



UNIVERSITY  
OF WOLLONGONG  
AUSTRALIA

# Preliminary Framework for Joint Management of Redistributed Tuna Stocks by WCPFC and IATTC

## GCF Study 8

Report prepared for the Pacific Community

ANCORS, August 2023



The **Australian National Centre for Ocean Resources and Security (ANCORS)**, University of Wollongong, is Australia's only multidisciplinary university-based centre dedicated to research, education and training on ocean law, maritime security and natural marine resource management providing policy development advice and other support services to government agencies in Australia and the wider Asia-Pacific region, as well as to regional and international organizations and ocean-related industry.

Website contact: <http://ancors.uow.edu.au>

Contact for the corresponding author: [cgoodman@uow.edu.au](mailto:cgoodman@uow.edu.au)

Citation:

Goodman, C., Azmi, K., Davis, R., Haas, B., and Hanich, Q., Preliminary framework for joint management of redistributed tuna stocks by WCPFC and IATTC. Report prepared for the Pacific Community by the Australian National Centre for Ocean Resources and Security, Wollongong, Australia, 2023.

Acknowledgments:

This report is based on and developed from a paper prepared by the authors together with a number of co-authors, published as: Camille Goodman, Ruth Davis, Kamal Azmi, Johann Bell, Grantly R. Galland, Eric Gilman, Bianca Haas, Quentin Hanich, Patrick Lehodey, Lara Manarangi-Trott, Simon Nicol, Pablo Obregon, Graham Pilling, Inna Senina, Katherine Seto and Martin Tsameny (2022). Enhancing cooperative responses by regional fisheries management organizations to climate-driven redistribution of tropical Pacific tuna stocks. *Front. Mar Sci.* 9, 1046018. doi: 10.3389/fmars.2022.1046018.

## Table of Contents

List of Abbreviations .....	iii
List of Figures .....	v
List of Tables .....	v
Executive Summary.....	vi
1. Introduction.....	1
2. The legal framework for cooperation between WCPFC and IATTC .....	3
2.1 International Fisheries Law .....	3
2.1.1 United Nations Convention on the Law of the Sea .....	3
2.1.2 United Nations Fish Stocks Agreement .....	4
2.2 RFMO Mandates.....	5
2.2.1 WCPFC.....	7
2.2.2 IATTC .....	8
2.2.3 Overlap area.....	9
2.3 Broader International law and policy considerations.....	13
2.3.1 International climate law .....	13
2.3.2 Sustainable development framework .....	14
2.3.3 The BBNJ Agreement .....	14
2.4 Summary .....	15
3. The current state of cooperation between WCPFC and IATTC .....	17
3.1 Governance and institutional issues .....	17
3.2 Scientific research .....	18
3.3 Conservation and management.....	19
3.4 Compliance and enforcement.....	21
3.5 Summary .....	21
4. Emerging needs, challenges and potential complexities arising from the redistribution of tuna stocks .....	23
4.1 Collaborating in scientific research .....	23
4.2 Clarifying the extent of jurisdiction.....	24
4.3 Developing governance or institutional mechanisms for cooperation .....	25
4.4 Addressing questions of membership.....	25

4.5	Inter-operability and compatibility across RFMO conservation and management measures .....	26
4.6	Implications for participatory rights .....	27
4.7	Enhancing cooperation in compliance and enforcement .....	28
4.8	Summary .....	30
5.	Opportunities for enhancing cooperation between WCPFC and IATTC .....	31
5.1	Options for revising existing institutional mechanisms .....	31
5.2	Options for revising existing arrangements for allocation .....	33
5.3	Examples from other regions .....	35
5.4	Incentives for cooperation .....	39
6.	References and further reading .....	42

### List of Abbreviations

AWS	Advanced Warning System
CAOF Agreement	Central Arctic Ocean Fisheries Agreement
CCAMLR	Commission for the Conservation of Antarctic Marine Living Resources
CCSBT	Commission for the Conservation of Southern Bluefin Tuna
CMM	conservation and management measure
EEZ	exclusive economic zone
EPO	Eastern Pacific Ocean
EPO-C	Central Eastern Pacific Ocean
EU	European Union
FAO	United Nations Food and Agriculture Organization
FFA	Pacific Islands Forum Fisheries Agency
IATTC	Inter-American Tropical Tuna Commission
ICCAT	International Commission for the Conservation of Atlantic Tunas
ICES	International Council for the Exploration of the Sea
IOTC	Indian Ocean Tuna Commission
ISC	International Scientific Committee
IUU fishing	illegal, unreported and unregulated fishing
JNSFC	Joint Norwegian-Soviet Fisheries Commission
Joint Working Group	IATTC-NC Joint Working Group on Pacific Bluefin Tuna Management
MCS	monitoring, control and surveillance
MSY	maximum sustainable yield
NAFO	North Atlantic Fisheries Organization
NC	WCPFC Northern Committee
NEAFC	North East Atlantic Fisheries Commission
PICES	North Pacific Marine Science Organization
PNA	Parties to the Nauru Agreement
RCP	representative concentration pathway
RFMO	regional fisheries management organization
SC	WCPFC Scientific Committee
SEAPODYM	Spatial Ecosystem And Population Dynamics Model
SIDS	small island developing States
SPC-OFPP	Oceanic Fisheries Programme of the Pacific Community

SPRFMO	South Pacific Regional Fisheries Management Organization
TCC	WCPFC Technical and Compliance Committee
UN	United Nations
UNCLOS	1982 United Nations Convention on the Law of the Sea
UNFCCC	1992 United Nations Framework Convention on Climate Change
UNFSA	1995 Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks
UNGA	United Nations General Assembly
VDS	Vessel Day Scheme
VMS	vessel monitoring system
WCPFC	Western and Central Pacific Fisheries Commission
WCPO	Western and Central Pacific Ocean

## **List of Figures**

- 1.** Average biomass distributions of skipjack, yellowfin and bigeye tuna in the Pacific Ocean basin for 2015 (2011–2020), and mean anomalies from the average 2015 biomass distribution of each tuna species projected to occur by 2050 (2044–2053) under the RCP 8.5 greenhouse gas emissions scenario.
- 2.** Map of the Pacific Ocean basin showing the Convention Areas of the Western and Central Pacific Fisheries Commission (WCPFC) and the Inter-American Tropical Tuna Commission (IATTC).

## **List of Tables**

- 1.** Key features, provisions and membership of the WCPFC and IATTC.
- 2.** Participation in international agreements and instruments by WCPFC and IATTC members and CNMs.

## Executive Summary

Climate change is predicted to alter the distributions of tropical tuna stocks in the Pacific Ocean. Recent modelling projects future shifts in tuna biomass from west to east, and, to a lesser degree, in polar directions, resulting in decreases in national jurisdictions in the Western Pacific and increases in high seas areas. The extent of this redistribution of biomass is dependent upon the magnitude of continued greenhouse gas emissions. Under high emission scenarios, the resulting redistribution of tuna may present new challenges for the regional fisheries management organizations (RFMOs) responsible for the conservation and management of tropical tuna stocks in Convention Areas spanning areas of both high seas and national jurisdiction: in the Western and Central Pacific Ocean (WCPO), the Western and Central Pacific Fisheries Commission (WCPFC), and in the Eastern Pacific Ocean (EPO), the Inter-American Tropical Tuna Commission (IATTC). This report provides a horizon scan to identify issues that will need to be considered by both RFMOs as the impacts of climate change on Pacific Ocean tuna populations continue to emerge. The report summarises the mandates and existing legal frameworks governing the operation of each RFMO at both the global and regional levels, summarises the issues likely to increase in prominence if redistribution of tuna biomasses due to climate change is substantive, and discusses options for both RFMOs to enhance cooperation and prepare for such change.

Shifting biomass distribution induced by climate change is likely to result in disproportionate burdens and affect small island developing States (SIDS) and developing economies in ways that challenge existing processes (including current rights-based principles) and invoke rights and responsibilities under the global legal frameworks for the law of the sea, international fisheries law, and international climate law (including important principles of inter- and intra-generational equity). Pursuant to these international law frameworks as well as the specific regional conventions by which they were established, WCPFC and IATTC have the ability and the obligation to cooperatively prepare for any climate-driven redistribution of tuna stocks between their Convention Areas. While there are already examples of cooperation between the WCPFC and IATTC, the report concludes that some of the projected shifts in the distribution of tropical tuna stocks in the Pacific Ocean Basin suggest that a more strategic approach to the form and substance of such cooperation will be needed in the future in order to ensure fisheries for Pacific tuna stocks are managed so they remain resilient to the impacts of climate change.

A more precise understanding of the likely extent of tuna biomass redistribution in the Pacific Ocean will be needed to help guide the degree of cooperation and climate adaptation that will be needed by both RFMOs. In this respect, harmonising (to the extent practical) fisheries and ecosystem monitoring activities undertaken by each RFMO will assist with future interoperability of data and cooperation in areas such as data analysis and modelling. Increasing the existing scientific dialogue and cooperation between both RFMOs would be a simple way to achieve this outcome. Participation of both RFMOs in the development and



implementation of the GCF-supported Advanced Warning System (AWS) will also help improve the precision of the models currently used to project future tuna biomass distributions, provide validated scalars of biomass, and improve stock structure definition.

Shifting distributions of biomass are also expected to necessitate a need for harvest strategies, evaluations of conservation and management measures and stock assessments to be climate aware. Strengthening scientific cooperation to support this technical work will assist with integrating climate awareness into the technical processes. Including climate change as a standing agenda item in all RFMO bodies that consider these processes would also help ensure that climate awareness is included in the technical work undertaken.

Increased availability of tuna biomass in high seas areas because of climate-induced redistribution is likely to necessitate greater cooperation on monitoring, control and surveillance (MCS) measures and other enforcement tools. WCPFC and IATTC have already established arrangements for cross-endorsement of at sea observers, sharing of data, and responses to vessels deemed to be engaging in illegal, unreported and unregulated (IUU) fishing. Enforcement in high seas areas is typically more challenging due to the remoteness of these regions and the reliance on flag State responsibility. Establishing arrangements that facilitate enhanced MCS and enforcement activities now will allow both RFMOs to be prepared for greater MCS and enforcement in the high seas, particularly in the central Pacific where the potential for more joint activity could be expected given the jurisdictional boundary and overlap area.

More broadly, formalising consultation between the two RFMOs on a more regular basis would assist the preparedness of both organisations. The IATTC was a participant in the negotiations to establish the WCPFC, and the Executive Secretaries of both organisations met annually until 2008, leading to the formal adoption of a Memorandum of Understanding relating to cooperation. Over time, however, this formal cooperation has diminished. Re-establishing (or re-invigorating) formal consultations between the two RFMOs would facilitate early dialogue on the options available for managing what potentially will become a more shared resource. Moreover, some international markets are moving towards 'jurisdictional' or 'seascape' approaches to seafood supply, and the development of principles for jointly managing the impacts of climate change on fisheries resources are likely to assist the Pacific to demonstrate its broader social and environmental responsibilities. This in turn would assist with growing the Pacific presence within these markets.

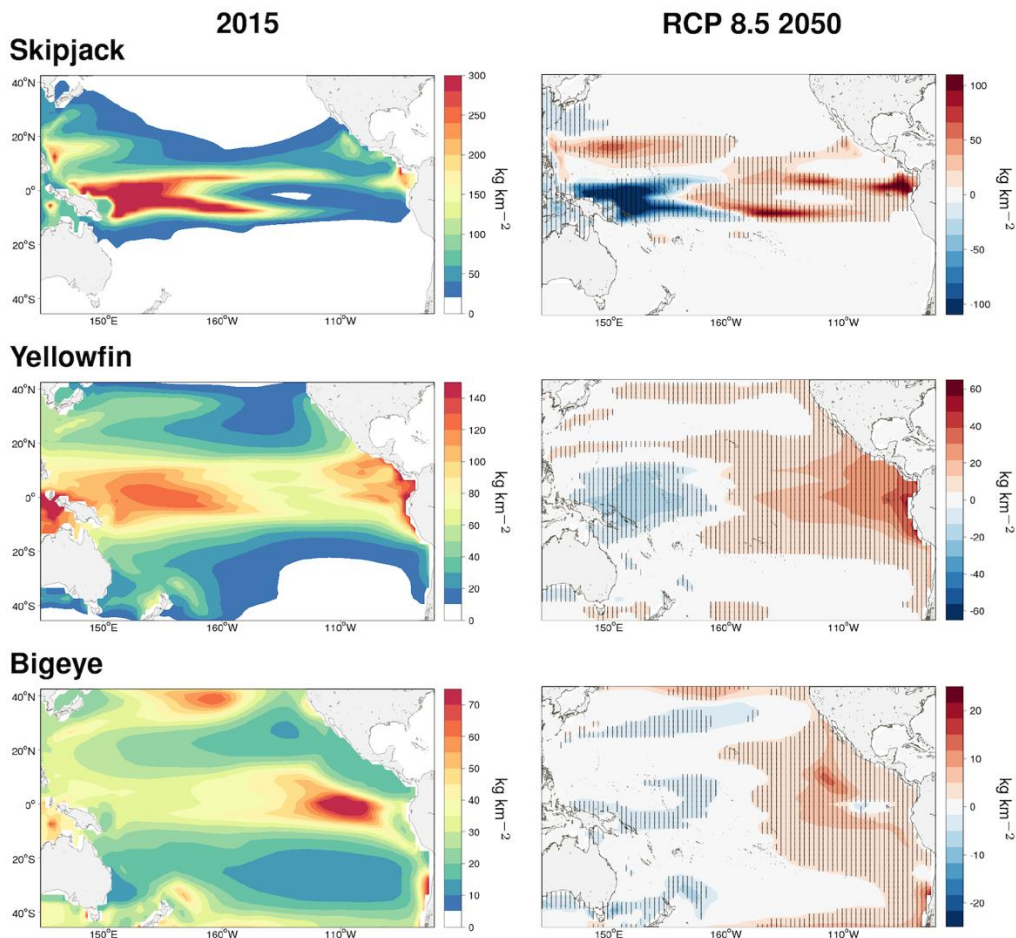
In addition to providing a horizon scan on emerging and developing issues for the two RFMOs about climate-induced redistribution of tuna biomass, this report serves as a basis for identifying potential priority investment for the GCF Pacific Tuna Proposal. Based on our review and evaluation of emerging issues, we recommend consideration be given to the following investments:

1. Designing the GCF Programme to include activities that engage both WCPFC and IATTC in the development of the PI-AWS and its supporting fisheries and ecosystem monitoring activities.
2. Strengthening processes to facilitate practical measures of cooperation between WCPFC and IATTC, including with respect to: enhanced dialogue on MCS and enforcement; harvest strategy development; the evaluation of conservation and management measures; data sharing and data compatibility; and stock assessment.
3. Including resources to re-establish or re-invigorate formal dialogue between WCPFC and IATTC with a purpose of, *inter alia*, preparing both RFMOs for adapting to the impacts of climate change and the consequent changes to international responsibilities and markets.

# 1. Introduction

It is predicted that climate change will alter the distribution of tropical tuna stocks in the Pacific Ocean. Recent modelling shows that continued high greenhouse gas emissions are expected to cause substantial changes in the distribution of skipjack, yellowfin and bigeye tuna within the Pacific Ocean Basin over a relatively short time frame (several decades), with predicted shifts in stock biomass from the Western and Central Pacific Ocean (WCPO) to the Eastern Pacific Ocean (EPO) and (to a lesser extent) in polar directions, resulting in decreases in areas under national jurisdiction in the Western Pacific and increases in high seas areas (Bell et al. 2021) (**Figure 1**). This is likely to present new challenges for the regional fisheries management organizations (RFMOs) responsible for the conservation and management of tropical tuna stocks in Convention Areas spanning both high seas and national jurisdiction: in the WCPO, the Western and Central Pacific Fisheries Commission (WCPFC), and in the EPO, the Inter-American Tropical Tuna Commission (IATTC).

**Figure 1.** Average biomass distributions ( $\text{kg km}^{-2}$ ) of skipjack, yellowfin and bigeye tuna in the Pacific Ocean basin for 2015 (2011–2020) (left), and mean anomalies ( $\text{kg km}^{-2}$ ) from the average 2015 biomass distribution of each tuna species projected to occur by 2050 (2044–2053) under the RCP 8.5 greenhouse gas emissions scenario (right). Shading indicates areas where projections from four Earth System Models agree in the sign of change. Source: Bell et al. (2021).



This report examines issues that will need to be considered in order to prepare both RFMOs for enhanced cooperative management of shared tropical tuna stocks into the future.

Section 2 summarises the existing legal framework for cooperation between the WCPFC and IATTC at both the global and regional levels and summarises the mandates of each RFMO and the core principles under which they operate **(output (i))**, as well as the extent and rationale for the existing overlap in their Convention Areas **(output (ii))**. This background is important in order to establish the principles and processes that may be invoked to support discussion on the sort of cooperation that could be undertaken in response to the redistribution of tropical tuna stocks in the Pacific Ocean. Section 3 provides an overview of the existing form and extent of cooperation between the two organizations to establish the benchmark from which future cooperation should be considered. With the existing forms of cooperation in mind, Section 4 identifies challenges and complexities that are likely to arise in sustainably managing shared tuna stocks occurring largely in high seas areas across the Convention Areas of the WCPFC and IATTC, **(output (iii))**. Section 5 concludes the report by outlining options that could be used to revise existing management arrangements for tuna stocks that are shared by the two tuna RFMOs, and the ways in which these mechanisms could be adapted to the continuing redistribution of these stocks due to climate change **(output (iv))**. To assist States in evaluating the likely effectiveness, applicability and attractiveness of these options, Section 5 also examines how similar issues have been addressed in other regions and highlights some potential incentives.

## 2. The legal framework for cooperation between WCPFC and IATTC

In order to evaluate the options for cooperation between WCPFC and IATTC, it is important to understand the legal framework which governs the activities of these RFMOs. Accordingly, this section of the report asks: to what extent are WCPFC and IATTC empowered or obliged under the existing international law framework to cooperate in response to the climate-driven redistribution of Pacific tuna stocks?

To answer this question, we must consider the requirements of the international fisheries law framework and of the specific agreements governing the WCPFC and IATTC, to clarify whether and how they may—or must—cooperate in the management of tuna stocks that are shared between areas under their jurisdiction. We can also draw on other areas of international law and policy that affect the exercise of rights and obligations under the fisheries regime, including international climate law, the sustainable development framework and the new implementing agreement on biodiversity beyond national jurisdiction.

### 2.1 International Fisheries Law

The international fisheries law framework provides limited guidance on cooperation between RFMOs on measures to manage climate-driven changes to the abundance and distribution of fish stocks. The global framework for international fisheries is focused primarily on the rights and obligations of individual States. While individual flag and coastal States have a general duty to cooperate in the management of shared fish stocks (including within the context of an individual RFMO), and RFMOs themselves generally have the legal capacity to engage in cooperative activities with other RFMOs, the global framework provides little guidance on cooperation between RFMOs.

#### 2.1.1 United Nations Convention on the Law of the Sea

The global legal framework for international fisheries management is based on the 1982 *United Nations Convention on the Law of the Sea* (UNCLOS). UNCLOS assigns responsibility for fisheries management based on a regime of maritime zones, with coastal States accorded primary responsibility for stocks within their 200 nautical mile exclusive economic zones (EEZs), and flag States responsible primarily for their vessels fishing on the high seas. Within the EEZ, the coastal State has sovereign rights over fishery resources, and must determine the total allowable catch (TAC) and establish the conservation and management measures that would support maximum sustainable yield (MSY) (Articles 56(1)(a) and 61, UNCLOS). On the high seas, all States *prima facie* have equal rights of access pursuant to the freedom of fishing (Article 116), subject to a general duty to conserve living resources and to ‘cooperate with each other in the conservation and management of living resources in the area of the high seas’ (Article 118). On the high seas, it is up to the fishing (flag) States to determine the allowable catch and other conservation measures in a way designed to produce MSY (Article 119).

In both cases, conservation and management measures must be based upon the best scientific advice available and the determination of MSY must be qualified by relevant environmental and economic factors (Articles 61, 119, UNCLOS). The special requirements of developing States are specifically identified as one of the 'economic' factors that must qualify any determination of MSY (Articles 61 and 119, UNCLOS). Although not specifically contemplated by UNCLOS, climate change must now be regarded as a 'relevant environmental factor' in determining MSY.

Fish which migrate between zones present a particular problem for international regulation. UNCLOS recognises different categories of fish stocks in this situation: 'straddling' stocks (whose range straddles the EEZ of two or more countries, or straddles areas of both EEZ and high seas) (Article 63, UNCLOS), and 'highly migratory' species (identified in Annex I and including the major commercial tuna species) (Article 64, UNCLOS). For straddling stocks and highly migratory species, as well as for high seas stocks, conservation and management must be coordinated between all relevant States. In these situations, the duty to cooperate is key.

UNCLOS lacks detail as to how this cooperation should proceed. In relation to highly migratory species, States whose nationals are fishing on the high seas and coastal States whose waters fall within the range of a highly migratory species must cooperate with a view to 'ensuring conservation and promoting the objective of optimum utilization of such species throughout the region, both within and beyond the exclusive economic zone' (Article 64, UNCLOS). The relevant States have a duty to cooperate either directly or through the appropriate international organization (i.e. an RFMO). In regions where no appropriate RFMO exists, the duty to cooperate extends to the establishment of such an organization and participation in its work (Article 64, UNCLOS).

The duty to cooperate has been recognised to exist not only under UNCLOS but also under general international law. In the *MOX Plant Case* (ITLOS, 2001) the International Tribunal for the Law of the Sea (ITLOS) stated that 'the duty to cooperate is a fundamental principle in the prevention of pollution of the marine environment under Part XII of the Convention and general international law' (par 82). In its *Sub-Regional Fisheries Commission Advisory Opinion* (2015), ITLOS recognised that the principle extended beyond the protection and preservation of the marine environment to fisheries conservation and management (in that case, dealing with illegal, unreported and unregulated (IUU) fishing). While the cases provide little guidance as to the level and form of cooperation required, ITLOS has been willing to identify a failure to cooperate and to make orders to cooperate in a specific way (*Land Reclamation in and around the Straits of Johor (Malaysia v. Singapore)*, Provisional Measures, Order of 8 October 2003, ITLOS Reports 2003, par 97).

### 2.1.2 United Nations Fish Stocks Agreement

UNCLOS is supplemented by the 1995 *Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks*

(UNFSA). The UNFSA provides more detail on how States must fulfil the duty to cooperate in relation to straddling and highly migratory stocks. The UNFSA also sets out principles relating to the long-term conservation and sustainable use of these fish stocks, which are relevant to the question of how best to respond to the management challenges posed by climate-driven stock redistribution.

The UNFSA requires States to ‘adopt measures to ensure long-term sustainability’ of fish stocks and ‘promote the objective of their optimum utilization’ (Article 5, UNFSA). In doing so, they must ‘assess the impacts of fishing, other human activities and environmental factors’, and ‘apply the precautionary approach in accordance with Article 6’ (Article 5, UNFSA). In applying the precautionary approach, States must take into account, inter alia, the impact of uncertainties relating to existing and predicted oceanic and environmental conditions (Article 6, UNFSA). The impact of climate variability and change must therefore be considered as part of the conservation and management process (Rayfuse, 2019).

Part III of the UNFSA focuses on mechanisms for international cooperation and requires States to participate in the relevant RFMO (Article 8, UNFSA). The UNFSA provides an extensive list of matters to be agreed upon or implemented by States through an RFMO to fulfil the duty to cooperate, including appropriate conservation and management measures, participatory rights, and the conduct of scientific stock assessments (Article 10, UNFSA). The UNFSA requires States to cooperate in establishing compatible conservation and management measures for the high seas and areas under national jurisdiction (Article 7, UNFSA).

The UNFSA does not directly address the issue posed by stocks that shift beyond their known geographical distribution in the area under the competence of one RFMO to an area under the management of another RFMO. Nor does it establish any specific standards or procedures for cooperation between RFMOs. In particular, although Article 7 addresses the compatibility of conservation and management measures adopted for areas under the jurisdiction of coastal States with measures adopted for the high seas, the UNFSA does not consider how to ensure compatibility *between RFMOs* in relation to highly migratory species in adjacent areas of the high seas.

Despite these limitations, many features of the UNFSA framework support enhanced cooperation between RFMOs in the context of climate-driven redistribution of highly migratory fish stocks. These include requirements for open and informed decision-making (Article 12, UNFSA), requirements for cooperation to strengthen RFMO performance through regular performance reviews (Article 13, UNFSA) and a requirement to cooperate in scientific research (Article 14, UNFSA). These requirements support sharing of information between RFMOs as well as the ongoing assessment of the management performance of each organization in light of current stock conditions.

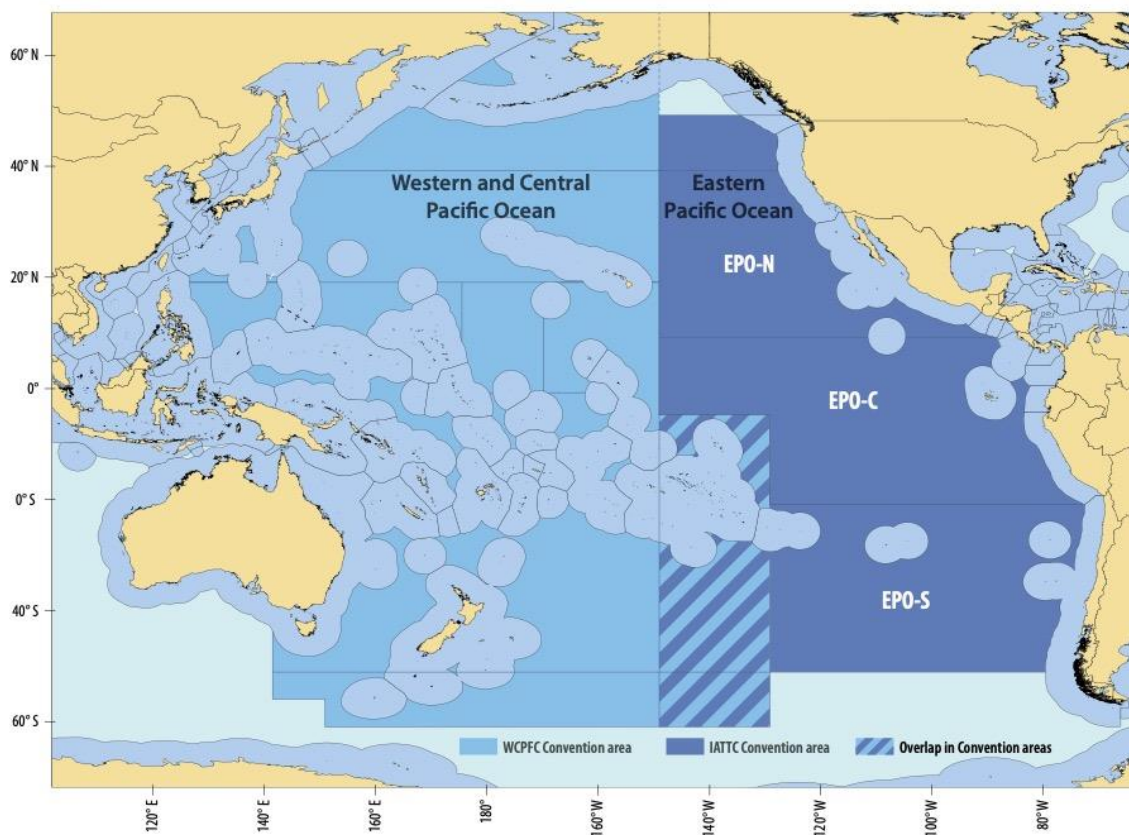
## **2.2 RFMO Mandates**

WCPFC and IATTC share a very similar objective—the long-term conservation and sustainable use of highly migratory stocks in their respective Convention Areas—and both RFMOs have

the power to adopt binding conservation and management measures for their members in order to achieve this. In addition, the constituent treaties of both RFMOs do specifically recognise the need to cooperate with other RFMOs in order to achieve their objectives, including in situations where two Convention Areas overlap, or where fish stocks also occur in or migrate through the Convention Area of another RFMO. However they differ significantly in some fundamental characteristics—they have different histories, geographical configurations, and membership.

The WCPFC manages the world’s most valuable tuna fishery (McKinney et al, 2020) and provides approximately 52 per cent of the global tuna catch (Williams and Ruaia, 2021; ISSF, 2022). It is distinguished from other tuna RFMOs by the size and productivity of the EEZs in its Convention Area (see **Figure 2**). In contrast to WCPFC, the IATTC Convention Area primarily covers high seas rather than EEZs, and the IATTC tuna fisheries are significantly less productive, producing around 13 percent of the global tuna catch (ISSF, 2022). The relevant features of both RFMOs, including key provisions, characteristics and measures, are summarized in **Table 1**.

**Figure 2.** Map of the Pacific Ocean basin showing the Convention Areas of the Western and Central Pacific Fisheries Commission (WCPFC) and the Inter-American Tropical Tuna Commission (IATTC). The overlap area is shaded. Adapted from Bell et al. (2021).





### 2.2.1 WCPFC

The WCPFC was established in 2004 under the *Convention for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean* (WCPFC Convention). The objective of the Convention is ‘to ensure, through effective management, the long-term conservation and sustainable use of highly migratory fish stocks in the western and central Pacific Ocean’. The WCPFC Convention Area extends from the Western and Northern limits of the Pacific Ocean to 60 degrees south and eastward to 130°W (see **Figure 2**) (WCPFC, 2004).

The WCPFC comprises 26 members, 7 participating Pacific Island territories and eight cooperating non-members. The members include major flag States such as Japan, China, Chinese Taipei, Korea, the US and the EU, and more than half the members of WCPFC are coastal States in the Convention Area. None of the key target species (bigeye tuna, yellowfin tuna, albacore tuna and skipjack tuna) are overfished, nor is overfishing occurring (Hare et.al., 2021; ISSF, 2022). In 2021, the total catch of albacore, bigeye, skipjack and yellowfin tuna in the WCPFC Statistical Area was 2,635,291 metric tons. This catch was taken by vessels flagged to 31 different States, territories and fishing entities, with 77% of the overall catch coming from eight States with the highest catches (Indonesia, Japan, Korea, Chinese Taipei, Kiribati, Philippines, Papua New Guinea and Federated States of Micronesia).

The fisheries management framework under the WCPFC Convention strongly reflects the UNFSA. It incorporates the UNFSA conservation and management principles (Article 5), guidance on application of the precautionary approach (Article 6 and Annex II), and rules for ensuring compatibility between measures adopted for the high seas and for areas under national jurisdiction (Article 7) (WCPFC, 2004). The work of the WCPFC is directed and overseen by a Commission (Articles 9 and 10), supported by subsidiary bodies including the Scientific Committee (SC), Technical and Compliance Committee (TCC), and a Northern Committee (NC) (Article 11) (WCPFC, 2004). The WCPFC Convention specifically recognises the importance of adequate scientific information (Article 5(b)) and authorises the Commission to engage the services of scientific experts to provide the necessary information and advice (Article 13) (WCPFC, 2004). Scientific and data management services in relation to tropical and southern tuna fisheries in the Convention Area are provided by the Oceanic Fisheries Programme of the Pacific Community (SPC-OFP). The International Scientific Committee for Tuna and Tuna-like Species in the North Pacific Ocean (ISC) provides similar scientific services in relation to northern stocks.

Importantly, Article 22(2) requires the Commission to make suitable arrangements for consultation, cooperation and collaboration with other organizations, including the IATTC. Article 22(3) notes that where the WCPFC Convention Area overlaps with an area under regulation by another RFMO, the WCPFC shall cooperate with that organization in order to avoid duplication of measures in respect of species that are regulated by both organizations. Even more specifically, Article 22(4) requires the WCPFC to initiate consultation with the IATTC with a view to reaching agreement on a consistent set of conservation and

management measures for fish stocks that occur in the Convention Areas of both organizations. In addition, Article 12(4) specifies that representatives of the IATTC shall be invited to participate in the work of the WCPFC Scientific Committee.

Currently, ten members of WCPFC are also members or cooperating non-members of IATTC (refer to **Table 1**).

### 2.2.2 IATTC

The 2003 *Convention for the strengthening of the Inter-American Tropical Tuna Commission established by the 1949 Convention between the United States of America and the Republic of Costa Rica* (Antigua Convention) entered into force in 2010 and updates a 1949 agreement focused largely upon scientific research. Pursuant to the Antigua Convention, the IATTC manages fishing primarily for ‘tuna and tuna-like species’ in a Convention Area located between 50N and 50S, bounded by the coastline of North, Central and South America in the east, and extending to 150W in the west (see **Figure 2**). The IATTC has 21 members and 5 cooperating non-members. Some of the IATTC members are major flag States, but more than half are coastal States in the Convention Area. In 2021, the total retained catch of tunas and bonitas caught by purse-seine vessels in the EPO was 651,163 metric tons. This catch was taken by vessels flagged to ten States, of which three States with the highest catches combined took 74.9% of the total (Ecuador, Mexico and Panama).

The provisions of the Antigua Convention reflect the fact that—like the WCPFC Convention—it was negotiated after the UNFSA, but it does not hew as closely to the UNFSA as the WCPFC Convention. For example, the Antigua Convention does not include the general principles for conservation and management established in Article 5 of the UNFSA, nor the specific provisions on the requirements of developing States contained in Article 24 of the UNFSA (although it does envisage financial and technical cooperation to assist developing members of the Commission (Article XXIII)). And while it does provide for the application of the precautionary approach (Article IV) and the establishment of compatible measures for the high seas and areas under national jurisdiction (Article V), these provisions are less detailed than those in the UNFSA.

The work of the IATTC is directed and overseen by a Commission (Articles VI and VII), supported by a Committee for the Review of Implementation of Measures Adopted by the Commission (Article X) and a Scientific Advisory Committee (Article XI) (IATTC, 2003). The Commission is specifically required to promote, carry out and coordinate scientific research on the stocks and species covered by the Antigua Convention—including ‘the effects of natural factors and human activities on the populations of these stocks and species’—and adopt measures based on the best scientific evidence available (Article VII). In this respect, and reflecting its original focus on scientific research, the IATTC has its own Scientific Staff to provide information, advice and recommendations to the Scientific Advisory Committee and the Commission (Article XIII), as well as field offices in a number of countries and its own research laboratory, based in Panama.

Like the WCPFC Convention, the Antigua Convention provides for cooperation with other RFMOs. Article XXIV(1) calls on the Commission to establish relevant institutional arrangements (such as consultative committees) with other RFMOs in order to achieve the objectives of the Convention, obtain the best available scientific information, and avoid duplication. Article XXIV(3) addresses the situation of overlapping Convention Areas and—without referring specifically to the WCPFC—provides that in such a situation, the IATTC shall cooperate with the other RFMO, and strive to agree on the relevant measures to be taken, such as ensuring harmonization and compatibility of the conservation and management measures adopted, or deciding that one RFMO avoid taking measures in respect of species regulated by the other RFMO. Finally, and of particular relevance to this report, Article XXIV(4) provides that this cooperation shall also apply in the situation where fish stocks migrate through areas under the purview of the IATTC and another RFMO.

Currently, eleven members of IATTC are members or cooperating non-members of WCPFC (refer to **Table 1**).

### 2.2.3 Overlap area

There is an ‘overlap’ area between the Convention Areas of the WCPFC and the IATTC, which falls between the western boundary of the IATTC at 150°W, and the eastern boundary of the WCPFC at 130°W (see **Figure 2**). The history of this overlap is briefly explored in discussion papers prepared by the Executive Directors of the IATTC and the WCPFC, which note that IATTC scientists and managers began to use 150°W as the western boundary of the IATTC as early as 1972, and that the Pacific Community also used 150°W as the eastern boundary of the central-western Pacific Ocean in preparing reports and assessments on yellowfin tuna in the 1990s (IATTC, 2011; WCPFC, 2011a). This approach was followed in setting the northern segment of the WCPFC’s eastern boundary (north of 4°S) at 150°W, but during the negotiation of the WCPFC Convention the southern part of the eastern boundary (between 60°S and 4°S) was placed at 130°W.

The decision seems to have been informed primarily by the desire to ensure that the entirety of French Polynesia’s EEZ (much of which lies between 150°W and 130°W) was included in the WCPFC Convention Area (WCPFC, 1999), rather than by scientific advice about the likely structure or location of Pacific Ocean tuna stocks, or patterns of historic fishing practice. However, the States participating in the negotiation of the WCPFC and the members of the IATTC were both cognisant of the creation of this overlap, and this is reflected in the inclusion of specific provisions on cooperation in each Convention, as described above.

**Table 1.** Key features, provisions and measures of WCPFC and IATTC. Adapted from Goodman et al, 2022.

<b>WCPFC</b> (Articles refer to the WCPFC Convention)		<b>IATTC</b> (Articles refer to the Antigua Convention)	
<b>Convention Area</b>			
<p>The WCPFC Convention Area comprises all waters of the Pacific Ocean extending south from the Australian continent along 141°E to the southern boundary at 60°S, then north at 130°W to 4°S, and thence north along 150°W. It does not have a defined boundary in the north or north-east (see Figure 2).</p>		<p>The IATTC Convention Area is located between 50°N and 50°S, bounded by the coastline of North, Central and South America in the east, and extending to 150°W in the west (see Figure 2).</p>	
<b>Catch</b>			
<p>The WCPFC Convention Area contains the world’s most valuable tuna fishery, which provides approximately 52% of the global tuna catch (McKinney et al, 2020; Williams and Ruaia, 2021; ISSF, 2022).</p> <p>In 2021, the total catch of tuna taken in the WCPFC Statistical Area by all gear types was 2,635,291 metric tons. This was caught by vessels flagged to 31 States. The 8 States with the highest catches combined took 77% of the total (Indonesia, Japan, Korea, Chinese Taipei, Kiribati, Philippines, Papua New Guinea and Federated States of Micronesia).</p>		<p>The tuna fisheries in the IATTC Convention Area are significantly less productive than those managed by the WCPFC, producing around just 13% of the global tuna catch (ISSF, 2022).</p> <p>In 2021, the total retained catch of tunas and bonitas caught by purse-seine vessels in the EPO was 651,163 metric ton. This was caught by vessels flagged to 10 States. The 3 States with the highest catches combined took 74.9% of the total (Ecuador, Mexico and Panama).</p>	
<b>Members and Cooperating Non-Members (CNMs)</b>			
*Small Island Developing States (SIDS) indicated in <i>italics</i>			
<b>WCPFC Member only</b>	<b>WCPFC and IATTC Member</b>	<b>IATTC Member only</b>	
<p>Australia, <i>Cook Islands</i>, <i>Federated States of Micronesia</i>, <i>Fiji</i>, <i>Marshall Islands</i>, <i>Nauru</i>, <i>New Zealand</i>, <i>Niue</i>, <i>Palau</i>, <i>Papa New Guinea</i>, <i>Philippines</i>, <i>Samoa</i>, <i>Solomon Islands</i>, <i>Tonga</i>, <i>Tuvalu</i></p>	<p>Canada, China, European Union, France, Japan, <i>Kiribati</i>, Korea, Chinese Taipei, United States, <i>Vanuatu</i></p>	<p><i>Belize</i>, Colombia, Costa Rica, Guatemala, Mexico, Peru, Venezuela</p>	
	<b>IATTC Member and WCPFC CNM</b>		
	<p>Ecuador, El Salvador, Nicaragua, Panama</p>		
<b>WCPFC CNM only</b>	<b>WCPFC and IATTC CNM</b>	<b>IATTC CNM only</b>	
<p>Curacao, Thailand, Vietnam</p>	<p>Liberia</p>	<p>Bolivia</p>	
<b>Structure of the RFMO</b>			
<p>The work of the WCPFC is directed and overseen by a Commission (Articles 9 and 10), supported by subsidiary bodies including:</p> <ul style="list-style-type: none"> <li>the Scientific Committee (SC) (Article 12)</li> </ul>		<p>The work of the IATTC is directed and overseen by a Commission (Articles VI and VII), supported by:</p> <ul style="list-style-type: none"> <li>a Committee for the Review of Implementation of Measures Adopted by the Commission (Article X)</li> <li>a Scientific Advisory Committee (Article XI), and</li> </ul>	

<ul style="list-style-type: none"> <li>• the Technical and Compliance Committee (TCC) Article 14)</li> <li>• the Northern Committee (NC), which makes recommendations in relation to stocks which occur in the area north of 20°N (Article 11(6)), and</li> <li>• the Finance and Administration Committee (Article 11(6)).</li> </ul> <p>A Secretariat, overseen by the Executive Director, supports the work of the Commission (Article 15). The work of the Commission and its subsidiary bodies may be supported, from time to time, by ad hoc or more long-term inter-sessional working groups.</p>	<ul style="list-style-type: none"> <li>• a Committee on Finance and Administration (Article VII(1)(u)).</li> </ul> <p>A Secretariat, overseen by the Director, supports the work of the Commission (Article XII). The work of the Commission and its subsidiary bodies may be supported from time to time by ad hoc or more long-term working groups.</p> <p>The IATTC also provides Secretariat services for the Agreement on the International Dolphin Conservation Program (AIDCP), which covers the Eastern Pacific Ocean.</p>
<b>Scientific Advice</b>	
<p>The WCPFC Convention specifically recognizes the importance of adequate scientific information (Article 5(b)) and provides for the Commission to engage the services of scientific experts to provide the necessary information and advice (Article 13).</p> <p>Scientific and data management services are provided by the Oceanic Fisheries Programme of the Pacific Community (SPC-OFP). Additional advice in relation to northern stocks is provided by the International Scientific Committee for Tuna and Tuna-like Species in the North Pacific Ocean (ISC).</p>	<p>The Commission is specifically required to promote, carry out and coordinate scientific research on the stocks and species covered by the Antigua Convention—including ‘the effects of natural factors and human activities on the populations of these stocks and species’—and adopt measures based on the best scientific evidence available (Article VII).</p> <p>The IATTC has internal scientific staff to provide information, advice and recommendations to the Scientific Advisory Committee and the Commission (Article XIII), as well as field offices in a number of countries and its own research laboratory, based in Panama. Additional advice in relation to northern stocks is provided by the International Scientific Committee for Tuna and Tuna-like Species in the North Pacific Ocean (ISC).</p>
<b>Conservation and Management Principles</b>	
<p>Reflecting the developments incorporated in the UNFSA, the WCPFC Convention incorporates an expanded range of conservation and management principles (Article 5), specific guidance on the application of the precautionary approach (Article 6 and Annex II), and rules for ensuring compatibility between measures adopted for the high seas and for areas under national jurisdiction (Article 7).</p>	<p>The Antigua Convention does not incorporate the general principles for conservation and management established in Article 5 of the UNFSA. It does provide for the application of the precautionary approach (Article IV) and the establishment of compatible measures for the high seas and areas under national jurisdiction (Article V), but these provisions are less detailed than those in the UNFSA.</p>
<b>Special Requirements of Developing States</b>	
<p>Article 30 of the WCPFC Convention addresses the special requirements of developing States, and in particular small island developing States. It provides that the Commission shall take these into account in giving effect to the duty to cooperate through the adoption of conservation and management measures and notes the vulnerability of developing States which are dependent on the exploitation of living marine resources.</p>	<p>The Antigua Convention does not include the specific provisions on the requirements of developing States contained in Article 24 of the UNFSA, although it does envisage financial and technical cooperation to assist developing members of the Commission (Article XXIII).</p>

Measures to Address Climate Change	
<p>In 2019, the WCPFC adopted a non-binding resolution on climate change, which commits the Commission to considering the impact of, and options for addressing, climate change on the WCPFC’s tuna stocks (WCPFC 2019a).</p> <p>In 2022, the WCPFC agreed to recommendations from the Scientific Committee relating to the inclusion of climate change in the Committee’s work, and also agreed to include climate change as a standing agenda item for the Commission, and to prioritize discussion of how to best incorporate climate change information and analysis in its work, as well as the work of the TCC and NC (WCPFC, 2022a).</p> <p>The WCPFC has supported the continuation of large-scale tagging experiment work led by the Oceanic Fisheries Programme of the Pacific Community (SPC-OPF) (the scientific services provider for the WCPFC), recognizing that it is necessary to inform stock assessments of tropical tunas in the WCPO (Hare et.al., 2021).</p> <p>The WCPFC’s Regional Observer Programme, which uses existing national and subregional observer programmes of WCPFC members, collects biological samples and data and provides information concerning the catch composition of the main WCPO tuna fisheries (Hare et.al., 2021).</p> <p>The WCPFC has also been using the Spatial Ecosystem And Population Dynamics Model (SEAPODYM) (Lehodey et al. 2014) framework to investigate how climate change could affect the distribution and abundance of tropical tunas and albacore tunas.</p>	<p>In 2023, the IATTC adopted a resolution providing for climate change to be included as an agenda item on the annual meetings of the Commission, the Scientific Advisory Committee and the Working Group on Ecosystem and Bycatch, in order to consider what amendments or new measures may be needed to address climate change impacts on fisheries in the Convention Area.</p> <p>The IATTC Strategic Science Program incorporates some projects on climate change, including Project N.2.a on developing models of the effects of climate change on pre-recruit life stages of tropical tunas and Project N.2.b on supporting climate-ready and sustainable fisheries using satellite data to conserve and manage life in the ocean and support sustainable fisheries under climate change.</p> <p>The IATTC’s Observer Programme uses a combination of national and IATTC Secretariat placements, and similarly collects biological samples and provides information concerning the catch composition of the main EPO tuna fisheries.</p>
Current Conservation and Management Measures Giving Effect to Cooperation with the other RFMO	
<p>WCPFC CMM 2021-02 on Conservation and Management Measure for Pacific Bluefin Tuna provides that the WCPFC Executive Director must communicate the measure to the IATTC Secretariat and its Parties who fish for Pacific bluefin tuna in the EPO, with a request that they take equivalent measures. WCPFC members are also ‘encouraged to communicate with and, if appropriate, work with the concerned IATTC contracting parties bilaterally’ (WCPFC, 2021b).</p> <p>WCPFC CMM 2009-03 on Conservation and Management for Swordfish recognizes ‘the need for both WCPFC and IATTC to adopt conservation and measures to provide for the sustainable management of swordfish stocks across the Pacific Ocean’,</p>	<p>Resolution C-21-05 Measures for the Conservation and Management of Pacific Bluefin Tuna in the Eastern Pacific Ocean recognizes that the stock of Pacific bluefin tuna is caught in both the WCPO and the EPO, and that conservation and management measures by WCPFC and IATTC should be considered ‘in cooperation between the two RFMOs taking into account historical and future projected proportional fishery impacts on spawning stock biomass (SSB) between fisheries in the EPO and fisheries in the WCPO’. Assessments prepared by the IATTC shall take into account conservation and management measures adopted by the WCPFC, and that in revising management measures for Pacific bluefin tuna, the Commission must consider outcomes of the Joint Working Group (IATTC, 2021b).</p>

<p>although in practice swordfish is essentially unmanaged by IATTC (WCPFC, 2009b).</p> <p>WCPFC CMM 2019-03 on North Pacific Albacore goes further, tasking the WCPFC Executive Director to communicate the WCPFC measure to the IATTC with a request that the two Commissions engage in consultations with a view to adopting uniform conservation and management measures and agreement on any reporting or other measures needed to ensure compliance (WCPFC, 2019b).</p>	<p>IATTC Resolution C-22-04 states that the Commission ‘shall promote compatibility, starting with the definition of “reference points”, between the harvest strategy adopted through this Resolution, and any future harvest strategy adopted in the WCPFC with respect to North Pacific albacore’ and tasks the Director to communicate this Resolution to the WCPFC Secretariat (IATTC, 2022c).</p>
---	--

### 2.3 Broader International law and policy considerations

Global rules and principles in the fields of marine environmental protection, climate change and sustainable development operate alongside the more specific rules governing international fisheries under each RFMO. The requirement for cooperative management must be viewed in the context of international obligations to mitigate climate change impacts and to ensure equity both in the allocation of marine resources and in the distribution of conservation burdens. This section of the report outlines some of the key areas of international law and policy which frame international fisheries management.

#### 2.3.1 International climate law

International obligations to respond to climate-driven redistribution of fish stocks can be derived from international climate law. The *United Nations Framework Convention on Climate Change* (UN, 1992a) (Climate Change Convention) seeks to stabilise the atmospheric concentration of greenhouse gases ‘at a level that would prevent dangerous anthropogenic interference with the climate system’, and to do so in a time frame that allows ecosystems to naturally adapt to climate change, to permit sustainable development and to ensure that food production is not threatened. That level was set in the 2015 *Paris Agreement* (UN, 2015a) at ‘well below 2 degrees Celsius above pre-industrial levels’, and preferably no more than 1.5 degrees Celsius above pre-industrial levels.

The Climate Change Convention includes a long list of specific commitments, but these can be summarised under the general principle that Parties must ‘take precautionary measures to anticipate, prevent or minimize the causes of climate change and mitigate its adverse effects.’ They are to do so in order to ‘protect the climate system for the benefit of present and future generations ... on the basis of equity and in accordance with [the parties’] common but differentiated responsibilities’ (Article 3.1). The Convention requires Parties to give full consideration to the special needs of developing country parties, especially those that are particularly vulnerable to the adverse effects of climate change, and those that would have to bear a disproportionate burden (Article 3.2). The Paris Agreement further seeks ‘to strengthen the global response to the threat of climate change ... including by ... increasing the ability to adapt to the adverse impacts of climate change’ (Article 2(1)(b)), and states that it ‘will be implemented to reflect equity and the principle of common but differentiated

responsibilities and respective capabilities, in the light of different national circumstances' (Article 2(2)).

The climate law framework can therefore be drawn upon to highlight the obligations of developed State parties to take measures to mitigate the impact of climate change on developing countries, based upon principles of equity and common but differentiated responsibilities. Ensuring that developing country parties to the WCPFC and IATTC are not unduly disadvantaged through the redistribution of fish stocks could be viewed as one way of meeting this obligation to mitigate climate change impacts.

Questions about the responsibilities of States with respect to climate change also underpin the Resolution adopted by the UN General Assembly on 23 March 2023 on the *Request for an advisory opinion of the International Court of Justice on the obligations of States in respect of climate change* (UN Doc A/77/L.58), as well as the *Request for an Advisory Opinion submitted by the Commission of Small Island States on Climate Change and International Law* submitted to ITLOS in December 2022, which seeks clarification of the legal consequences of the failure of States to avoid causing significant harm, in particular to small island developing States. The outcome of these requests may also be relevant to the way in which the international climate law framework can be drawn upon in considering responses to the climate-driven redistribution of fish stocks.

### 2.3.2 Sustainable development framework

These arguments are strengthened when considered alongside the *2030 Agenda for Sustainable Development* and the UN Sustainable Development Goals (UN, 2015b). While all 17 goals are interconnected, a number are particularly important to the challenge of climate induced redistribution of tuna stocks. SDG 13, *Climate Action*, urges States to take 'urgent action to combat climate change and its impacts'. SDG 14, *Life below water*, requires States to 'conserve and sustainably use the oceans, seas and marine resources for sustainable development'. In particular, SDG 14 targets 'increased economic benefits to Small Island developing States and least developed countries from the sustainable use of marine resources, including the sustainable management of fisheries' (target 14.7).

### 2.3.3 The BBNJ Agreement

The recently negotiated *Draft Agreement under the United Nations Convention on the Law of the Sea on the Conservation and Sustainable Use of Marine Biological Diversity of Areas Beyond National Jurisdiction of 4 March 2023* (draft BBNJ Agreement) (UN, 2023) reinforces these important principles. The preamble to the draft BBNJ Agreement recognises the need to address climate change-induced degradation of marine ecosystems and biodiversity loss 'in a coherent and cooperative manner', whilst 'contributing to the realization of a just and equitable international economic order which takes into account ... the special interests and needs of developing States'. More concretely, the draft BBNJ Agreement provides a mechanism for the establishment of area-based management tools, including marine protected areas, in areas beyond national jurisdiction (Part III). There is clearly the potential



for such measures to overlap with the management area of an existing RFMO. While the draft BBNJ Agreement requires that decisions regarding area-based measures ‘respect the competences of, and not undermine, relevant legal instruments and frameworks and relevant [regional bodies]’, it also contains significant obligations to regularly consult, and to enhance international cooperation and coordination amongst relevant bodies (Article 19). Whilst it remains to be seen exactly how the draft BBNJ Agreement is implemented once it enters into force, the strength of obligations regarding international cooperation and coordination in this context support a strong reading of existing obligations under international fisheries law.

## 2.4 Summary

This section has examined the extent to which existing international agreements and arrangements address cooperation between RFMOs in the sustainable use of living marine resources, including with respect to impacts arising from climate change, and the needs of SIDS and developing States.<sup>1</sup> While none of these instruments specifically contemplate the action to be taken by RFMOs to address the climate-driven redistribution of tuna stocks, a strong legal basis for cooperative action can nonetheless be found in the relevant legal frameworks. The global framework for the law of the sea and international fisheries, as set out in UNCLOS and UNFSA, generally requires States to cooperate in the management of highly migratory species such as tuna and to take into account the special requirements of developing States as they do so. In addition, there are international obligations in other legal frameworks—including international climate law, the sustainable development framework and the draft BBNJ Agreement—which can be drawn upon to invoke important principles of inter- and intra-generational equity that are directly challenged by the impact that climate change is projected to have on the distribution of tuna stocks and, consequentially, the livelihoods, nutrition and food security of Pacific Small Island Developing States.

As shown in **Table 2** below, not all of the legal instruments discussed in this report are legally binding on all the members of WCPFC and IATTC—whether because they are by nature ‘non-binding’ (the SDGs), because they have not yet opened for signature and ratification (the BBNJ Agreement), or because not all States are Party to them (UNCLOS and UNFSA). However, the WCPFC and the IATTC Conventions *are* binding on all the members of each RFMO, and all the CNMs have agreed to apply them as a condition of their co-operating non-membership. This is important, because the constituent instruments of the WCPFC and the IATTC provide a more expansive and detailed framework for cooperation than UNCLOS or the UNFSA. In particular, they recognise the necessity of cooperation in relation to shared stocks, and contain the necessary principles and powers for the members of these organizations to take the decisions that are likely to be required to manage the climate-driven redistribution of

---

<sup>1</sup> While there are other binding and non-binding instruments addressing important aspects of fisheries law and policy (including the 1993 Compliance Agreement, the Code of Conduct for Responsible Fisheries and the Port State Measures Agreement), these do not address the issues under examination in this report.

tuna stocks. So while the broad obligations of UNCLOS and the UNFSA may not apply directly to all Parties, the more specific cooperation obligations in the WCPFC and IATTC Conventions do.

**Table 2.** Participation in international agreements and instruments by WCPFC and IATTC members and CNMs

Agreement or Arrangement	WCPFC/IATTC Members who are <u>not</u> Party	WCPFC/IATTC CNMs who are <u>not</u> Party
<b>UNCLOS</b>	United States, Chinese Taipei, Peru, Venezuela	All are Party
<b>UNFSA</b>	China (signatory), Colombia, El Salvador, Guatemala, Mexico, Nicaragua, Peru, Venezuela	Bolivia
<b>UNFCCC</b>	All are Party	All are Party
<b>Paris</b>	All are Party	All are Party
<b>SDGs</b>	Non-binding, apply to all as a political commitment	Non-binding, apply to all as a political commitment
<b>BBNJ</b>	Not yet open for signature	Not yet open for signature

It is also worth noting that the duty under international law to take measures for the conservation and management of stocks on the high seas—or to cooperate with other States in the taking of such measures—is not dependent upon or confined to the existence of RFMOs with suitably defined areas of competence. The duty to cooperate in relation to the living resources of the high seas ultimately rests with individual States fishing for those resources, as does the duty to cooperate with regard to highly migratory stocks. It is the duty of a coastal State to adopt the conservation and management measures necessary to ensure the living resources of its EEZ, and the duty of a flag State to ensure that vessels flying its flag do not fish illegally in the waters of a coastal State. Each of these duties points to the ultimate responsibility of the relevant States themselves. Accordingly, it is up to the relevant coastal and fishing States to make the amendments necessary to the structure and operation of the RFMOs to which they are members, if there are blockages or difficulties that prevent or limit cooperation.

### **3. The current state of cooperation between WCPFC and IATTC**

Cooperation between WCPFC and IATTC has been underway in a range of guises for many years. Between 1996 and 2000, the IATTC Executive Director participated as an observer at all seven sessions of the Multilateral High Level Conference that led to the adoption of the WCPFC Convention and made interventions reflecting on the need for—and potential options for—future cooperation between the WCPFC and the IATTC on ‘both of the issues in which cooperation is necessary—overlapping areas and cross-boundary migrations’ (WCPFC, 2000). During the preparatory conference for the entry into force of the WCPFC Convention, the Secretariats of the two organizations collaborated to produce a paper on how to give effect to cooperation between them, which included recommendations about cooperation on stock assessments for bigeye tuna, a Pacific-wide tagging program for tropical tunas, procedures for sharing information on scientific and management issues, and the creation of a permanent working group to enhance cooperation through information sharing and dialogue (WCPFC, 2002; IATTC, 2005). This Section provides a stock-take of the extent to which practical measures have so far eventuated, by considering four areas of cooperation:

- governance and institutional issues;
- scientific research;
- conservation and management; and
- compliance and enforcement.

#### **3.1 Governance and institutional issues**

To date, cooperation between WCPFC and IATTC at the institutional level has consisted primarily of: (i) formal Memoranda of Understanding addressing specific issues; (ii) meetings between the two Secretariats; and (iii) attendance by members of one Secretariat at the meetings of some bodies of the other RFMO.

The two organizations have developed three formal instruments on cooperation:

- a 2006 Memorandum of Understanding (2006 MOU), in which they agree to consult and cooperate in respect of matters of common interest including the exchange of data and information, research on stocks and species of mutual interest (including Pacific-wide stock assessments), and conservation and management measures for stocks of mutual interest (WCPFC, 2006a);
- a 2009 Memorandum of Cooperation on the Exchange and Release of Data (MOC on Data), which underpins cooperation on Pacific-wide stock assessments for tunas and sharks and an annual exchange of data and information between the IATTC and SPC-OFP (WCPFC, 2009a); and
- a 2011 Memorandum of Cooperation on the Cross-Endorsement of Observers (MOC on Observers), which provides for approved observers who meet the necessary training requirements to be cross-endorsed to operate on vessels that fish on the high seas in both Convention Areas and the overlap area (WCPFC, 2011b).

A meeting between the Secretariats was also established to facilitate cooperation between the two RFMOs (the 'WCPFC-IATTC Consultative Meeting'), which met on four occasions in 2007 and 2008. While there have not been any further meetings of the WCPFC-IATTC Consultative Meeting since 2008, in 2011 the Executive Directors of both RFMOs met to discuss measures for managing fishing in the overlap area. This discussion produced five options for consideration by WCPFC and IATTC (IATTC, 2012a):

1. management of the overlap area assigned to one RFMO only, through an MOU;
2. management of the overlap area assigned by gear type, with IATTC managing the purse-seine fishery, and WCPFC managing longlining;
3. establishment of a 'special management area', where an agreed set of management measures would be applied;
4. application of measures by both Commissions, with vessels from the WCPFC Register fishing under WCPFC rules, vessels from the IATTC Register fishing under IATTC rules, and vessels registered with both RFMOs selecting and advising under which Commission's rules they wished to fish; and
5. establishment of a working group to consider longer-term options for management of tuna in the Pacific Ocean basin.

The RFMOs agreed that option 4 was the most practical in the short term, but that a longer-term process should be established to explore avenues for managing tuna stocks in the entire Pacific Ocean, as proposed in option 5 (IATTC, 2012b; WCPFC, 2013). The first (short term) part of this decision is reflected in the conservation and management measures of both organizations (as discussed below), but no progress appears to have been made on the second (long term) proposed avenue for cooperation.

Although the two Secretariats have not held a WCPFC-IATTC Consultative Meeting since 2008, a member of the Secretariat of each RFMO generally attends the Commission meetings and the Scientific Committee meetings of the other RFMO, although only as an observer. However, this does not currently extend to attendance at meetings of all other subsidiary bodies, such as the WCPFC Technical and Compliance Committee or the meeting of the IATTC Committee for the Review of Implementation of Measures Adopted by the Commission.

### **3.2 Scientific research**

Scientific research is currently the area of closest cooperation between the RFMOs. Until recently, scientific collaboration between the two RFMOs has tended to focus on coordination of tagging initiatives, tuna biology, ecosystem modelling, bycatch vulnerability analyses and northern stocks. Cooperation in regard to northern stocks has been conducted principally through the WCPFC Northern Committee (which makes recommendations to WCPFC in relation to stocks which occur mostly in the WCPFC Convention Area north of 20°N) and the

ISC (which provides scientific advice to both the WCPFC and IATTC for northern stocks).<sup>2</sup> The ISC comprises seven full Members,<sup>3</sup> four non-voting Members<sup>4</sup> (including the WCPFC and SPC)<sup>5</sup> and one cooperating non-Member (the IATTC). All Members of the ISC are also Members of the IATTC and, with the exception of Mexico, are Members of the WCPFC. The ISC has facilitated scientific collaboration on Pacific-wide stock assessments for Pacific bluefin tunas, billfishes and sharks, many of which have a shared distribution between the IATTC and the WCPFC Convention Areas. The ISC also has four species working groups (for Pacific bluefin tuna, North Pacific albacore, billfish and sharks) through which Members and non-voting Members collaborate on scientific research and technical matters. A Statistical Working Group focuses on the collection and exchange of scientific and monitoring data.

In contrast to SPC's Commission-wide role as Scientific Services Provider to the WCPFC, the ISC and the Northern Committee effectively quarantine their work on northern stocks from the rest of the WCPFC, despite the fact that non-ISC Members harvest species for which the ISC and Northern Committee provide advice.<sup>6</sup> The IATTC's Strategic Science Plan indicates that the IATTC will collaborate with ISC on stock assessments conducted by the latter, and on management strategy evaluations (MSEs) for North Pacific albacore and Pacific bluefin tuna (IATTC, 2018).

The IATTC and WCPFC also collaborate on scientific assessments by attending each other's Scientific Committee meetings and exchanging data and assessments as required under the MOU. Both organizations take account of stock distributions in the WCPO and EPO, and the IATTC takes account of the ISC's stock assessments and recommendations on harvest strategies. Both organisations also assist each other with periodic and independent peer-review of their stock assessments.

### **3.3 Conservation and management**

In 2015, the WCPFC Northern Committee requested WCPFC to arrange a joint meeting with IATTC on the management of Pacific bluefin tuna. This led to the establishment of the IATTC-

---

<sup>2</sup> This distinction is reflected in the different way in which stock assessments for South Pacific and North Pacific albacore have been conducted: while the ISC has conducted the North Pacific albacore assessment (covering the entire North Pacific, including the waters of the IATTC), SPC has conducted the South Pacific albacore assessment (covering the WCPFC Convention Area only). However, this distinction may be starting to diminish, with a Pacific-wide stock assessment for south Pacific albacore conducted jointly by the SPC and IATTC for the first time in 2021, utilizing data from both Convention Areas.

<sup>3</sup> Canada, Chinese Taipei, Japan, Republic of Korea, Mexico, People's Republic of China, the United States of America.

<sup>4</sup> Food and Agriculture Organization of the United Nations (FAO), North Pacific Marine Science Organization (PICES), Secretariat of the Pacific Community (SPC), and the WCPFC.

<sup>5</sup> While SPC is a member of ISC, it rarely participates.

<sup>6</sup> For example, the 2020 stock assessment for North Pacific albacore noted that Vanuatu caught 4% of total catches from 2014-2018.

Northern Committee Joint Working Group on Pacific Bluefin Tuna Management (Joint Working Group), which has convened annually since 2016, and makes recommendations and drafts proposals for each RFMO on the basis that there will be few or no alterations when the proposals are put forward for final adoption at each Commission. The annual meetings of the Joint Working Group include all participants in Pacific bluefin tuna fisheries, who receive the scientific advice and stock assessment updates from the ISC and develop harmonized draft proposals for conservation and management measures and harvest strategies. At the Joint Working Group's second meeting in 2017, a rebuilding plan was negotiated for the depleted, single population of Pacific bluefin tuna (Madigan et al., 2017). In 2018, the Joint Working Group also established a Technical Working Group to progress the development of a draft Catch Documentation Scheme for Pacific Bluefin tuna, which has so far met three times.

The practical extent of cooperation between WCPFC and IATTC through the Joint Working Group can be considered by reference to the conservation and management measures adopted for relevant stocks, such as Pacific Bluefin tuna. For the WCPFC, CMM 2021-02 requires the WCPFC Executive Director to communicate the measure to the IATTC Secretariat and its Parties who fish for Pacific bluefin tuna in the Eastern Pacific Ocean, with a request that they take equivalent measures (WCPFC 2021a). WCPFC members are also 'encouraged to communicate with, and if appropriate, work with the concerned IATTC contracting parties bilaterally'. The IATTC measure for Pacific Bluefin Tuna (Resolution C-21-05) is more comprehensive. It specifically recognises that the stock of Pacific bluefin tuna is caught in both the WCPO and the EPO, and that conservation and management measures by WCPFC and IATTC should be considered 'in cooperation between the two RFMOs taking into account historical and future projected proportional fishery impacts on SSB between fisheries in the EPO and fisheries in the WCPO' (IATTC 2021b). It also specifies that assessments prepared by the IATTC Scientific Staff shall take into account conservation and management measures adopted by WCPFC, and that in revising management measures for Pacific bluefin tuna, the Commission must consider outcomes of the IATTC-NC Joint Working Group. The success of the cooperation in conservation and management through the Joint Working Group is reflected in the adoption of the rebuilding plan for Pacific bluefin tuna, the resulting improvement in stock status (ISC, 2022), and the negotiation of new management activities by both RFMOs in 2021 (IATTC, 2021a; WCPFC, 2021a).

Cooperation between the two organizations is also specifically addressed in individual conservation and management measures for other species. For example, WCPFC CMM 2009-03 on Conservation and Management for Swordfish recognises 'the need for both WCPFC and IATTC to adopt conservation and measures to provide for the sustainable management of swordfish stocks across the Pacific Ocean'. WCPFC CMM 2019-03 on North Pacific Albacore, tasks the WCPFC Executive Director to communicate the WCPFC measure to the IATTC with a request that the two Commissions engage in consultations with a view to adopting uniform conservation and management measures and agreement on any reporting or other measures needed to ensure compliance. Similar sentiments are reflected in IATTC Resolution C-18-03,

which states that the Commission ‘shall continue efforts to promote compatibility between the conservation and management measures adopted by the IATTC and the WCPFC with respect to North Pacific Albacore’, and tasks the Director to communicate this Resolution to the WCPFC Secretariat.

Cooperation between the two RFMOs in conservation and management also arose for consideration at the most recent (2022) WCPFC Commission meeting, in relation to South Pacific albacore, for which the WCPFC is seeking to develop a management procedure. While no substantive decisions were made at this meeting, a number of WCPFC members (including Pacific Island Countries, Chinese Taipei, New Caledonia and French Polynesia) urged the WCPFC to work with IATTC to secure compatible management of South Pacific albacore in the EPO.

### **3.4 Compliance and enforcement**

As part of their obligation to cooperate through RFMOs, members of the WCPFC and the IATTC are responsible for ensuring the establishment of ‘appropriate cooperative mechanisms for effective monitoring, control, surveillance and enforcement’ (MCS) of the stocks and areas under their jurisdiction (Article 10(h), UNFSA). In addition, the constituent instruments of both RFMOs contain general obligations to cooperate with other organizations—and Article 22(4) of the WCPFC Convention specifically requires the WCPFC Commission to consult with the IATTC on measures relating to MCS for stocks that occur in the Convention Areas of both organizations (WCPFC, 2004). The MOC on Observers has provided a foundation for cooperation in compliance and enforcement duties undertaken by the observer programmes operating in each jurisdiction. Each RFMO has adopted measures to give effect to their agreement that approved observers from both observer programs who meet the necessary training requirements can be cross-endorsed to operate on vessels that fish on the high seas in both Convention Areas and the overlap area (WCPFC, 2011b).

Both RFMOs have also independently established many of the key MCS tools needed to ensure compliance and enforcement with their conservation and management measures, from a record of fishing vessels and a regional observer programme to a vessel monitoring system and a procedure for establishing a list of vessels engaged in IUU fishing. Beyond these, neither of the two RFMOs’ constituent instruments specifically provide for cooperation with other RFMOs in relation to compliance or enforcement issues.

### **3.5 Summary**

The legal frameworks of both organizations envisage, enable and encourage cooperation between the WCPFC and the IATTC on relevant issues, and some steps have been taken to put meaningful measures into place—in particular, the 2006 MOU, the MOC on Data, the MOC on Observers, the decision regarding vessels operating in the overlap area, and the Joint Working Group on Pacific Bluefin Tuna. While the decisions that will be needed to effectively manage shifting stocks cannot be taken in advance, WCPFC and IATTC can act now to identify the relevant challenges, in order to develop a framework that will support informed and

effective cooperation in the management of shared tropical tuna stocks when the time comes.



## **4. Emerging needs, challenges and potential complexities arising from the redistribution of tuna stocks**

Building on the existing forms of cooperation as well as the issues, gaps and obstacles identified across the areas of RFMO activity discussed above, a number of future needs and emerging challenges can be identified:

- collaborating in further scientific research
- clarifying the extent of each RFMO's jurisdiction
- developing governance or institutional mechanisms or processes for cooperation
- addressing questions of membership
- inter-operability and compatibility of conservation and management measures
- implications for participatory rights, and
- enhancing cooperation in compliance and enforcement.

### **4.1 Collaborating in scientific research**

The need for cooperative management approaches to the climate-driven redistribution of tuna resources will depend on the extent to which stocks become or remain transboundary. As such, it will be imperative to develop a clearer understanding of the spatial distribution and connectivity within and between tuna stocks within the Pacific Ocean. For example, if further scientific research confirms that stock structures of tropical tuna species are panmictic, Pacific-wide processes would need to be considered for stock assessments, but little to no change may be required to current management practices. Conversely, if research reveals more complex population structuring and the presence of multiple stocks, more complicated and spatially explicit assessment frameworks will be required.

Cooperation will also be needed to improve the modelling for how each identified tuna stock is likely to respond to climate change. WCPFC has been using the Spatial Ecosystem And Population Dynamics (SEAPODYM) modelling framework (Lehodey et al., 2014) to investigate how climate change could affect the distribution and abundance of tropical tunas and albacore tunas. SEAPODYM is particularly well suited for simulating the effects of climate-driven changes to the physical, chemical and biological features of the Pacific Ocean on the distribution of tuna (Lehodey et al., 2008; Senina et al., 2008; Senina et al., 2020a). However, further improvements over past and recent SEAPODYM simulations and analyses (Lehodey et al., 2011; Lehodey et al., 2013; Lehodey et al., 2015; Bell et al., 2021) are needed to reduce uncertainty and improve the resolution of current models from basin-wide to more regional or sub-regional application. The two RFMOs can also play a role in reducing uncertainty in ecosystem and tuna modelling through enlisting the assistance of industrial fishing vessels operating within their jurisdictions to collect additional data and information needed to verify and inform the modelling.

Most Pacific tuna stock assessments to date have generally been RFMO-specific, although Pacific-wide assessments have been performed to test the 'sensitivity' of assessed stock

status to the RFMO-specific stock assumption (Hampton and Maunder, 2005; McKechnie et al., 2015) or to meet managers' specific requests (Castillo Jordán et al., 2021). In these cases, the spatial structure of pan-Pacific assessments was developed so that RFMO boundaries were maintained, and RFMO-specific results could be provided. These results to date have proved to be relatively robust to the regional/Pacific-wide assumption (Hampton and Maunder, 2005; McKechnie et al., 2015). However, adjustments may need to be made to incorporate the improved understanding of stock structure and the projected responses of stocks to climate change.

Cooperation in monitoring of biological parameters such as growth and reproductive biology is also likely to be needed. These parameters can vary from the west to the east Pacific (Hampton, 2017), and are likely to shift with changing environmental conditions caused by climate change. Close monitoring of these parameters will be necessary given the sensitivity of the stock assessment models to shifts in the shape and value of these parameters.

It will also be useful to integrate information from climate modelling into the harvest strategies being developed for tuna stocks by WCPFC and IATTC (see, e.g., Merino et al., 2019). While harvest strategies are likely to be reviewed at timescales shorter than those currently projected for the substantial impacts of climate change on Pacific tuna, ongoing improvements to modelling about how climate change may alter stock distribution, and fish movement and biology, will allow these uncertainties to be re-examined as harvest strategies evolve. In turn, monitoring the actual impacts of climate change on the stock and fishery over time will signal an 'exceptional circumstance' where those changes fall outside the ranges of uncertainty against which a harvest strategy was tested, and hence whether that strategy needs to be revisited (de Moor et al., 2022). It will also allow review of the ability of selected management procedures to continue to achieve the objectives of stakeholders in the face of regional climate impacts (Merino et al., 2019). In short, using climate modelling to inform harvest strategies would provide both RFMOs with a better framework to adjust overall catch and effort limits to ensure sustainable management within their jurisdiction, and to adjust these limits if fish are progressively re-distributed into other jurisdictions so that shared stocks can be managed sustainably.

#### **4.2 Clarifying the extent of jurisdiction**

In the WCPFC Convention and the Antigua Convention, jurisdiction is defined both spatially (in terms of the Convention Area within which each RFMO has competence), as well as biologically (in terms of the species and stocks that are the focus of their management). These jurisdictional requirements are cumulative; that is, neither Convention contemplates the organization having management of a particular stock once it travels outside the relevant Convention Area.

This limitation reflects both the essential strength and fundamental weakness of the UNCLOS framework of maritime zones: the clear demarcation lines of each Convention Area provide certainty in terms of the exercise of rights and responsibilities by each RFMO, but do not

reflect biological limits. Accordingly, it will be important for the two RFMOs to identify the stocks that are likely to be impacted by climate-driven redistribution, and then—reflecting the commitments to inter-RFMO cooperation already contained in each RFMO agreement—agree on the best institutional arrangements for the cooperative management of these stocks.

### **4.3 Developing governance or institutional mechanisms for cooperation**

A starting point for this should be to add climate change to the agenda of RFMO meetings, both in terms of individual RFMO activity, and as a priority area for cooperation. While the meeting agendas of Commissions and subsidiary bodies are already crowded and contested, the issue of climate change and the importance of cooperation will increase in importance over time as climate-driven stock redistribution occurs. Developing a practice of substantive and open discussion within and across the RFMOs will be a critical basis for responding to change. At an individual level, both RFMOs have made some progress with respect to integrating climate change into their work agenda and discussions.

For example, at its 2022 meeting, the WCPFC agreed that climate change be included in the Scientific Committee's work, and also agreed to include climate change as a standing agenda item for the Commission, and to prioritize discussion of how to best incorporate climate change information and analysis in the work of the Commission as well as the work of the Technical and Compliance Committee and the Northern Committee (WCPFC, 2022a). However, no formal progress has yet been made with the IATTC on any cooperation needed for managing the effects of climate change.

### **4.4 Addressing questions of membership**

As shown in **Table 1**, there is already a substantial overlap in participation between WCPFC and IATTC. However, as stocks re-distribute, States which are not currently members of one or other of these RFMOs might be motivated to pursue membership of that RFMO in order to ensure access to the fishery, and to participate in decision-making. The possibility of additional States seeking to join these RFMOs highlights the importance of effective mechanisms for institutional cooperation, but also raises complex questions about the application of the rules in each organization regarding whether—and how—to accommodate new members. In this event, the provisions of the Antigua Convention and the WCPFC Convention on accession to the treaty will become particularly important.

In respect of the IATTC, aside from Parties to the 1949 Convention which originally established the IATTC, and Parties with a coastline bordering the Convention Area, accession to the Antigua Convention is generally open to new members only if their vessels fish for stocks covered by the Convention (following consultations with the existing Parties), or if they are otherwise invited to become members on the basis of a decision by the existing Parties (Articles XXVII and XXX, Antigua Convention). The situation is similar in the WCPFC, since Article 35 of the WCPFC Convention provides that, beyond the States which participated in the negotiation of the Convention, other States may only become party by a consensus

decision of all Parties. This regime gives considerable control to the existing members in determining whether or not to allow new members—although it may be difficult to reconcile with Article 8 of UNFSA, which provides that ‘States having a real interest in the fisheries concerned may become members of such organization’, and further, that ‘the terms of participation in such organization or arrangement shall not preclude such States from membership or participation; nor shall they be applied in a manner which discriminates against any State or group of States having a real interest in the fisheries concerned’. In this context, questions might also arise about the existing approach that these organizations take to new membership. To date, for example, consensus to admit new members to the WCPFC has not been forthcoming, despite explicit requests to join from co-operating non-members including Belize, Ecuador, El Salvador, Mexico, Panama and Vietnam (WCPFC, 2017a). There is also the possibility of additional States seeking co-operating non-membership of these RFMOs.

In addition to resolving processes for membership, the complex issues of access to participatory rights and/or the allocation of such rights to new members or co-operating non-members will need to be resolved.

#### **4.5 Inter-operability and compatibility across RFMO conservation and management measures**

As described in their constituent instruments, the central objective of both the WCPFC and the IATTC is to ensure the long-term conservation and sustainable use of highly migratory stocks in the Pacific Ocean through the adoption of appropriate conservation and management measures (WCPFC, 2004; IATTC, 2010). This necessarily includes setting appropriate limits on fishing. Where stocks are overfished or where overfishing is occurring—or where there is a risk of exceeding target and limit thresholds—effective conservation and management of fish stocks should include a limit in some form, whether defined as catch volume, effort or capacity. Limits should be applied across the entire range of the stock or sub-stock (Article 7(2), UNFSA), guided by harvest strategies based on the best scientific evidence available and applying a precautionary approach. Importantly, limits for highly migratory stocks must be compatible across jurisdictional boundaries—not only between EEZs and high seas, as established in Article 7 of the UNFSA, but also between the Convention Areas of different RFMOs.

In this respect, a critical challenge for the WCPFC and the IATTC will be to consider how to define limits adopted by the two organizations in a way that ensures they are compatible. This will be particularly important if the ranges of principal market tuna stocks increasingly straddle the two Convention Areas. At present, the WCPFC manages its key tropical tuna stocks through a combination of catch and effort limits, whereas the IATTC primarily relies on closures and capacity limits. If limits cannot be defined using the same metrics, they should at least be translatable between RFMOs to ensure that they are directed toward achieving a shared objective for the stock. An increasing priority towards Pacific basin evaluations of

CMMs may be necessary as connectivity within and between stocks becomes better understood.

If basin-scale CMM evaluations suggest that differences between the measures of the two RFMOs generate counter-productive outcomes, the two RFMOs will need to come to some form of agreement that enables the adoption of equivalent CMMs. This could include the adoption of harvest strategies for all shared stocks, or stocks that are likely to shift across RFMO boundaries over time. The WCPFC and the IATTC may therefore need to consider the role of harvest strategy development in providing a tool to assist in managing potential future shifts in tuna biomass. Although they are at different stages in the process, both RFMOs have already decided to develop harvest strategies for one or more of the stocks under their jurisdiction. Thus, there should be scope for aligning some aspects of these strategies—whether in relation to the management objectives or the actions to be taken in the face of specified situations—to help ensure that foreseeable levels of change can be managed as consistently, predictably and as transparently as possible within the scope of each RFMO’s management framework.

#### **4.6 Implications for participatory rights**

Allocation is a complex and often divisive task, and the level of difficulty will only be increased by the climate-driven redistribution of stocks. The failure to equitably allocate resources has been recognized as one of the greatest threats to the stability of fisheries management regimes (Lodge et al., 2007), and significant cooperation will be needed to ensure that fishing opportunities continue to be allocated equitably in light of climate-driven stock redistributions, not only between parties to one RFMO or the other, but across both RFMOs.

Options for transferability of rights between RFMOs will need to be developed and considered by each RFMO if the magnitude of climate-induced biomass redistribution results in significant losses and damages to SIDS and developing economies who have existing participatory rights. The development of options should give meaningful effect to principles of intra-generational and inter-generational equity. In addition to the ‘special requirements’ and ‘special circumstances’ provisions in Articles 24 and 25 of the UNFSA, the principle of common but differentiated responsibilities which is laid out in the 1992 *Rio Declaration on Environment and Development* (UN, 1992a) and embodied in the *United Nations Framework Convention on Climate Change* (UNFCCC) (UN, 1992b) will also be relevant. A key objective of cooperation between the RFMOs in this context should be to find a way to preserve the rights and interests of all States as they were prior to the climate-driven changes that are coming.

This idea is not without precedent. At the 2019 WCPFC Commission Meeting, Korea noted anecdotal evidence that tropical tunas were aggregating in the high seas more frequently compared to past years, and expressed concern that its industry would suffer if Korea was unable to access sufficient fishing opportunities in the high seas. In this context, Korea suggested that the WCPFC explore the possibility of allowing States to use ‘vessel days purchased under bilateral fishing arrangements in the high seas, while making sure that such

a system does not negatively affect the sovereign rights or aspirations of SIDS' (WCPFC, 2019c; Hanich et al, 2021).

For example, providing coastal States that are expected to lose biomass in their EEZ due to climate change with a permanent, transferable allocation would enable them to hold valuable rights that could be exercised wherever the fish are—even if they no longer occur in the EEZ of the coastal State in the same numbers. This would retain some level of equity for both current and future generations by providing a permanent income stream regardless of biomass redistribution. In this respect, some examples of transferable rights have already been developed in the WCPO, where they have been operating successfully between the PNA members (and the flag States who fish in their waters) for many years under the Vessel Day Scheme. A significant additional complexity in a climate change scenario will be to consider transferability not only among EEZs, or between EEZs and the high seas, but potentially between RFMOs.

How rights in such schemes are allocated between coastal and flag states will also need consideration, particularly given the jurisdictional differences between the RFMOs (one of which is dominated by EEZs and one by the high seas). Making allocations to coastal States based on past fishing in their EEZs would be consistent with international law (Davis et al., 2022) and would assist in mitigating the economic impacts of stock losses incurred by coastal States—and particularly by Pacific SIDS—as a result of climate change. Flag States would continue to have the opportunity to fish in coastal States' EEZs by negotiating access for their vessels, consistent with the established practice.

#### **4.7 Enhancing cooperation in compliance and enforcement**

A final challenge for cooperation will relate to compliance and enforcement. In this respect, both RFMOs have already established many of the key MCS tools needed to monitor and enforce compliance with their conservation and management measures. However, the IATTC compliance and enforcement regime is not as developed as that of WCPFC. For example, while the WCPFC has established its own high seas boarding and inspection regime (WCPFC, 2006b), which has now been in operation for more than 15 years, IATTC has not—although the high seas boarding and inspection procedure established in Articles 21 and 22 of the UNFSA does apply between UNFSA parties in any area covered by an RFMO, including the IATTC Convention Area. In addition, although members of IATTC are required to ensure that all commercial fishing vessels longer than 24 meters carry and operate a satellite-based VMS, this is not a centralized system which reports directly to the Commission in the same way as the WCPFC VMS. This means that, unlike WCPFC member States, coastal State members of IATTC cannot get access to centralized VMS data for IATTC-registered vessels operating in their EEZs (as provided for in Article 24(8) of the WCPFC Convention), nor can they receive real-time VMS data for these vessels in areas of high seas adjacent to their EEZs for the conduct of compliance and enforcement operations (as established in paragraph 22 of Rules and Procedures for Access to High Seas Non-Public Domain Data) (WCPFC, 2009c). However,

at its 2022 Commission meeting, IATTC did commit to improving its compliance review process (IATTC, 2022b).

With the strengths and weaknesses of the current arrangements in mind, there are some gaps where enhanced cooperation and collaboration may be required. The first, and most obvious, is in the overlap area. WCPFC and IATTC already have some basic measures in place for cooperation in compliance and enforcement in the overlap area—in particular, the MOC on Observers, which provides that approved observers from both observer programs who meet the necessary training requirements can be cross-endorsed to operate on vessels that fish on the high seas in both Convention Areas and the overlap area (WCPFC, 2011b).

However, given the overlapping jurisdiction in this area, a sensible next step might be to consider the extent to which the existing arrangements are fit for purpose—both currently, and in anticipation of future changes in the distribution of fish stocks due to climate change. In particular, further scientific modelling might be needed to understand whether the overlap area is expected to be more productive or less productive, and whether and how the existing compliance and enforcement arrangements might need to be enhanced.

Second, although each RFMO will continue to oversee compliance and enforcement with respect to fishing for highly migratory stocks in the high seas of its own Convention Area, there are also opportunities for greater cooperation—and this might be particularly important in the high seas of the EPO, where the biomass of tropical tuna is expected to increase significantly. To date, the majority of tuna in the Pacific Ocean basin have been caught in the EEZs of WCPFC coastal State members, where compliance and enforcement can be carried out by coastal States in an exercise of their sovereign rights. However, if Pacific tuna biomass shift progressively east and into the high seas of the EPO, where there are fewer oceanic islands to generate coastal State jurisdiction, this will become more difficult, because the primacy of flag State jurisdiction on the high seas will limit the jurisdiction of other States for compliance and enforcement activities. Further modelling of the likely climate-driven redistribution of each stock to these high seas areas will once again be important, this time in revealing the areas with the greatest potential for increased risk of illegal fishing, and concomitant need for closer cooperation.

For example, it might be necessary to cooperate to expand the operation and coverage of the WCPFC and IATTC VMS systems, so that vessels authorized to operate under the rules of either RFMO are required to transmit VMS data at all times when fishing in, transshipping catches in or transiting both Convention Areas. In this case, the MOC on Data might need to be amended to ensure that relevant data and information are available to both RFMOs. In relation to electronic monitoring, which is in its infancy in terms of implementation across both organisations, the cooperative model established in the MOC for Observers, which allows vessels operating in the high seas of either Convention Area to use authorized observers from either RFMO to meet their observer coverage obligations, could be considered as a starting point.

Finally, a review could be undertaken in cooperation with both RFMOs to see whether any best practice or innovative approaches developed and applied in one organization might be able to be adapted and applied in the other, in order to enhance the overall high seas compliance and enforcement capacity of both organizations. A candidate for evaluation is the agreement in the WCPFC that coastal States can access near real-time VMS data for the high seas in areas up to 100 nautical miles adjacent to their EEZs, for the purpose of conducting MCS activities (WCPFC, 2009c).

#### **4.8 Summary**

As biomass shifts and new scientific information emerges, the management frameworks for affected stocks will need to be flexible—particularly in relation to stocks that are shared between RFMOs. WCPFC and IATTC will need to identify appropriate and adaptive governance frameworks and management tools to address new challenges, and effectively manage new or emerging fisheries. Consideration will also need to be given to enhancing and expanding existing modes of cooperation—and to developing new forms of cooperation. Much of this will be breaking new ground for RFMOs and will require the development of new institutional and management arrangements.



## 5. Opportunities for enhancing cooperation between WCPFC and IATTC

At the heart of the challenge explored in this report are two key questions:

- the first relates to **governance**: what institutional mechanisms are needed to enable WCPFC and IATTC to cooperate effectively in the management of tuna stocks affected by climate-driven redistribution in a way that takes into account the needs and interests of all relevant States and entities?
- the second relates to **management**: how can WCPFC and IATTC set fishing limits and allocate fishing opportunities for tuna stocks affected by climate-driven redistribution in a way that ensures the sustainable management of the stock and takes into account the needs and interests of all relevant States and entities?

Potential options for addressing these questions can be identified, ranging from minimal change to much greater change, with a variety of potential costs and benefits. To aid in the consideration of these options, we start by outlining the range of options potentially available to revise existing arrangements and facilitate adaptation to continuing change, and then explore examples of the sort of approaches that have been taken in other regions, and highlight some of the limitations, challenges and incentives that may be relevant in evaluating and applying them in the Pacific context.

### 5.1 Options for revising existing institutional mechanisms

At the 'minimal' end of the scale, there are a wide range of ways in which WCPFC and IATTC can simply **enhance the existing arrangements for cooperation**. This might include (but is not limited to):

- re-instituting the annual meetings between the Executive Directors of both RFMOs;
- establishing procedures for a senior representative of one RFMO to routinely attend each meeting of the other RFMO (not just the Commission meeting and the Scientific Committee);
- adding a standing agenda item on cooperation to each meeting of both RFMOs, to formalise and facilitate meaningful information sharing and cooperative approaches to the issues under discussion;
- ensuring that representatives from one RFMO attending a meeting of the other RFMO have access to all relevant papers and are invited to speak on relevant measures and attend key discussions (such as Heads of Delegation discussions on management and allocation issues); and
- formalising consideration of 'the effects of climate change and cooperative responses to address them' as a standing requirement in the development, adoption or amendment of all conservation and management measures.

These options would enhance the existing arrangements for cooperation by providing more formalised opportunities for information-sharing between the RFMOs, highlighting the need

for consideration of climate-driven impacts on fisheries, and normalising cooperation on these issues as a routine consideration in the discussion and decision-making of each RFMO.

Further along the scale of cooperation, the two RFMOs could **create a new mechanism for cooperation**. There are a number of ways in which such a mechanism could be set up, and some existing examples from which inspiration might be drawn. For example, consideration could be given to re-enlivening the WCPFC-IATTC Consultative Meeting, which was held four times between 2007 and 2008 in the margins of the annual WCPFC and IATTC meetings. This Meeting was focused on reviewing three areas for collaboration: data and information, scientific research, and conservation. There were some useful outcomes from this Meeting, including the 2006 MOU, the MOU on Data, the exchange of information on IUU lists, and ongoing informal cooperation between the Secretariats on relevant issues. This Meeting primarily involved discussion between the Secretariats of the two RFMOs (although it was also attended by IATTC and WCPFC members participating in the main Commission meeting), and has not been convened since 2008. However, it could be re-instituted, the agenda revised to address contemporary areas in which cooperation is needed to address the effects of climate change, and the focus shifted to attendance of and discussion between IATTC and WCPFC members. There are a range of issues that WCPFC and IATTC members would need to work through in setting up such a mechanism, from administrative issues such as chairing, duration and administrative support to substantive questions of scope and objective, procedures for decision-making and the participation of observers.

Noting the importance of discussions between RFMO members themselves, a new mechanism for cooperation between WCPFC and IATTC could be modelled loosely on the Joint Tuna RFMOs Meeting, commonly known as the Kobe Process. The Kobe Process met three times between 2008 and 2011 to bring together the members of the five tuna RFMOs with the objective of improving coordination across the whole range of RFMO policy. In this context, participants discussed and adopted recommendations on a range of issues, including scientific research, ecosystem considerations, capacity, allocation, and support for developing countries, for consideration and implementation by each tuna RFMO. Many of these recommendations were subsequently considered and adopted by WCPFC and IATTC.

Drawing on these examples, arrangements for a new mechanism for cooperation between WCPFC and IATTC might include (but are not limited to):

- participation by the member States of each RFMO (rather than Secretariats);
- regular scheduling, possibly in conjunction with the Commission meeting of one or other RFMO (perhaps alternating each year);
- an objective of improving coordination between the two RFMOs in relation to issues on which substantive cooperation is required to address the impacts of climate change, reflected in a standing agenda;
- an option to establish working groups or thematic groups on topics for which additional discussion is needed; and

- a process for adopting recommendations to be considered, adopted and implemented by each RFMO individually (not directly binding on each RFMO).

A joint meeting of this sort would provide a basis for discussion and cooperation on more substantive issues and allow the two RFMOs to elaborate joint approaches and make recommendations on issues of shared interest—from scientific research agendas to draft conservation and management measures—but would still leave each RFMO to discuss, adopt and implement them pursuant to decisions of its own membership, under its own legal framework.

At the far end of the scale, the members of the two RFMOs could decide to **revise or amend existing institutional arrangements to enhance cooperation**. For example, one option would be to establish an over-arching Pacific-wide organization to sit above WCPFC and IATTC, underneath which WCPFC and IATTC could serve as regional sub-committees, responsible for making recommendations to the over-arching organization for adoption (along the lines of the Eastern and Western Sub-Regional Management Committees established in the South Pacific Regional Fisheries Management Organization (SPRFMO)). Another option would be to merge the two RFMOs together into one Pacific-wide organization with responsibility for highly migratory stocks across the whole ocean basin, in a similar way to the Inter-American Commission for the Conservation of Atlantic Tunas (ICCAT).

## 5.2 Options for revising existing arrangements for allocation

Regardless of what institutional arrangements are adopted, the two RFMOs will still need to consider how to define and allocate fishing rights. In this respect, the simplest option might be for **management of a particular stock or species (including the setting of catch limits) to be assigned to one RFMO only, on the proviso that a portion of the quota be set aside for the other RFMO**. This sort of approach is followed in the North Atlantic to address the redistribution of the oceanic redfish stock (discussed in Section 5.2 below), whereby the North East Atlantic Fisheries Commission (NEAFC) reserves a portion of the stock for NAFO, which is then able to allocate that amongst its members.

Applied in the context of climate-driven redistribution of a particular tuna stock from the WCPFC Convention Area to the IATTC Convention Area, this might entail WCPFC setting the limit for fishing of that stock (however defined), and then reserving a portion of the quota for that stock for the IATTC, which would then be able to allocate it amongst its own members. There are a number of ways in which this option could be implemented within the existing legal framework (provided agreement was reached between both RFMOs), and it could be adopted together with the various options for institutional cooperation noted in Section 5.1. If this approach were adopted, there would be no need to reach agreement on how the limits are defined, since the management and catch limit of each stock would be the responsibility of one RFMO alone—the only requirement would be for the other RFMO to allocate its reserved portion of the quota amongst its own members in compatible terms. However, it may be challenging to secure agreement on which RFMO is to manage the stock—let alone

the difficult question of how much should be set aside for the other RFMO, or how to reflect the inequities that are likely to be produced by climate-driven redistribution of tuna stocks. In this respect, as noted in Section 4.6 above, the allocation between RFMOs would need to take into account the characteristics of their respective membership and reaching agreement on management strategies that currently apply catch- or effort-based systems.

Another option would be for the two RFMOs to adapt their fisheries management regimes to **permit fishing rights to be transferred from the Convention Area of one RFMO to the other**, or to **permit pooling of fishing rights to allow them to be exercised in multiple jurisdictional zones**. The objective of such an arrangement would be to achieve an equitable outcome by maintaining allocations at a level that is more reflective of the 'pre-climate change' distribution of fish stocks. This approach would enable fishing rights to 'follow the fish', rather than limit their exercise to the jurisdiction in which they were originally allocated. This sort of approach has been a feature of Pacific tuna fisheries for some time, in the context of adaptations required to reflect the El Nino-La Nina southern oscillation.

For example, allocations of fishing opportunities (or participatory rights) could be made in each RFMO, to coastal State members with respect to their EEZs and the high seas, and to fishing State members for the high seas only. Once allocated, States could then transfer rights to another coastal State or fishing State member of either RFMO, to be exercised in the transferee coastal State's EEZ or on the high seas in the Convention Area of either RFMO. These sorts of transfers between coastal States already occur between the Parties to the Nauru Agreement (PNA), a subset of WCPFC Members, pursuant to the Palau Arrangement.

Alternatively, a form of pooling could be employed. This might entail a coastal State member of an RFMO (in particular, the WCPFC) being able to assign a portion of its allocation to a particular vessel, with conditions that permit that vessel to exercise the right not only in the coastal State's EEZ, but in other EEZs or in a portion of the high seas in the Convention Area of either RFMO. Once again, this sort of mechanism already operates between some coastal States in the WCPO, pursuant to the Federated States of Micronesia Arrangement, which allows a Party to assign rights that the Party has been allocated under an overall cap to vessels to fish in the EEZ of any Party to the Arrangement.

Once again, these options will require cooperation to be made in relation to a range of institutional prerequisites. These include:

- a process for jointly conducting scientific assessments and setting limits on fishing opportunities for shared stocks, for example, through a single harvest strategy for each stock;
- a sustainable Pacific-wide limit on fishing opportunities, or compatible limits in each RFMO Convention Area;
- allocation of a Pacific-wide cap to each RFMO, to be assigned by that RFMO to each coastal State and fishing State Member of the RFMO;
- consistent definitions of fishing opportunities to enable transfers to occur between jurisdictions on a like-for-like basis;

- strong monitoring, particularly in relation to the high seas, to ensure that vessels exercising rights are doing so in compliance with relevant RFMO measures and their authorisations;
- clear rules about where transferred or pooled rights may and may not be exercised;
- a single joint register of rights allocated to RFMO Members, including transfers;
- a public register of vessel authorisations, including where any authorisations (rights) are able to be exercised; and
- agreement between the two RFMOs on the arrangements to permit transfers or pooling.

Importantly, these options would be adaptive, in that they would not attempt to centrally predict where stocks are and assign rights accordingly. Instead, they would allow the actors—RFMO members and vessels flagged to those members—to make decisions about where to fish. Coastal States who transfer rights out of the EEZ would still receive a return on their allocation through the sale of fishing rights to vessels, compensating for the physical loss of stocks from their waters, and the anticipated revenues lost under various climate change scenarios (Bell et al, 2021).

### **5.3 Examples from other regions**

The effects of climate change on the distribution of fish stocks will not be limited to the WCPFC and the IATTC, or to the Pacific Ocean. Climate change is also predicted to lead to other distributional shifts in fish stocks, and in particular, a poleward distribution of fish species (Pecl et al., 2017)—and in some places, geographic shifts in species distribution have been underway for a long time. These changes are likely to alter the adequacy of the coverage and effectiveness of existing management regimes and require enhanced cooperation between States and between RFMOs. Although most RFMOs now have MOUs in place with neighbouring RFMOs, these MOUs predominantly relate to information sharing and awareness programmes, and the sharing of or cooperation in scientific research (Haas et al., 2021).

While none of these MOUs specifically address climate change or climate-driven redistribution of fish stocks (Haas et al., 2021), there are nonetheless some useful examples of cooperation between RFMOs (and even just between States) regarding the management of and access to shared stocks, from which some lessons could be drawn for the WCPFC and the IATTC. This section gives a brief overview of the following examples:

- the approach to cooperation between NEAFC and NAFO following a shift in the distribution of Oceanic redfish in the North Atlantic Ocean;
- the ongoing tensions between NEAFC members regarding the northward movement of Northeast Atlantic mackerel;
- the long-standing cooperation between Norway and Russia in relation to shared fish stocks in the Barents Sea;

- the adoption of a precautionary approach by the parties to the *Agreement to Prevent Unregulated High Seas Fisheries in the Central Arctic Ocean* (CAOF Agreement) in light of the potential that climate change will increase accessibility to the Central Arctic Ocean; and
- the idea that one RFMO may have a ‘regulatory priority’ and be best-placed to address stock shifts, focusing on the example of the Commission for the Conservation of Southern Bluefin Tuna (CCSBT) and the Indian Ocean Tuna Commission (IOTC).

The impact of climate change is highly apparent in the North Atlantic Ocean, where cooperation has been required to address shifts in the distribution of the commercially exploited Oceanic redfish (Caddell, 2021) from the waters of NEAFC into the neighbouring NAFO Convention. Although Oceanic redfish had been under the exclusive jurisdiction of NEAFC since 1982, by the late 1990s, warming waters had displaced a sizeable portion of the stock into the NAFO Convention Area (Caddell, 2021). Despite a lack of clarity about the longevity of this shift, the two RFMOs agreed on a system of joint management pursuant to which NEAFC would continue to set the TAC for redfish, of which a portion would be allocated to NAFO, which would then distribute it among its members (Caddell, 2021). As Caddell notes, this approach ensured that ‘the parties to two RFMOs with broadly similar memberships and conservation obligations were able to broker a pragmatic solution to a then-unprecedented issue, which has subsequently facilitated further collaboration on common operational matters’ (Caddell, 2022). Due to the overfished status of redfish in the Irminger Sea and adjacent waters, NEAFC adopted a ban on fishing for this stock from 2011 to 2019, which was also implemented by NAFO members (NEAFC, 2011; NAFO, 2011). NAFO and NEAFC do not have an MoU in place that formalises their relationship but conduct yearly informal negotiations (Koubrak & VanderZwaag, 2020). They have also established a joint advisory group to streamline data management and reporting procedures (Stokke, 2019).

Shifts in the distribution of North Atlantic species have also produced tension among the members of NEAFC, due to the northward movement of the Northeast Atlantic mackerel, which is one of the most profitable fish stocks in the region. Since NEAFC only has jurisdiction in waters beyond 200 nautical miles, coastal State agreement is first reached on EEZ quotas before NEAFC starts negotiations on management measures for the high seas (Osthagen et al., 2022), and for many years the Northeast Atlantic mackerel quota was allocated predominantly among the European Union (EU), Norway, and the Faroe Islands (Osthagen et al., 2022). Starting in 2006, however (in parallel with a rise in sea temperatures in the North Sea), the stock shifted northwards into Icelandic waters, and by 2009 Iceland’s catches increased from virtually nothing to 737,969 tonnes. Since agreement could not be reached between NEAFC members on the quota to be attributed on the basis of ‘zonal attachment’, and the other coastal States were unwilling to reduce their quota, Iceland set its quota unilaterally—and as the stock continued to shift westwards, Greenland also sought a quota (Osthagen et al., 2022). Due to the failure of the NEAFC member States to agree on a TAC, the stock is now overfished (ICES, 2022) and has lost its MSC certification (MSC, 2019). This

example demonstrates not only the pitfalls that can arise from a lack of clarity about the drivers and longevity of shifts in distribution, but the particular challenge of negotiating disagreements regarding the calculation of ‘zonal attachment’ (Osthagen et al., 2022). As Jorgensen observes, this cautionary example is a situation in which the task of negotiating a ‘climate-resilient’ allocation mechanism has thus far proven ‘beyond the abilities of the coastal States in the region’ (Jorgensen, 2022).

A more constructive example is the Norwegian-Russian fisheries management regime in the Barents Sea, where there has long been a link between ocean temperature and the spatial distribution of fish stocks. In warm periods, the stocks tend to grow and expand toward the north and east, whereas in colder periods they tend to decrease and shrink back to their core areas in the south and west (Matishov and Zhichkin 2013; Zhichkin 2014). As early as the 1970s, Norway and Russia established the Joint Norwegian-Soviet Fisheries Commission (JNSFC), which sets the TAC and other regulations for stocks shared between the two States in the Barents Sea. There is also a supplementary agreement, which grants each party the right to fish in the other’s waters. Even prior to the establishment of the JNSFC, agreement was reached on ‘allocation keys’, pursuant to which cod and haddock stocks are split 50:50 and capelin 60:40 (in favour of Norway). Although this regime has experienced a range of challenges and fluctuations in effectiveness, it is generally considered successful—and despite stock-shifts up to four times faster than the global average, the allocation keys have remained ‘an unalterable feature of the regime itself’ (Jorgensen, 2022).<sup>7</sup> While this example involves only two States and a regime that has been in place for 50 years, two of its features may be worth considering in the Pacific context: first, the stability produced by the agreement on allocation keys; and second, the flexibility that is produced by a multi-stock governance system, which provide more room for trade-offs and quota swapping (Jorgensen, 2022).

Another example is found even further north, where the coastal States of the Central Arctic Ocean (CAO),<sup>8</sup> along with other States with an interest in the region,<sup>9</sup> have sought to address the potential for future shifts in fish stocks and the management of associated commercial fisheries, should receding ice coverage make such activities feasible. This is reflected in the *2018 Agreement to Prevent Unregulated High Seas Fisheries in the Central Arctic Ocean* (CAOF Agreement), which recognises that climate change justifies precautionary consideration of the current and potential future fish stocks in the region, and seeks to ‘prevent unregulated fishing in the high seas portion of the central Arctic Ocean through the application of precautionary conservation and management measures’ (Article 2, CAOF Agreement). The CAOF applies in the waters of the Arctic beyond the fisheries jurisdiction of coastal States with

---

<sup>7</sup> However, this stability is not equally evident for other stocks (such as Saith, halibut and redfish), in relation to which Russia has sought to increase its quotas in light of eastward shifts (Jorgensen, 2022).

<sup>8</sup> Canada, Denmark, Norway, Russia and the United States.

<sup>9</sup> China, the EU, Iceland, Japan and South Korea.

respect to all fish other than sedentary species (Article 1, CAOF Agreement), and imposes a moratorium on all commercial fishing activities pending the adoption of applicable measures by an RFMO, although there are exceptions for exploratory and research fishing (Article 3, CAOF Agreement). Caddell suggests that the regulation of such fishing will likely mirror the experience of the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR) in regard to new and exploratory fisheries, but notes that the CAOF Agreement ‘represents a unique approach to managing changing ecosystems by elaborating pre-emptive controls and imposing a precautionary ethos *ab initio*’ (Caddell, 2021). While this example is very different to the situation in the Pacific, it does involve a number of the same fishing States and may be drawn on for inspiration regarding the practical application of a precautionary approach in a situation of climate-driven changes in stock distribution.

Finally, it has been suggested that the position of the IOTC in respect of the measures established by the CCSBT for southern bluefin tuna illustrates that there can be ‘acquiescence of a regulatory priority for the organization within which the bulk of a tuna stock occurred’ (NAFO, 2001). CCSBT provides the clearest example of this approach, because its constituent treaty provides for jurisdiction over the entire migratory range of a single species, rather than to multiple species within a specified geographic area, and other tuna RFMOs (including IOTC and WCPFC) have recognised its ‘prime responsibility’ over any stocks of that species located within their areas of operation (Caddell, 2022). For example, the MOU between WCPFC and CCSBT notes that CCSBT ‘is the appropriate body to develop and implement southern bluefin tuna conservation and management measures’ (WCPFC, 2009d). These arrangements have been more challenging to negotiate in relation to non-tuna RFMOs, in particular CCAMLR, which initially insisted on recognition of its own measures (particularly with respect to by-catch mitigation) (Caddell, 2022). CCAMLR has now agreed to a more collaborative approach, involving the exchange of data on fishing effort and practices for species of relevance to each organisation, and cooperation to ‘harmonise measures in areas of mutual interest and concern’ but has not ceded jurisdiction over southern bluefin tuna to CCSBT in the same way as WCPFC (CCAMLR, 2019). Nevertheless, the concept of a ‘regulatory priority’ or ‘prime responsibility’ for particular stocks may provide some inspiration for dealing with shifting stocks in the Pacific Ocean.

These examples from other regions highlight the importance of pro-actively dealing with climate change-driven redistribution. They demonstrate that having an MOU in place is an important step in cooperation (although cooperation can also take place in other ways), but that this will likely only be effective to the extent that it addresses climate-driven redistribution. They also suggest that RFMOs should take a precautionary approach to addressing climate change-induced changes, and they provide some blueprints for action that involve some key flag States which are also members of WCPFC and IATTC. But while they provide valuable inspiration for potential approaches to cooperative management, they also show what can happen if management fails—in particular, the cautionary tale of northeast Atlantic mackerel, which is now overfished, and for which overfishing is continuing.



#### 5.4 Incentives for cooperation

The members of WCPFC and IATTC have **legal obligations to cooperate** in the management of highly migratory species such as tuna. This duty to cooperate falls on individual States engaged in fishing for such stocks, regardless of their membership of RFMOs, so each member of WCPFC and IATTC has an independent duty to act even if the RFMOs fail to do so—and the UNFSA contains a range of principles and standards by which the fulfilment of the duty can be assessed. In addition, the constituent instruments of both WCPFC and IATTC recognise the necessity of cooperation in relation to shared stocks, and contain the principles and powers necessary for their members to take the decisions required to manage the climate-driven redistribution of tuna stocks.

In the specific context of the Pacific—where the climate driven-redistribution of tropical tuna stocks will disproportionately affect the small island developing States of the WCPO, including by significantly impacting their national economies—it is relevant to note that both UNCLOS and the UNFSA require their Parties to give consideration to the special requirements of developing States and to relevant environmental factors (which would include the impact of climate change). The UNFSA in particular contains specific instructions that the duty to cooperate in the establishment of conservation and management measures for highly migratory fish stocks must take into account ‘the vulnerability of developing States which are dependent on the exploitation of living marine resources’ and ‘the need to ensure that such measures do not result in transferring, directly or indirectly, a disproportionate burden of conservation action onto developing States’ (Article 24, UNFSA). In addition, the UNFSA specifically requires all States to cooperate, either directly or through RFMOs, ‘to assist developing States, in particular the least-developed among them and small island developing States to enable them to participate in high seas fisheries for such stocks’, including with respect to the allocation of participatory rights to new members in an RFMO (Article 25, UNFSA).

Beyond the law of the sea and international fisheries law, support can also be drawn from international obligations in other legal frameworks—including international climate law, the sustainable development framework and the draft BBNJ Agreement. These frameworks also invoke important principles of inter- and intra-generational equity which will be directly challenged by the impact that climate change is projected to have on the distribution of tuna stocks and thereby on the livelihoods, nutrition and food security of Pacific Small Island Developing States.

From both a **diplomatic and security perspective**, all members of WCPFC and IATTC should support effective cooperation to address climate-driven redistribution of Pacific Ocean tuna stocks. Without framing this issue through a ‘deficit narrative’, it is relevant to note that the projected redistribution of tropical tuna could have severe economic impacts for Pacific Small Island Developing States (Bell et al., 2021). This could have a negative effect on the regional security situation—not only in terms of food security and economic security, but political security—which would be contrary to the interests of most WCPFC and IATTC members.

Framing the issue through a positive lens, it is also clear that the Pacific Island States are extremely adept at advancing important law of the sea and climate-related issues through multilateral forums—from the Pacific-led UNGA resolutions banning high seas driftnet fishing and regulating fishing on vulnerable marine ecosystems, to their effective advocacy in the BBNJ negotiations, Vanuatu’s successful instigation of a UNGA request for an ICJ advisory opinion on climate change, and a similar request to ITLOS from the Commission of Small Island States. A wide range of diplomatic efforts could be contemplated in response to any failure of cooperation between WCPFC and IATTC.

A third category of arguments relates to issues of **economic imperative and social licence**, particularly in relation to market-based incentives and certification schemes. For example, a failure of cooperation between IATTC and WCPFC might lead to the loss of MSC certification for key fish stocks. This was the case in NEAFC, where the failure of cooperation between NEAFC members led to the loss of the MSC certification of mackerel. A similar situation in the Pacific might have severe economic consequences for all WCPFC and IATTC members, as retailers in the EU and USA are increasingly paying attention to what happens in tuna management, and commonly prioritize fish from MSC-certified fisheries. For example, the dire status of yellowfin tuna in the Indian Ocean prompted some retailers to boycott yellowfin tuna sourced from there. If WCPFC and IATTC are unable to agree on a management solution for shared stocks, retailers might boycott relevant fish, regardless of its status.

On a positive note, effective cooperation between WCPFC and IATTC would anticipate advocacy efforts by private-sector market partners, who are increasingly recognizing the need to support ‘jurisdictional’ or ‘seascape’ approaches to seafood (Murphy et al., 2021a). ‘Jurisdictional’ approaches integrate market-based and governance incentives at relevant ecological and political scales to drive fisheries sustainability and value creation across entire seafood production geographies, while ‘seascape’ approaches seek to integrate market-incentives and ecosystem-based management at relevant ecological and political scales to drive fisheries sustainability and value creation across entire seafood production geographies (Kittinger et al., 2021; Murphy et al., 2021b). The UK-based super-market chain, TESCO, for instance recently announced a ‘seascape sourcing approach’ for tuna, and has developed a roadmap to transition to sourcing tuna from fisheries with an ecosystem-based management approach by 2030 (Holland, 2021; Tesco, 2021). The member States of the PNA are already applying these principles in the WCPO to manage fishing effort through their Vessel Day Scheme under the Palau Arrangement and associated marketing initiatives (Aqorau, 2020). Enhanced cooperation in the Pacific Ocean Basin, including through application of jurisdictional approaches spanning WCPFC and IATTC Convention Areas where appropriate, could therefore competitively position Pacific tuna as managed under a climate-resilient ecosystem approach, and further strengthen market partner interest in preferentially sourcing sustainable tuna from the region.

A fourth reason to cooperate relates to the **continued uncertainty about the long-term effects of climate change**, and other potential causes of redistribution. While current

projections are that climate change will cause biomass of some of the key tropical tuna stocks to redistribute from the WCPO to the EPO, there is still a great deal of research to be done—and a range of other drivers, stocks and living marine resources to consider. In a situation of such uncertainty, rather than seeking to secure new advantages from shifting stocks or benefit from the climate-driven losses of other States or RFMOs, there is a strong argument to be made for both WCPFC and IATTC—and their member States—to take an active, constructive, precautionary and equitable approach to cooperation.

## 6. References and further reading

- Aires-da-Silva, A., Maunder, M. N., Xu, H., Minte-Vera, C., Valero, J. L., and Lennert-Cody, C. E. (2020). Risk analysis for management of the tropical tuna fishery in the Eastern Pacific Ocean. IATTC document SAC-11-08 REV. Available at: [https://www.iattc.org/GetAttachment/650968a3-f4c6-454a-8e8c-eef38fcb0dbb/SAC-11-08-REV-09-Jun-20\\_Risk-analysis-for-management.pdf](https://www.iattc.org/GetAttachment/650968a3-f4c6-454a-8e8c-eef38fcb0dbb/SAC-11-08-REV-09-Jun-20_Risk-analysis-for-management.pdf).
- Aqorau, T. (2020). Fishing for success: Lessons in Pacific regionalism (Canberra, Australia: Australian National University). Available at: <https://dpa.bellschool.anu.edu.au/experts-publications/publications/7644/fishing-success-lessons-Pacificregionalism>
- Aqorau, T., Bell, J. D., and Kittinger, J. N. (20186408). Good governance for migratory species. *Science* 361, 1208–1209. doi: 10.1126/science.aav2051
- Azmi, K., and Hanich, Q. (2021). Mapping interests in the tuna fisheries of the Western and Central Pacific Ocean. *Ocean Coast. Manage.* 212, 105779. doi: 10.1016/j.ocecoaman.2021.105779
- Bahri, T., Vasconcellos, M., Welch, D., Johnson, J., Perry, R. I., Ma, X., et al (Eds.) (2021). Adaptive management of fisheries in response to climate change. (Rome, Italy: Food and Agriculture Organization of the United Nations). Available at: <https://www.fao.org/3/cb3095en/CB3095EN.pdf>.
- Bell, J. D., Senina, I., Adams, T., Aumont, O., Calmettes, B., Clark, S., et al. (2021). Pathways to sustaining tuna-dependent Pacific Island economies during climate change. *Nat. Sustain.* 4, 900–910. doi: 10.1038/s41893-021-00745-z
- Butterworth, D. S. (2007). Why a management procedure approach? some positives and negatives. *ICES J. Mar. Sci.* 64 (4), 613–617. doi: 10.1093/icesjms/fsm003
- Caddell, R. (2021). Where's the Catch? Shifting Stocks, International Fisheries Management and the Climate Change Conundrum, in *The Achievements of International Law: Essays in Honour of Robin Churchill*, ed. J. Hartmann, and U. Khaliq (Oxford: Hart Publishing), 283-313.
- CAFO Agreement. (2018). Agreement to prevent unregulated high seas fisheries in the central arctic ocean. Available at: <https://www.mofa.go.jp/files/000449233.pdf>.
- CCAMLR. (2005). Report of the twenty-fourth meeting of the commission. Available at: [https://meetings.ccamlr.org/system/files/e-cc-xxiv\\_1.pdf](https://meetings.ccamlr.org/system/files/e-cc-xxiv_1.pdf).
- CCAMLR. (2019). Arrangement between The Commission for the Conservation of Southern Bluefin Tuna and The Commission for the Conservation of Antarctic Marine Living Resources. Available at: [https://www.ccamlr.org/en/system/files/CCSBT\\_2.pdf](https://www.ccamlr.org/en/system/files/CCSBT_2.pdf).
- Castillo Jordán, C., Hampton, J., Ducharme-Barth, N., Xu, H., Vidal, T., Williams, P., et al. (2021). Stock assessment of South Pacific albacore tuna. WCPFC-SC17-2021/ SA-WP-02. Available at: <https://meetings.wcpfc.int/node/12551>.
- Cavanagh, R. D., Broszeit, S., Pilling, G. M., Grant, S. M., Murphy, E. J., and Austen, M. C. (2016). Valuing biodiversity and ecosystem services: a useful way to manage and conserve marine resources? *Proc.R.SocB.* 283, 20161635. doi: 10.1098/rspb.2016.1635
- Clark, S., Bell, J., Adams, T., Allain, V., Aqorau, T., Hanich, Q., et al. (2021). “The Parties to the Nauru Agreement (PNA) ‘Vessel day scheme’: A cooperative fishery management mechanism assisting member countries to adapt to climate variability and change” In *Adaptive management of fisheries in response to climate change*. 667. Eds. T. Bahri, M. Vasconcellos, D. Welch, J. Johnson, R. I. Perry, X. Ma and R. Sharma (Rome, Italy: Food and Agriculture Organization of the United Nations), 209–224.

Davis, R. A., Hanich, Q., Haas, B., Cisneros-Montemayor, A. M., Azmi, K., Seto, K. L., et al. (2022). Who gets the catch? How conventional catch attribution frameworks undermine equity in transboundary fisheries. *Front. Mar. Sci.* 9. doi: 10.3389/fmars.2022.831868

de Moor, C. L., Butterworth, D. S., and Johnston, S. (2022). Learning from three decades of management strategy evaluation in South Africa. *ICES J. Mar. Sci.* 79 (6), 1843–1852. doi: 10.1093/icesjms/fsac114

Ducharme-Barth, N., Pilling, G., and Hampton, J. (2019). Stock assessment of SW Pacific striped marlin in the WCPO WCPFC-SC15-2019/SA-WP-07. Available at: <https://meetings.wcpfc.int/node/11232>.

Engler, C. (2020). Transboundary fisheries, climate change, and the ecosystem approach: Taking stock of the international law and policy seascape. *Ecol. Soc.* 25 (4), 1–13. doi: 10.5751/ES-11988-250443

FFA (2021). Value of WCPFC-CA tuna catches 2021. Pacific Islands Forum Fisheries Agency (Honiara, Solomon Islands: Forum Fisheries Agency). Available at: <https://www.ffa.int/node/425>.

Frommel, A., Margulies, D., Wexler, J.B., Stein, M.S., Scholey, V.P., Williamson, J. E., et al. (2016). Ocean acidification has lethal and sub-lethal effects on larval development of yellowfin tuna, *thunnus albacares*. *J. Exp. Mar. Biol. Ecol.* 482, 18–24. doi: 10.1016/j.jembe.2016.04.008

Haas, B., Haward, M., McGee, J., and Fleming, A. (2021). Explicit targets and cooperation: regional fisheries management organizations and the sustainable development goals. *Int. Environ. Agreem.: Politics Law Econ.* 21, 133-145. doi: 10.1007/s10784-020-09491-7

Hampton, J. (2017). What is going on with bigeye tuna? SPC fisheries newsletter. Available at: <https://coastfish.spc.int/en/component/content/article/479-spcfisheries-newsletter-153.html>.

Hampton, J., and Maunder, M. (2005). Comparison of Pacific-wide, Western and Central Pacific, and Eastern Pacific assessments of bigeye tuna WCPFC-SC1-2005/ SA-WP-2-Sup. Available at: <https://meetings.wcpfc.int/node/6444>.

Hanich, Q., Jung, M., McDonald, A., Oh, S., Moon, S., An, J., et al. (2021). Tuna fisheries conservation and management in the Pacific Islands region: Implications for Korean distant water fisheries. *Asia-Pacific J. Ocean Law Policy* 6 (2), 192–220. doi: 10.1163/24519391-06020003

Hare, S. R., Williams, P. G., Jordan, C. C., Hamer, P. A., Hampton, W. J., and Scott, R. D. (2021). The Western and Central Pacific tuna fishery: 2020 overview and status of stocks. WCPFC18-2021-IP02\_rev1 tuna fisheries assessment report no. 21, Pacific community. Available at: <https://meetings.wcpfc.int/node/14499>.

Holland, J. (2021). Tesco introduces new tuna-sourcing approach. *seafood source*, 2 march 2021. Available at: <https://www.seafoodsource.com/news/environmentsustainability/tesco-introduces-new-tuna-sourcing-approach>.

IATTC (2002) Resolution on the Capacity of the Tuna Fleet Operating in the Eastern Pacific Ocean (Revised). Document IATTC C-02-03 Available at: [https://www.iattc.org/GetAttachment/ce47a29a-9f62-4572-9a6c-7ff23832e481/C-02-03-Active\\_Capacity-of-the-tuna-fleet-operating-in-the-EPO.pdf](https://www.iattc.org/GetAttachment/ce47a29a-9f62-4572-9a6c-7ff23832e481/C-02-03-Active_Capacity-of-the-tuna-fleet-operating-in-the-EPO.pdf)

IATTC (2005). Cooperation with the Western and Central Pacific Fisheries Commission. Document IATTC-73-11. Available at: <https://www.iattc.org/GetAttachment/9bd20b84-ded8-4c52-ace0-566d7c5cc091/IATTC-73-11%20-%20Cooperation%20with%20WCPFC>

IATTC (2010). Convention for the Strengthening of the Inter-American Tropical Tuna Commission Established by the 1949 Convention between the United States of America and the Republic of Costa Rica. Available at: <https://www.iattc.org/getattachment/593fe044-9e3c-440b-8acf-e676d16b6618/Antigua%20Convention%20-%20text>.

IATTC (2012a). IATTC-WCPFC overlap area. Document IATTC-83-Inf-B. Available at: <https://www.iattc.org/GetAttachment/113a3fd0-1349-4e68-97f1fd0089799f4f/B.%20Overlap%20area>

IATTC (2012b). Recommendation C-12-11, IATTC-WCPFC overlap area. Available at: <https://www.iattc.org/GetAttachment/e38aeaa0-029e-4534-9c65-c2a5480f4efe/Recommendation%20on%20IATTC%20-%20WCPFC%20Overlap%20area>.

IATTC (2014). Resolution C-14-02, resolution (Amended) on the establishment of a vessel monitoring system (VMS). Available at: <https://www.iattc.org/GetAttachment/d7077963-3935-4a8a-b206-0c523f9dd57c/Vessel%20Monitoring%20System>.

IATTC 2018. IATTC Strategic Science Plan 2019-2023. Document IATTC-93-06a. Available at: [https://iattc.org/getattachment/54e1e93b-833b-4600-9f74-ae50be1abc46/IATTC-93-06a\\_Strategic-Science-Plan.pdf](https://iattc.org/getattachment/54e1e93b-833b-4600-9f74-ae50be1abc46/IATTC-93-06a_Strategic-Science-Plan.pdf).

IATTC (2018a). Resolution C-18-03, amendment to Resolution C-13-03 supplementing Resolution C-05-02 on North Pacific albacore. Available at: <https://www.iattc.org/GetAttachment/ff17a945-791e-4cb4-8456-d744cd416b62/North%20Pacific%20albacore>.

IATTC (2018b). Resolution C-18-06, resolution (Amended) on a regional vessel register. Available at: <https://www.iattc.org/GetAttachment/cae37180-6ca8-46459dc7-3b633c9a14c6/Regional%20Vessel%20Register>.

IATTC (2019a). Resolution C-19-08, resolution on scientific observers for longline vessels. Available at: <https://www.iattc.org/GetAttachment/614c5692-74c5-40a7a8b0-148ec0e52206/Observers%20on%20longliners>.

IATTC (2019b). Resolution C-19-02, amendment to Resolution C-15-01 on establishing a list of vessels presumed to have carried out illegal, unreported and unregulated fishing activities in the Eastern Pacific Ocean. Available at: [https://www.iattc.org/GetAttachment/7478a141-eeda-4594-b77c-a88326e693aa/C-19-02Active\\_Amendments-and-replaces-C-15-01-IUU-fishing.pdf](https://www.iattc.org/GetAttachment/7478a141-eeda-4594-b77c-a88326e693aa/C-19-02Active_Amendments-and-replaces-C-15-01-IUU-fishing.pdf)

IATTC (2020). Stock status indicators (SSIs) for tropical tunas in the Eastern Pacific Ocean. IATTC document SAC-11-05. Available at: [https://www.iattc.org/getattachment/ae96afee-a437-496b-976f-01e801b69f7a/SAC-11-05-MTG\\_Stockstatus-indicators-\(SSIs\)-for-tropical-tunas-in-the-EPO.pdf](https://www.iattc.org/getattachment/ae96afee-a437-496b-976f-01e801b69f7a/SAC-11-05-MTG_Stockstatus-indicators-(SSIs)-for-tropical-tunas-in-the-EPO.pdf).

IATTC (2021a). Resolution C-21-04, conservation measures for tropical tunas in the Eastern Pacific Ocean during 2022-2024. Available at: [https://iattc.org/GetAttachment/e3dc0a7e-e73c-4b8e-889e-a4cd2cdd7b8b/C-21-04-Active\\_Tunaconservation-in-the-EPO-2022-2024.pdf](https://iattc.org/GetAttachment/e3dc0a7e-e73c-4b8e-889e-a4cd2cdd7b8b/C-21-04-Active_Tunaconservation-in-the-EPO-2022-2024.pdf).

IATTC (2021b) Resolution C-21-05 measures for the conservation and management of Pacific Bluefin Tuna in the Eastern Pacific Ocean. Available at: <https://www.iattc.org/GetAttachment/b425762e-aba3-4727-ac13-5c9eadd175ac/Bluefin%20tuna>.

IATTC (2021c). Resolution C-21-07, resolution for an IATTC scheme for minimum standards for inspection in port. Available at: <https://www.iattc.org/GetAttachment/f68ac134-db13-4463-b4d6-fe7d902c987b/Port%20State%20measures>.

IATTC (2022a). Resolution C-22-03, Amendment to Resolution C-12-07 on establishing a program for transshipments by large-scale fishing vessels. Available at: [https://www.iattc.org/GetAttachment/241076b4-3ac9-4ead-91f91665a9e39ae9/C-22-03\\_Amendment-C-12-07-Transshipments.pdf](https://www.iattc.org/GetAttachment/241076b4-3ac9-4ead-91f91665a9e39ae9/C-22-03_Amendment-C-12-07-Transshipments.pdf).

IATTC (2022b). Resolution C-22-02 on the process for improved compliance of resolutions adopted by the commission. Available at: [https://iattc.org/GetAttachment/82979774-0873-498a-8416-67ca268e023a/C-22-02\\_Compliance.pdf](https://iattc.org/GetAttachment/82979774-0873-498a-8416-67ca268e023a/C-22-02_Compliance.pdf).

IATTC (2022c). Resolution C-22-04 on a harvest strategy for North Pacific albacore in the Eastern Pacific Ocean. Available at: [https://iattc.org/GetAttachment/9d1676e8-b2af-4f40-88c1-5c3f0f8594ea/C-22-04\\_North-Albacore-HarvestStrategy.pdf](https://iattc.org/GetAttachment/9d1676e8-b2af-4f40-88c1-5c3f0f8594ea/C-22-04_North-Albacore-HarvestStrategy.pdf).

- IATTC (2023). Instruments. Available at: <https://www.iattc.org/en-US/About/Instruments>
- ICCAT. (2015). Report for biennial period, 2014-15 Part II (2015) – Vol.1. Available at: [https://www.iccat.int/Documents/BienRep/REP\\_EN\\_14-15\\_II-2.pdf](https://www.iccat.int/Documents/BienRep/REP_EN_14-15_II-2.pdf).
- ICES. (2022). Mackerel (*Scomber scombrus*) in subareas 1-8 and 14 and division 9.a (the Northeast Atlantic and adjacent waters). In Report of the ICES Advisory Committee, 2022. ICES Advice 2022, mac.27.nea. <https://doi.org/10.17895/ices.advice.7789>
- ISC (2019). Stock assessment report for striped marlin (*Kajikia audax*) in the Western and Central North Pacific Ocean through 2017. WCPFC-SC15-2019/SAWP-09 WCPFC-SC15-2019/SA-WP-09. Available at: <https://meetings.wcpfc.int/node/11225>.
- ISC (2022). Stock assessment of Pacific bluefin tuna in the Pacific Ocean in 2022. ISC/22/ANNEX/13/. Available at: [https://isc.fra.go.jp/pdf/ISC22/ISC22\\_ANNEX13\\_Stock\\_Assessment\\_for\\_Pacific\\_Bluefin\\_Tuna.pdf](https://isc.fra.go.jp/pdf/ISC22/ISC22_ANNEX13_Stock_Assessment_for_Pacific_Bluefin_Tuna.pdf).
- ISSF (2022). Status of the world fisheries for tuna: July 2022. ISSF technical report 2022-13. Available at: <https://www.issf-foundation.org/issf-downloads/downloadinfo/issf-2022-13-status-of-the-world-fisheries-for-tuna-july-2022/>.
- Jorgensen, A. (2022). Stock-shifts and regime resilience in the Barents Sea. In O. Schram Stokke, A. Østhagen, and A. Raspotnik (eds)., *Marine Resources, Climate Change and International Management Regimes*. Bloomsbury. pp. 153-177.
- Kittinger, J. N., Bernard, M., Finkbeiner, E., Murphy, E., Obregon, P., Klinger,, et al. (2021). Applying a jurisdictional approach to support sustainable seafood. *Conserv. Sci. Pract.* 3, e386. doi: 10.1111/csp2.386
- Koubrak, O., and VanderZwaag, D. (2020). Are transboundary fisheries management arrangements in the Northwest Atlantic and North Pacific seaworthy in a changing ocean? *Ecol. Soc.* 25, 42. doi:10.5751/ES-11835-250442
- Lehodey, P., Hampton, J., Brill, R. W., Nicol, S., Senina, I., Calmettes, B., et al. (2011). “Vulnerability of oceanic fisheries in the tropical Pacific to climate change” in *Vulnerability of tropical Pacific fisheries and aquaculture to climate change*. Eds. J. Bell, J. E. Johnson and A. J. Hobday (Noumea, New Caledonia: Secretariat of the Pacific Community). 433–492.
- Lehodey, P., Senina, I., Calmettes, B., Hampton, J., and Nicol, S. (2013). Modelling the impact of climate change on Pacific skipjack tuna population and fisheries. *Clim. Change* 119, 95–109. doi: 10.1007/s10584-12-0595-1
- Lehodey, P., Senina, I., and Murtugudde, R. (2008). A spatial ecosystem and populations dynamics model (SEAPODYM) - modelling of tuna and tuna-like populations. *Prog. Oceanogr.* 78, 304–318. doi: 10.1016/j.pocean.2008.06.004
- Lehodey, P., Senina, I., Nicol, S., and Hampton, J. (2015). Modelling the impact of climate change on South Pacific albacore tuna. *Deep Sea Res. Part II*, 113, 246259. doi: 10.1016/j.dsr2.2014.10.028
- Lehodey, P., Senina, I., Titaud, O., Calmettes, B., Conchon, A., Dragon, A., et al. (2014). Project 62: SEAPODYM applications in WCPO. WCPFC-SC10-EB-WP-02. Available at: <https://meetings.wcpfc.int/node/8722>.
- Lodge, M. W., Anderson, D., Lorbach, T., Munro, G., Sainsbury, K., and Willock, A. (2007). Recommended best practices for regional fisheries management organizations. Available at: <https://repository.oceanbestpractices.org/bitstream/handle/11329/1456/39374297.pdf?sequence=1&isAllowed=y>.
- MacKenzie, B.R., Payne, M.R., Boje, J., Høyer, J.L., and Siegstad, H. (2014). A cascade of warming impacts bring bluefin tuna to Greenland waters. *Glob. Change Biol.* 20, 2484-2491. doi: 10.1111/gcb.12597
- Madigan, D. J., Boustany, A., and Collette, B. B. (2017). East not least for Pacific bluefin tuna. *Science* 357, 356–357. doi: 10.1126/science.aan3710

Maunder, M., Xu, H., Minte-Vera, C., Valero, J., Lennert-Cody, C., and Airesda-Silva, A. (2022). Skipjack tuna in the Eastern Pacific ocean: Interim assessment. IATTC document SAC-13-07. Available at: <https://www.iattc.org/GetAttachment/0acfc999-fbcd-4b07-9e8d-fc5f85fd88e8/SAC-13-07>.

McKechnie, S., Hampton, J., Abascal, F., Davies, N., and Harley, S. J. (2015). Sensitivity of the WCPO bigeye tuna stock assessment results to the inclusion of EPO dynamics within a pacific-wide model. WCPFC-SC11-2015/SA/-WP-03. Available at: <https://meetings.wcpfc.int/node/9175>.

McKinney, R., Gibbon, J., Wozniak, E., and Galland, G. (2020). Netting billions 2020: A global tuna valuation (The Pew Charitable Trusts). Available at: <https://www.pewtrusts.org/-/media/assets/2020/10/nettingbillions2020.pdf>.

Mendenhall, E., Hendrix, C., Nyman, E., Roberts, P. M., Hoopes, J. R., Watson, J. R., et al. (2020). Climate change increases the risk of fisheries conflict. *Mar. Policy* 117, 103954. doi: 10.1016/j.marpol.2020.103954

Merino, G., Arrizabalaga, H., Arregui, I., Santiago, J., Murua, H., Urtizberea, A., et al. (2019). Adaptation of north Atlantic albacore fishery to climate change: Yet another potential benefit of harvest control rules. *Front. Mar. Sci* 6, 620. doi: 10.3389/fmars.2019.00620

Moore, B. R., Bell, J. D., Evans, K., Farley, J., Grewe, P. M., Hampton, J., et al. (2020a). Defining the stock structures of key commercial tunas in the Pacific Ocean I: Current knowledge and main uncertainties. *Fish. Res.* 230, 105525. doi: 10.1016/j.fishres.2020.105525

Moore, B. R., Adams, T., Allain, V., Bell, J. D., Bigler, M., Bromhead, D., et al. (2020b). Defining the stock structures of key commercial tunas in the Pacific Ocean II: Sampling considerations and future directions. *Fish. Res.* 230, 105524. doi: 10.1016/j.fishres.2020.105524

MSC. (2019). MSC certificates suspended for all North East Atlantic mackerel fisheries. Available at: <https://www.msc.org/media-centre/press-releases/press-release/msc-certificates-suspended-for-all-north-east-atlantic-mackerel-fisheries>.

Murphy, E. L., Bernard, M., Gerber, L. R., and Dooley, K. J. (2021a). Evaluating the role of market-based instruments in protecting marine ecosystem services in wild-caught fisheries. *Ecosystem Serv.* 51, 101356. doi: 10.1016/j.ecoser.2021.101356

Murphy, S. E., Farmer, G., Katz, L., Troëng, S., Henderson, S., Erdmann, M. V., et al. (2021b). Fifteen years of lessons from the seascape approach: a framework for improving ocean management at scale. *Conserv. Sci. Pract.* 3, e423. doi: 10.1111/csp2.423

NAFO. (1999). Resolution to guide the expectations of future new members with regard to fishing opportunities in the NAFO regulatory area. NAFO/GC doc. 99/8. Available at: <https://archive.nafo.int/open/gc/1999/gcdoc99-08.pdf>.

NAFO. (2001). Report of the NAFO/NEAFC Working Group on Oceanic Redfish. NAFO/FC/Doc.01/3/. Available at: <https://www.nafo.int/Portals/0/PDFs/fc/2001/FC-01-003.pdf>.

NAFO. (2011). Northwest Atlantic Fisheries Organization conservation and enforcement measures. NAFO/FC Doc. 11/1. Available at: <https://www.nafo.int/Portals/0/PDFs/fc/2011/fcdoc11-01.pdf>.

NEAFC. (2011). Report of the 30th annual meeting of the North-East Atlantic Fisheries Commission. 7-11 November, Vol. I. Available at: <https://www.neafc.org/system/files/AM2011-final-report-09.pdf>.

Nicol, S., Lehodey, P., Senina, I., Bromhead, D., Frommel, A. Y., Hampton, J., et al. (2022). Ocean futures for the world's largest yellowfin tuna population under the combined effects of ocean warming and acidification. *Front. Mar. Sci.* 9. doi: 10.3389/fmars.2022.816772



- Østhagen, A., Spijkers, J., and Totland, O. A. (2020). Collapse of cooperation? the north-Atlantic mackerel dispute and lessons for international cooperation on transboundary fish stocks. *Maritime Stud.* 19, 155–165. doi: 10.1007/s40152-02000172-4
- Østhagen, A., Spijkers, J., and Totland, O.A. (2022). The North Atlantic Mackerel Dispute: Lessons for International Cooperation on Transboundary Fish Stocks. In O. Schram Stokke, A. Østhagen, and A. Raspotnik (eds.), *Marine Resources, Climate Change and International Management Regimes*. Bloomsbury. pp. 137-152
- Pecl, G., et al. (2017). Biodiversity redistribution under climate change: Impacts on ecosystems and human well-being. *Science*, 355, eaai9214. doi: 10.1126/science.aai9214
- Pentz, B., and Klenk, N. (2020). Understanding the limitations of current RFMO climate change adaptation strategies: the case of the IATTC and the Eastern Pacific Ocean. *Int. Environ. Agreements: Politics Law Economics* 20 (1), 21–39. doi: 10.1007/s10784-019-09452-9
- Pentz, B., Klenk, N., Ogle, S., and Fisher, J. A. D. (2018). Can regional fisheries management organizations (RFMOs) manage resources effectively during climate change? *Mar. Policy* 92 (2018), 13–20. doi: 10.1016/j.marpol.2018.01.011
- Pinsky, M. L., Reygondeau, G., Caddell, R., Palacios-Abrantes, J., Spijkers, J., and Cheung, W. W. L. (2018). Preparing ocean governance for species on the move. *Science* 360 (6394), 1189–1191. doi: 10.1126/science.aat2360
- PFRP (1999). “MHLC4 sets convention area, calls for scientific report,” in Pelagic Fisheries Research Program, vol. 4 (2) April-June 1999. <http://www.soest.hawaii.edu/pfrp/newsletters/Apr-June1999.pdf>
- Punt, A. E., Butterworth, D. S., de Moor, C. L., De Oliviera, J. A. A., and Haddon, M. (2016). Management strategy evaluation: best practices. *Fish and Fisheries* 17 (2), 303–334. doi: 10.1111/faf.12104
- Rademeyer, R. A., Pleganyi, C. C., and Butterworth, D. S. (2007). Tips and tricks in designing management procedures. *ICES J. Mar. Sci.* 64 (4), 618–625. doi: 10.1093/icesjms/fsm050
- Rayfuse, R. (2019). “Addressing climate change impacts in regional fisheries management organizations,” in *Strengthening international fisheries law in an era of changing oceans*. Eds. R. Caddell and J. E. Molenaar (Oxford, United Kingdom: Hart Publishing), 247–268. doi: 10.5040/9781509923373.ch-011
- Schatz, V.J., Proelss, A., and Liu, N. (2019). The 2018 Agreement to Prevent Unregulated High Seas Fisheries in the Central Arctic Ocean: A Critical Analysis. *Int. J. Mar. Coast.* 34, 195-244. doi:10.1163/15718085-23342015
- Schram Stokke, O. (2019). Management Options for High Seas Fisheries: Making Regime Complexes More Effective. In R. Caddell, and E.J. Molenaar (eds.), *Strengthening International Fisheries Law in an Era of Changing Oceans*. Oxford: Hart. pp. 51-78.
- Scott, F., Scott, R., Yao, N., Pilling, G. M., and Hamer, P. (2022). Mixed-fishery harvest strategy update. WCPFC-SC18-2022/MI-WP-06. Available at: <https://meetings.wcpfc.int/node/16288>.
- Senina, I., Lehodey, P., Hampton, J., and Sibert, J. (2020a). Quantitative modeling of the spatial dynamics of South Pacific and Atlantic albacore tuna populations. *Deep Sea Res. Part II* 175, 104667. doi: 10.1016/j.dsr2.2019.104667
- Senina, I., Lehodey, P., Sibert, J., and Hampton, J. (2020b). Integrating tagging and fisheries data into a spatial population dynamics model to improve its predictive skills. *Can. J. Aquat. Fish. Sci.* 77, 576–593. doi: 10.1139/cjfas-2018-0470
- Senina, I., Sibert, J., and Lehodey, P. (2008). Parameter estimation for basin-scale ecosystem-linked population models of large pelagic predators: Application to skipjack tuna. *Prog. Oceanogr.* 78, 319–335. doi: 10.1016/j.pocean.2008.06.003

Seto, K., Miller, N., Young, M., and Hanich, Q. (2021). Resource allocation in transboundary tuna fisheries: A global analysis. *Ambio*. 50, 242–259. doi: 10.1007/s13280-020-01371-3

Spijkers, J., Singh, G. G., Wabnitz, C. C. C., Österblom, H., Cumming, G. S., and Morrison, T. H. (2021). Identifying predictors of international fisheries conflict. *Fish Fisheries* 22, 834–850. doi: 10.1111/faf.12554

Tesco (2021). Tesco takes action to improve marine sustainability, moving to a seascape approach for tuna sourcing. Available at: <https://www.tescopl.com/news/2021/tesco-takes-action-to-improve-marine-sustainability-moving-to-a-seascapeapproach-for-tuna-sourcing/>.

Tremblay-Boyer, L., Carvalho, F., Neubauer, P., and Pilling, G. (2019). Stock assessment for oceanic whitetip shark in the Western and Central Pacific Ocean. WCPFC-SC15-2019/SA-WP06. Available at: <https://meetings.wcpfc.int/node/11231>.

UN (1982). United Nations Convention on the Law of the Sea. Available at: [https://www.un.org/Depts/los/convention\\_agreements/texts/unclos/unclos\\_e.pdf](https://www.un.org/Depts/los/convention_agreements/texts/unclos/unclos_e.pdf).

UN (1992a). United Nations Framework Convention on Climate Change. Available at: [https://unfccc.int/sites/default/files/convention\\_text\\_with\\_annexes\\_english\\_for\\_posting.pdf](https://unfccc.int/sites/default/files/convention_text_with_annexes_english_for_posting.pdf).

UN (1992b). Rio Declaration on Environment and Development. Available at: [https://www.un.org/en/development/desa/population/migration/generalassembly/docs/globalcompact/A\\_CONF.151\\_26\\_Vol.I\\_Declaration.pdf](https://www.un.org/en/development/desa/population/migration/generalassembly/docs/globalcompact/A_CONF.151_26_Vol.I_Declaration.pdf).

UN (1995). Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks. Available at: <https://documents-dds-ny.un.org/doc/UNDOC/GEN/N95/274/67/PDF/N9527467.pdf?OpenElement>.

UN (2015a). Paris Agreement. Available at: [https://unfccc.int/sites/default/files/english\\_paris\\_agreement.pdf](https://unfccc.int/sites/default/files/english_paris_agreement.pdf).

UN (2015b). Transforming our world: the 2030 Agenda for Sustainable Development. UN Doc A/RES/70/1 (adopted 25 September 2015). Available at: <https://documents-dds-ny.un.org/doc/UNDOC/GEN/N15/291/89/PDF/N1529189.pdf?OpenElement>.

UN (2023). Draft Agreement under the United Nations Convention on the Law of the Sea on the Conservation and Sustainable Use of Marine Biological Diversity of Areas Beyond National Jurisdiction of 4 March 2023. Available at: [https://www.un.org/bbnj/sites/www.un.org.bbnj/files/draft\\_agreement\\_advanced\\_unedited\\_for\\_posting\\_v1.pdf](https://www.un.org/bbnj/sites/www.un.org.bbnj/files/draft_agreement_advanced_unedited_for_posting_v1.pdf).

WCPFC (1999). Report of the multilateral high-level conference on the conservation and management of highly migratory fish stocks in the Western and Central Pacific, fourth session (Honolulu, Hawaii).

WCPFC (2000). Report of the multilateral high-level conference on the conservation and management of highly migratory fish stocks in the Western and Central Pacific, seventh session (Honolulu, Hawaii). Available at: <http://coastfish.spc.int/Asides/Conventions/MHLC/MHLC7rep.pdf>.

WCPFC (2002). Implementation of article 22, paragraph 4, of the convention: Cooperation with the Inter-American Tropical Tuna Commission (IATTC) to avoid duplication of measures. WCPFC/PrepCon/WP.12. Available at: <https://www.wcpfc.int/doc/wcpfcprepconwp12/cooperation-iattc>.

WCPFC (2004). Convention on the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean. Available at: <https://www.wcpfc.int/doc/convention-conservation-and-management-highlymigratory-fish-stocks-western-and-central-pacific>.

WCPFC (2006a). Memorandum of understanding between the Commission for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean and the Inter-American Tropical Tuna Commission. Available at: <https://www.wcpfc.int/doc/wcpfc-iattc-memorandum-understanding>.

WCPFC (2006b). CMM 2006-08, Western and Central Pacific Fisheries Commission boarding and inspection procedures. Available at: <https://www.wcpfc.int/doc/cmm-2006-08/western-and-central-pacific-fisheries-commissionboarding-and-inspection-procedures>.

WCPFC (2009a). Memorandum of cooperation on the exchange and release of data between the Commission for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean and the Inter-American Tropical Tuna Commission. Available at: <https://www.wcpfc.int/doc/wcpfc-iattc-memorandum-cooperation-exchange-and-release-data>.

WCPFC (2009b). CMM 2009-03, conservation and management for swordfish. Available at: <https://www.wcpfc.int/doc/cmm-2009-03/conservation-andmanagement-swordfish>.

WCPFC (2009c). Rules and procedures for the protection, access to, and dissemination of high seas non-public domain data and information compiled by the commission for the purpose of monitoring, control or surveillance (MCS) activities and the access to and dissemination of high seas VMS data for scientific purposes. Available at: <https://www.wcpfc.int/doc/commission-09/rules-andprocedures-protection-access-and-dissemination-high-seas-non-public>.

WCPFC (2009d). Memorandum of Understanding Between the Commission for the Conservation of Southern Bluefin Tuna and the Western And Central Pacific Fisheries Commission. Available at: <https://www.wcpfc.int/doc/wcpfc-ccsbt-memorandum-understanding>.

WCPFC (2011a). WCPFC-IATTC Overlap Area. WCPFC8-2011/41 Rev 1. Available at: <https://meetings.wcpfc.int/node/7581>.

WCPFC (2011b). Memorandum of cooperation (MOC) on the cross-endorsement of WCPFC and IATTC observers when observing on the high seas of the convention areas of between the Commission for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean. Available at: <https://www.wcpfc.int/doc/memorandum-cooperation-cross-endorsement-iattcand-wcpfc>.

WCPFC (2013). WCPFC9 summary Report. 9th regular session of the Commission, Manila, Philippines, 2–6 December 2012. Available at: <https://meetings.wcpfc.int/node/7867>.

WCPFC (2014a). CMM 2014-06, conservation and management measure on establishing a harvest strategy for key fisheries and stocks in the Western and Central Pacific Ocean. Available at: <https://www.wcpfc.int/doc/cmm-2014-06/conservation-and-management-measures-develop-and-implement-harveststrategy-approach>.

WCPFC (2014b). CMM 2014-02, conservation and management measure for commission VMS. Available at: <https://www.wcpfc.int/doc/cmm-2014-02/conservation-and-management-measure-commission-vms>.

WCPFC (2017a). Discussion paper on membership process in WCPFC. WCPFC14-2017-DP18. Available at: <https://meetings.wcpfc.int/node/10480>.

WCPFC (2017b). CMM 2017-02, conservation and management measure on minimum standards for port state measures. Available at: <https://www.wcpfc.int/doc/cmm-2017-02/conservation-and-management-measure-minimumstandards-port-state-measures>.

WCPFC (2018a). CMM 2018-06, conservation and management measure for WCPFC record of fishing vessels and authorisation to fish. Available at: <https://www.wcpfc.int/doc/cmm-2018-06/conservation-and-management-measure-wcpfc-record-fishing-vessels-and-authorisation>.

WCPFC (2018b). CMM 2018-05, conservation and management measure for the regional observer programme. Available at: <https://www.wcpfc.int/doc/cmm-201805/conservation-and-management-measure-regional-observer-programme>.

WCPFC (2019a). CMM 2019-03 on North Pacific albacore. Available at: <https://www.wcpfc.int/doc/cmm-2019-03/conservation-and-management-measure-north-Pacific-albacore>.

WCPFC (2019b). Resolution 2019-01, resolution on climate change as it relates to the Western and Central Pacific Fisheries Commission. Available at: <https://www.wcpfc.int/doc/resolution-2019-01/resolution-climate-change-it-relates-western-and-central-Pacific-fisheries>.

WCPFC (2019c). WCPFC16 summary report. 16th regular session of the Commission, Port Moresby, Papua New Guinea, 5–11 December 2019. Available at: <https://meetings.wcpfc.int/node/11593>.

WCPFC (2019d). CMM 2019-07, conservation and management measure to establish a list of vessels presumed to have carried out illegal, unreported and unregulated fishing activities in the WCPO. Available at: <https://www.wcpfc.int/doc/cmm-2019-07>.

WCPFC (2021a). CMM 2021-02, conservation and management measure for Pacific bluefin tuna. Available at: <https://www.wcpfc.int/doc/cmm-2021-02/conservation-and-management-measure-Pacific-bluefin-tuna>.

WCPFC (2021b). CMM 2021-01, conservation and management measure for bigeye, yellowfin and skipjack tuna in the Western and Central Pacific Ocean. Available at: <https://www.wcpfc.int/doc/cmm-2021-01/conservation-and-management-measure-bigeye-yellowfin-and-skipjack-tuna-western-and>.

WCPFC (2022a). WCPFC19 summary report 19<sup>th</sup> regular session of the Commission, Da Nang, Vietnam, 28 November–3 December 2022. Available at: <https://meetings.wcpfc.int/node/18547>.

WCPFC (2022b). Updates on management procedure evaluations for South Pacific Albacore Since SMD01. WCPFC19-2022-16. Available at: <https://meetings.wcpfc.int/node/18132>.

WCPFC Scientific Committee (2019). Southwest Pacific striped marlin (*Kajikia audax*) stock status and management advice. Available at: <https://www.wcpfc.int/doc/09/southwest-Pacific-striped-marlin>.

Williams, P., and Ruaia, T. (2021). Overview of tuna fisheries in the Western and Central Pacific Ocean, including economic conditions – 2020. WCPFC-SC17-2021/ GN-IP-01. Available at: <https://meetings.wcpfc.int/node/12527>.