org/sites/ccsbt.org/files/userfiles/file/docs.english/meetings/meeting_reports/ccsbt.10/report_of_mpws2.pdf (Accessed 21 November 2016).
- CCSBT, 2003c. Report of the Tenth Annual Meeting of the Commission, https://www.ccsbt.org/sites/ccsbt.org/files/userfiles/file/docs.english/meetings/meeting_reports/ccsbt.10/report_of_ccsbt10.pdf (Accessed 21 November 2016).
- CCSBT, 2004a. Report of the Eleventh Annual Meeting of the Commission, https://www.ccsbt.org/sites/ccsbt.org/files/userfiles/file/docs.english/meetings/meeting_reports/ccsbt.11/report_of_ccsbt11.pdf (Accessed 21 November 2016).
- CCSBT, 2004b. Report of the Ninth Meeting of the Scientific Committee, https://www.ccsbt.org/userfiles/file/docs.english/meetings/meeting_reports/ccsbt.11/report_of_sc9.pdf (Accessed 21 November 2016).
- CCSBT, 2004c. Report of the Special Meeting of the Commission, https://www.ccsbt.org/sites/ccsbt.org/files/userfiles/file/docs.english/meetings/meeting_reports/ccsbt.11/report_of_special_meeting.pdf (Accessed 21 November 2016).
- CCSBT, 2004d. Report of the Third Meeting of the Management Procedure Workshop, https://www.ccsbt.org/sites/ccsbt.org/files/userfiles/file/docs.english/meetings/meeting_reports/ccsbt.11/Report_of_mpws3.pdf (Accessed 21 November 2016).
- CCSBT, 2005a. Report of the Fourth Meeting of the Management Procedure Workshop, https://www.ccsbt.org/sites/ccsbt.org/files/userfiles/file/docs.english/meetings/meeting_reports/ccsbt.12/report_of_MPWS4.pdf (Accessed 21 November 2016).
- CCSBT, 2005b. Report of the Management Procedure Special Consultation, https://www.ccsbt.org/sites/ccsbt.org/files/userfiles/file/docs.english/meetings/meeting_reports/ccsbt.12/report_of_MP.SpecialConsultation.pdf (Accessed 21 November 2016).
- CCSBT, 2005c. Report of the Tenth Meeting of the Scientific Committee, https://www.ccsbt.org/userfiles/file/docs.english/meetings/meeting_reports/ccsbt.12/report_of_SC10.pdf (Accessed 21 November 2016).
- CCSBT, 2005d. Report of the Twelfth Annual Meeting of the Commission, https://www.ccsbt.org/sites/ccsbt.org/files/userfiles/file/docs.english/meetings/meeting_reports/ccsbt.12/report_of_ccsbt12.pdf (Accessed 21 November 2016).
- CCSBT, 2006. Report of the Thirteenth Annual Meeting of the Commission, https://www.ccsbt.org/userfiles/file/docs.english/meetings/meeting_reports/ccsbt.13/report_of_CCSBT13.pdf (Accessed 21 November 2016).
- CCSBT, 2011. Report of the Eighteenth Annual Meeting of the Commission, https://www.ccsbt.org/sites/ccsbt.org/files/userfiles/file/docs.english/meetings/meeting_reports/ccsbt.18/report_of_CCSBT18.pdf (Accessed 21 November 2016).
- Cox, S.P., Kronlund, A.R., 2008. Practical stakeholder-driven harvest policies for groundfish fisheries in British Columbia. *Can. Fish. Res.* 94, 224–237.
- Culbert, S.A., 1996. Mind-Set Management. Oxford University Press.
- De Bruyn, P., Murua, H., Aranda, M., 2013. The precautionary approach to fisheries management: how this is taken into account by tuna regional fisheries management organisations (RFMOs). *Mar. Pol.* 38, 397–406.
- FAO, 1995. Code of Conduct for Responsible Fisheries, <http://www.fao.org/docrep/005/v9878e/v9878e00.htm> (Accessed 21 November 2016).
- Hanchet, S., Sainsbury, K., Butterworth, D., Darby, C., Bizikov, V., Godø, O.R., Ichii, T., Kock, K.H., Abellán, L.L., Vacchi, M., 2015. CCAMLR's precautionary approach to management focusing on Ross Sea toothfish fishery. *Antarct. Sci.* 27 (4), 333–340.
- Hilborn, R., Walters, C.J., 1992. Quantitative Fisheries Stock Assessment: Choice, Dynamics and Uncertainty. Chapman and Hall, New York.
- ICCAT, 2013a. Recommendation by ICCAT for the Conservation of North Atlantic Swordfish, <http://www.iccat.int/Documents/Recs/compendiopdf-e/2013-02-e.pdf> (Accessed 21 November 2016).
- ICCAT, 2013b. Report of the Standing Committee on Research and Statistics (SCRS), http://iccat.org/Documents/BienRep/REP_EN.12-13.II.2.pdf (Accessed 21 November 2016).
- ICCAT, 2014a. First Meeting of the Standing Working Group to Enhance Dialogue Between Fisheries Scientists and Managers, <https://iccat.int/Documents/Meetings/Docs/2014-SWGS.ENG.pdf> (Accessed 21 November 2016).
- ICCAT, 2014b. Report of the 2014 Atlantic Bluefin Tuna Stock Assessment Session, http://iccat.int/Documents/Meetings/Docs/2014.BFT_ASSESS-ENG.pdf (Accessed 21 November 2016).
- ICCAT, 2015a. Recommendation by ICCAT on a Multi-Annual Conservation and Management Program for Tropical Tunas, <http://www.iccat.int/Documents/Recs/compendiopdf-e/2015-01-e.pdf> (Accessed 21 November 2016).
- ICCAT, 2015b. Recommendation by ICCAT to Establish Harvest Control Rules for the North Atlantic Albacore Stock, <http://iccat.int/Documents/Recs/compendiopdf-e/2015-04-e.pdf> (Accessed 21 November 2016).
- ICCAT, 2015c. Report of the Standing Committee on Research and Statistics (SCRS), <http://iccat.org/Documents/Meetings/SCRS2015/SCRS.PROV.ENG.pdf> (Accessed 21 November 2016).
- ICCAT, 2015d. Second Meeting of the Standing Working Group to Enhance Dialogue Between Fisheries Scientists and Managers (SWGSM), <https://iccat.int/Documents/Meetings/Docs/2015-SWGS-Report.ENG.pdf> (Accessed 21 November 2016).
- ICCAT, 2016. Report of the Intersessional Meeting of Panel 2, <https://www.iccat.int/Documents/Meetings/Docs/2016.PA2-Report.ENG.pdf> (Accessed 21 November 2016).
- ICES, 2013. Report of the Workshop on Guidelines for Management Strategy Evaluations, <http://archimer.ifremer.fr/doc/00166/27686/25879.pdf> (Accessed 21 November 2016).
- IOTC, 2010a. Report of the Fourteenth Session of the Indian Ocean Tuna Commission, <http://www.iotc.org/sites/default/files/documents/2014/03/iotc-2010-s14-re-fin.pdf> (Accessed 21 November 2016).
- IOTC, 2010b. Report of the Thirteenth Session of the Scientific Committee, <http://www.iotc.org/sites/default/files/documents/proceedings/2010/sc/IOTC-2010-SC-R%5BE%5D.rev1.pdf> (Accessed 21 November 2016).
- IOTC, 2011a. Report of the Fifteenth Session of the Indian Ocean Tuna Commission, <http://www.iotc.org/sites/default/files/documents/proceedings/2011/s/IOTC-2011-S15-R%5BE%5D.pdf> (Accessed 21 November 2016).
- IOTC, 2011b. Report of the Fourteenth Session of the IOTC Scientific Committee, <http://www.iotc.org/sites/default/files/documents/proceedings/2011/sc/IOTC-2011-SC14-R%5BE%5D.pdf> (Accessed 21 November 2016).

- IOTC, 2012a. Report of the Fourth Session of the IOTC Working Party on Methods, <http://www.iotc.org/sites/default/files/documents/proceedings/2012/wpm/IOTC-2012-WPM04-R%5BE%5D.pdf> (Accessed 21 November 2016).
- IOTC, 2012b. Report of the Sixteenth Session of the Indian Ocean Tuna Commission, <http://www.iotc.org/sites/default/files/documents/proceedings/2012/s/IOTC-2012-S16-R%5BE%5D.pdf> (Accessed 21 November 2016).
- IOTC, 2013. Report of the Sixteenth Session of the IOTC Scientific Committee, <http://www.iotc.org/sites/default/files/documents/2014/01/IOTC-2013-SC16-RE.pdf> (Accessed 21 November 2016).
- IOTC, 2014a. Report of the Fifth Session IOTC Working Party on Methods, http://www.iotc.org/sites/default/files/documents/2014/12/IOTC-2014-WPM05-R_Rev.1E.-FINAL.DO_NOT_MODIFY.pdf (Accessed 21 November 2016).
- IOTC, 2014b. Report of the IOTC Management Procedure Dialogue, <http://www.iotc.org/sites/default/files/documents/2014/06/MPDReportFINAL.pdf> (Accessed 21 November 2016).
- IOTC, 2014c. Report of the Seventeenth Session of the IOTC Scientific Committee, http://www.iotc.org/sites/default/files/documents/2014/12/IOTC-2014-SC17-RE.-FINAL.DO_NOT_MODIFY.zip (Accessed 21 November 2016).
- IOTC, 2015a. Report of the 2nd IOTC Management Procedure Dialogue, <http://www.iotc.org/sites/default/files/documents/2015/07/IOTC-2015-MPD02-RE.-FINAL.pdf> (Accessed 21 November 2016).
- IOTC, 2015b. Report of the 18th Session of the IOTC Scientific Committee, http://www.iotc.org/sites/default/files/documents/2016/01/IOTC-2015-SC18-RE.-FINAL.DO_NOT_MODIFY.pdf (Accessed 21 November 2016).
- IOTC, 2015c. Report of the 19th Session of the Indian Ocean Tuna Commission, <http://www.iotc.org/sites/default/files/documents/2015/06/IOTC-2015-S19-RE.pdf> (Accessed 21 November 2016).
- IOTC, 2015d. Resolution 15/10 on Target and Limit Reference Points and a Decision Framework, http://www.iotc.org/sites/default/files/documents/compliance/cmm/iotc_cmm.15-10-en.pdf (Accessed 21 November 2016).
- IOTC, 2016a. Chair Report of the 3rd Management Procedures Dialogue, <http://www.iotc.org/sites/default/files/documents/2016/05/IOTC-2016-MPD03-RE.0.pdf> (Accessed 21 November 2016).
- IOTC, 2016b. Resolution 16/02: On Harvest Control Rules for Skipjack Tuna in the IOTC Area of Competence, http://www.iotc.org/sites/default/files/documents/compliance/cmm/iotc_cmm.16-02-en-objection.pdf (Accessed 21 November 2016).
- IOTC, 2016c. Resolution 16/09: On Establishing a Technical Committee on Management Procedures, http://www.iotc.org/sites/default/files/documents/compliance/cmm/iotc_cmm.16-09-en.pdf (Accessed 21 November 2016).
- IPHC, 2013a. International Pacific Halibut Commission Annual Report 2013, <http://www.iphc.int/publications/annual/ar2013.pdf> (Accessed 21 November 2016).
- IPHC, 2013b. Management Strategy Advisory Board Meeting Report, <http://www.iphc.int/documents/MSAB/201306/MSABJune2013MeetingReportFinal.pdf> (Accessed 21 November 2016).
- IPHC, 2014a. MSAB Meeting III – Summary Minutes, <http://www.iphc.info/MSAB%20Documents/MSABMay2014SummaryMinutes.pdf> (Accessed 21 November 2016).
- IPHC, 2014b. MSAB Meeting IV – Summary Minutes, http://www.iphc.info/MSAB%20Documents/MSAB_October2014SummaryMinutes_final.pdf (Accessed 21 November 2016).
- IPHC, 2015a. Management Strategy Advisory Board – Summary Of Meeting October 1 St and 2nd, 2015, http://www.iphc.info/MSAB%20Documents/MSAB_Meeting_Summary_Oct.1_and.2.2015.FINAL.v1.3.pdf (Accessed 21 November 2016).
- IPHC, 2015b. MSAB Meeting V – Summary Minutes, http://www.iphc.info/MSAB%20Documents/MSAB_May2015_Summary_Minutes_revised_final.pdf (Accessed 21 November 2016).
- IPHC, 2016. Management Strategy Advisory Board Report, http://www.iphc.info/MSAB%20Documents/MSAB_Report.28Jan2016.pdf (Accessed 21 November 2016).
- ISC, 2015. Report of the Fifteenth Meeting of the International Scientific Committee for Tuna and Tuna-Like Species in the North Pacific Ocean, http://isc.fra.go.jp/pdf/ISC15/ISC15_Report.1Sept15.docx (Accessed 21 November 2016).
- ISC, 2016a. 2nd ISC Management Strategy Evaluation Workshop – ALBWG Chairman's Report on Outcomes for North Pacific Albacore, <https://www.wcpfc.int/system/files/SC12-MI-WP-07%20ISC16%20MSE%20Report%20of%20the%20ALBWG.pdf> (Accessed 21 November 2016).
- ISC, 2016b. Report of the Albacore Working Group Workshop, [http://isc.fra.go.jp/pdf/ISC16/ISC16_Annex.08_Report%20of%20the%20ALBWG%20\(Apr%202016\).pdf](http://isc.fra.go.jp/pdf/ISC16/ISC16_Annex.08_Report%20of%20the%20ALBWG%20(Apr%202016).pdf) (Accessed 21 November 2016).
- Kurota, H., Hiramatsu, K., Takahashi, N., Shono, H., Itoh, T., Tsuji, S., 2010. Developing a management procedure robust to uncertainty for southern bluefin tuna: a somewhat frustrating struggle to bridge the gap between ideals and reality. *Popul. Ecol.* 52 (3), 359–372.
- Marine Stewardship Council, 2015. Final Determination on Echebstar Indian Ocean Tuna Fishery, <https://www.msc.org/newsroom/news/final-determination-on-echebstar-indian-ocean-tuna-fishery> (Accessed 21 November 2016).
- Maunder, M.N., Zhu, J., Aires-da-Silva, A., 2015. Preliminary Management Strategy Evaluation to Evaluate the IATTC Interim Reference Points and Proposed Harvest Control Rule, <https://www.iattc.org/Meetings/Meetings2015/6SAC/PDFs/SAC-06-10b-Preliminary-MSE.pdf> (Accessed 21 November 2016).
- Maunder, M.N., Minto-Vera, C.V., Aires-da-Silva, A., Valero, J.L., 2016. Current and Future Research on Management Strategy Evaluation (MSE) for Tunas and Related Species in the Eastern Pacific Ocean, <https://www.iattc.org/Meetings/Meetings2016/SAC7/PDFfiles/SAC-07-07h-Research-on-MSE.pdf> (Accessed 21 November 2016).
- Maunder, M.N., 2014. Management Strategy Evaluation (MSE) Implementation in Stock Synthesis: Application to Pacific Bluefin Tuna, <https://www.iattc.org/Meetings/Meetings2014/MAYSAC/PDFs/SAC-05-10b-Management-Strategy-Evaluation.pdf> (Accessed 21 November 2016).
- NAFO, 2003. Report of Fisheries Commission Meeting NAFO, <http://archive.nafo.int/open/mp/2003-04/fc-s03.pdf> (Accessed 21 November 2016).
- NAFO, 2007a. Report of the Fisheries Commission and Its Subsidiary Body (STACTIC), 29th Annual Meeting, <http://archive.nafo.int/open/mp/2007-08/fc-sep07.pdf> (Accessed 21 November 2016).
- NAFO, 2007b. Report of Scientific Council Meeting: Part A, <http://archive.nafo.int/open/rb/2007/parta.pdf> (Accessed 21 November 2016).
- NAFO, 2007c. Report of Scientific Council Meeting: Part B, <http://archive.nafo.int/open/rb/2007/partb.pdf> (Accessed 21 November 2016).
- NAFO, 2008. Report of Scientific Council Meeting, <http://archive.nafo.int/open/rb/2008/parta-08.pdf> (Accessed 21 November 2016).
- NAFO, 2009a. Report of the Fisheries Commission and Its Subsidiary Body, <http://archive.nafo.int/open/mp/2009-10/fc-sep09.pdf> (Accessed 21 November 2016).
- NAFO, 2009b. Report of Scientific Council Meeting, <http://archive.nafo.int/open/rb/2009/SCRep-2009-partA.pdf> (Accessed 21 November 2016).
- NAFO, 2010a. Report of the FC Working Group on Greenland Halibut Management Strategy Evaluation (WGMSE) 28–29 January 2010, <http://archive.nafo.int/open/mp/2009-10/wgmse-jan10.pdf> (Accessed 21 November 2016).
- NAFO, 2010b. Report of the FC Working Group on Greenland Halibut Management Strategy Evaluation (WGMSE) 2–4 May 2010, <http://archive.nafo.int/open/mp/2009-10/wgmse-may10.pdf> (Accessed 21 November 2016).
- NAFO, 2010c. Report of the FC Working Group on Greenland Halibut Management Strategy Evaluation (WGMSE) 16–17 September 2010, <http://archive.nafo.int/open/mp/2010-11/wgmse-sep10.pdf> (Accessed 21 November 2016).
- NAFO, 2010d. Report of the Fisheries Commission and Its Subsidiary Body (STACTIC), 32nd Annual Meeting, <http://archive.nafo.int/open/mp/2010-11/fc-sep10.pdf> (Accessed 21 November 2016).
- Punt, A.E., Donovan, G.P., 2007. Developing management procedures that are robust to uncertainty: lessons from the International Whaling Commission. *ICES J. Mar. Sci.* 64 (4), 603–612.
- Punt, A.E., Butterworth, D.S., de Moor, C.L., de Oliveira, J.A.A., Haddon, M., 2016. Management strategy evaluation: best practices. *Fish. Fish.* 17, 303–334.
- Punt, A.E., 2006. The FAO precautionary approach after almost 10 years: have we progressed towards implementing simulation-tested feedback-control management system for fisheries management? *Nat. Resour. Model.* 19 (4), 441–464.
- Rademeyer, R.A., Plagányi, E.E., Butterworth, D.S., 2007. Tips and tricks in designing management procedures. *ICES J. Mar. Sci.* 64, 618–625.
- SPRFMO, 2015. Report of the 3rd Scientific Committee Meeting, <https://www.sprfmo.int/assets/Meetings/Meetings-2013-plus/SC-Meetings/3rd-SC-Meeting-2015/Report/SC-03-Final-report-14Oct15-A1-7.pdf> (Accessed 21 November 2016).
- Schnute, J.T., Maunder, M.N., Ianelli, J.N., 2007. Designing tools to evaluate fishery management strategies: can the scientific community deliver? *ICES J. Mar. Sci.* 64, 1077–1084.
- Smith, A.D.M., Sainsbury, K.J., Stevens, R.A., 1999. Implementing effective fisheries-management systems – management strategy evaluation and the Australian partnership approach. *ICES J. Mar. Sci.* 56, 967–979.
- Valero, J.L., Aires-da-Silva, A., Maunder, M.N., Minto-Vera, C., Martínez-Ortiz, J., Torrejón-Magallanes, E.J., Carranza, M.N., 2016. Exploratory Management Strategy Evaluation (MSE) of Dorado (*Coryphaena Hippurus*) in the Southeastern Pacific Ocean, [https://www.iattc.org/Meetings/Meetings2016/SAC7/PDFfiles/SAC-07-06a\(ii\)-MSE-for-dorado.pdf](https://www.iattc.org/Meetings/Meetings2016/SAC7/PDFfiles/SAC-07-06a(ii)-MSE-for-dorado.pdf) (Accessed 21 November 2016).
- WCPFC, 2006. Report of the Scientific Committee Second Regular Session, <https://www.wcpfc.int/system/files/0.WCPFC-SC2-Summary%20Report%20with%20all%20attachments.pdf> (Accessed 21 November 2016).
- WCPFC, 2008a. Report of the Scientific Committee Fourth Regular Session, <https://www.wcpfc.int/system/files/0.SC4%20Summary%20Report%20%5BEdited%20Version%5D.pdf> (Accessed 21 November 2016).
- WCPFC, 2008b. Report of the Commission for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean Fifth Regular Session, <https://www.wcpfc.int/system/files/WCPFC5%20%5BSummary%20Report%20-%20Final%204May2009%5D.pdf> (Accessed 21 November 2016).
- WCPFC, 2010. Seventh Regular Session of the Commission: Summary Report, https://www.wcpfc.int/system/files/WCPFC7_Summary_Report.%28Final.12.April%29-from%20website%20on%2016June2011.ISBN.pdf (Accessed 21 November 2016).
- WCPFC, 2012a. Eighth Regular Session of the Commission: Summary Report, <https://www.wcpfc.int/system/files/WCPFC8-Summary-Report.pdf> (Accessed 21 November 2016).
- WCPFC, 2012b. WCPFC Management Objectives Workshop Report, <https://www.wcpfc.int/system/files/Report-Management-Objectives-Workshop.pdf> (Accessed 21 November 2016).

- WCPFC, 2013. Report on the Second Management Objectives Workshop, <https://www.wcpfc.int/system/files/MOW2%20Summary%20Report%20Final.1.pdf> (Accessed 21 November 2016).
- WCPFC, 2014a. Conservation and Management Measure on Establishing a Harvest Strategy for Key Fisheries and Stocks in the Western and Central Pacific Ocean, <https://www.wcpfc.int/system/files/CMM%202014-06%20Conservation%20and%20Management%20Measures%20to%20develop%20and%20implement%20a%20harvest%20strategy%20approach%20for%20key%20fisheries%20and%20stocks%20in%20the%20WCPO.pdf> (Accessed 21 November 2016).
- WCPFC, 2014b. Eleventh Regular Session of the Commission: Summary Report, <https://www.wcpfc.int/system/files/WCPFC11%20summary%20report%20-FINAL.1.pdf> (Accessed 21 November 2016).
- WCPFC, 2014c. Report on the Third Management Objectives Workshop, <https://www.wcpfc.int/system/files/MOW3%20Report%20Final.pdf> (Accessed 21 November 2016).
- WCPFC, 2015a. Conservation and Management Measure for Bigeye, Yellowfin and Skipjack Tuna in the Western and Central Pacific Ocean, <https://www.wcpfc.int/system/files/CMM%202015-01%20Conservation%20and%20Management%20Measure%20for%20Bigeye%20Yellowfin%20and%20Skipjack%20Tuna.0.pdf> (Accessed 21 November 2016).
- WCPFC, 2015b. Eleventh Regular Session of Northern Committee: Summary Report, https://www.wcpfc.int/system/files/0_NC11%20Summary%20Report%20-%20adopted%20-%2004Dec2015.docx (Accessed 21 November 2016).
- WCPFC, 2015c. Report on the Harvest Strategy Workshop (MOW4), <https://www.wcpfc.int/system/files/FINAL%20HSW%20Report%20for%20WCPFC12.1.pdf> (Accessed 21 November 2016).
- WCPFC, 2015d. Twelfth Regular Session of the Commission: Summary Report, <https://www.wcpfc.int/system/files/WCPFC12%20Summary%20Report.final1-rev2.pdf> (Accessed 21 November 2016).
- WCPFC, 2016a. Commission Thirteen Regular Session Provisional Annotated Agenda, <https://www.wcpfc.int/system/files/WCPFC13-2016-02-rev1%20WCPFC13%20Provisional%20Annotated%20Agenda%20-%20revision%201.pdf> (Accessed 21 November 2016).
- WCPFC, 2016b. Twelfth Regular Session of Northern Committee: Summary Report, https://www.wcpfc.int/system/files/0_NC12%20Summary%20Report%20-%20adopted%20on%202Sep2016-Rev.01%20%2813Sep2016%29.0.docx (Accessed 21 November 2016).