SUSTAINING TOMORROW'S CENTRAL ARCTIC OCEAN TODAY



Using Best Practices to Guide the Central Arctic Ocean Fisheries Agreement's Implementation

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EXECUTIVE SUMMARY

The central Arctic Ocean (CAO) is becoming accessible for the first time in human history. As climate change diminishes the CAO's traditional meters-thick sea ice cover, the potential for a commercial fishery is growing. In precautionary response to the ecological disaster that overfishing would cause to the CAO's ecosystem, 10 parties (Canada, Denmark in respect of Greenland and the Faroe Islands, Norway, Russia, the United States, China, Iceland, Japan, South Korea, and the European Union) signed the Central Arctic Ocean Fisheries Agreement (CAOFA) in October 2018, with the agreement entering into force in June 2021. This report examines best practices and lessons learned from regional fisheries management organizations (RFMOs), other relevant organizations and agreements, and subject matter experts to inform good fisheries governance within the CAO as well as good governance within the greater Arctic environment.

Novel for its application of the precautionary approach and inclusion of non-Arctic states and entities (the EU) in an Arctic treaty for the first time, the CAOFA temporarily bans all commercial fishing in the high seas portion of the CAO while its parties cooperate on gaining an increased understanding of the CAO's ecosystem and fisheries potential through research and exploratory fishing. With an initial duration of 16 years from entry into force and possible five year extensions beyond, the CAOFA facilitates the determination of whether or not a commercial fishery should commence in the high seas portion of the CAO and if negotiations to replace the CAOFA with one or more fully-fledged RFMOs or similar agreements should commence. With the Arctic's patchwork of disparate governance regimes being put under increasing political and economic stress, the need for successfully implementing the CAOFA is paramount. Not only will it directly influence the ecological health of the CAO, the CAOFA's implementation can inform future efforts to strengthen Arctic governance.

For a successful implementation – guided by this report's pillars of (1) the promotion of independent science informing management with minimum political influence, and (2) the development of ecologically sustainable practices and long-term cooperation – parties to the CAOFA should incorporate a variety of measures. Tools such as management procedures and reference points should be developed by CAOFA scientists to promote scientifically-driven, sustainable CAO fisheries management whether they be for the CAOFA's exploratory fishing or any eventual high seas CAO RFMO. Strategies including a pre-approved vessel list, quota reduction sanctions, and 100% vessel monitoring systems (VMS) and observer coverage should be developed to promote effective monitoring and compliance. The CAOFA's exploratory fishing regime should be designed to maximize information collection while preventing de facto commercial fishing. Various actions and approaches not limited to appointing non-party nationals to leadership positions, structurally incorporating the independent review of decisions, and appropriately incorporating indigenous and local knowledge should be pursued. These examples are some among many.

With Arctic governance becoming increasingly challenging while ecosystems continue to degrade worldwide, learning from the past is crucial. The best practices contained within this report, while largely applying directly to high seas fisheries management, offer insights into best practices to govern the Arctic at large. If used successfully to implement the CAOFA, these best practices can set the path to a more ecologically sustainable and cooperative Arctic for years and decades to come.

1. INTRODUCTION

The central Arctic Ocean (CAO) is a place that so often conjures notions of remoteness, isolation, and untouched wilderness. A place like the high seas portion of the CAO – the most remote and inaccessible portion of the Arctic Ocean – only compounds those sentiments. Yet, as climate change and other anthropogenic impacts increasingly disrupt the natural world, the high seas portion of the CAO is not spared from risks. The innovative Agreement to Prevent Unregulated High Seas Fisheries in the Central Arctic Ocean (known as the Central Arctic Ocean Fisheries Agreement and abbreviated here as CAOFA) has entered into force in hopes to proactively address those risks.

Once covered year-round in meters-thick ice, increasingly rapid loss of Arctic sea ice is opening up the high seas portion of the CAO for the first time in human history. As an area of high seas beyond national jurisdiction, no state may claim sovereignty over the high seas portion of the CAO and all states have the right to fish there. Meanwhile, not only is climate change making the CAO more accessible, it is also shifting marine species of commercial value northwards into the CAO for the first time. Recognizing the ecological disaster that could result from unregulated fishing in the previously unexploited and unexplored high seas portion of the CAO, the CAO's five coastal states were joined by five non-Arctic states and entities in negotiating the CAOFA. Signed in 2018 and entered into force in 2021, the CAOFA temporarily bans all commercial fishing while mandating states collaborate on understanding the CAO ecosystem and its future potential as a commercial fishery. Notably, the CAOFA is the first Arctic treaty directly including non-Arctic states and entities, all five of which were involved due to their interests in and/or capacity for fishing in the CAO. With the CAOFA's implementation still in its infancy, the chance to shape good fisheries governance as an example of good Arctic governance has arrived.

Rarely does the opportunity arise to build governance regimes from scratch in a vast wilderness that has never been exploited nor wholly explored. Even rarer does that opportunity arise in a place with a unique governance patchwork of agreements, organizations, and management like the Arctic. As such, efforts must be maximized in learning from examples of best practices and missteps.

This report will present best practices and lessons learned to inform good governance in the CAO. These examples will be collected and synthesized from regional fisheries management organizations (RFMOs), other international agreements and fora, relevant Arctic and near-Arctic intergovernmental organizations, and subject matter experts via literature. Insights will be conceptually structured around two main pillars: (1) the promotion of independent science informing management with minimum political influence, and (2) the development of ecologically sustainable practices and long-term cooperation. This report will begin by presenting the context in which the CAOFA is being implemented and briefly discussing the precautionary approach before detailing the collected best practices, missteps, and lessons learned and highlighting recommendations.

2. CONTEXT

The CAOFA is a novel multilateral resource management agreement. With the Arctic a rapidly changing place, the fisheries governance architecture of the previously unexploited high seas portion of the CAO is being negotiated by the parties to the CAOFA. Due to the previously inaccessible nature of the high seas portion of the CAO, the CAOFA offers the unique opportunity to build, essentially from scratch, a best practice fisheries governance and management regime. This section overviews the CAO's characteristics, the CAOFA's development and key provisions, and the state of Arctic governance in which the CAOFA is being implemented.

2.A. The Central Arctic Ocean

The central Arctic Ocean generally refers to the loosely bounded region of Arctic Ocean centered around the north pole, although several specific definitions exist. The ecologically defined CAO and the high seas region which the CAOFA addresses overlap, yet differ. One of the Arctic's 17 Large Marine Ecosystems (LMEs), the CAO LME's 3.3 million km2 primarily consist of two deep, abyssal basins separated by the Lomonosov Ridge (PAME, 2016). The CAOFA's agreement area, meanwhile, includes only the 2.8 million km2 of high seas surrounding the geographic north pole as defined by the outer limits of the exclusive economic zones (EEZs) and other 200 nautical mile coastal state maritime zones of Russia, the United States, Canada, Greenland, and Norway. Roughly the size of the Mediterranean, this region of high seas overlaps with a majority of the CAO LME as well as portions of the Beaufort Sea, Northern Bering-Chukchi Sea, and East Siberian Sea LMEs. While largely characterized by the CAO LME's deep, abyssal basins, 3% of the CAO's high seas are over continental shelf. For the purpose of this report, "CAO" will refer to the general central Arctic Ocean region and ecosystem as a whole while "CAO high seas" or "the high seas portion of the CAO" will refer to the CAOFA's agreement area (see Figure 1).

Historically characterized by year-round, meters-thick sea ice cover, the CAO has remained inaccessible for nearly all of human history. As such, knowledge regarding the CAO's ecosystem and fish stock availability is limited. Twelve of the Arctic Ocean's ~250 fish species have been observed in the high seas portion of the CAO, although fish observation records in the region have been sporadic and isolated (FiSCAO, 2018; Snoeijs-Leijonmalm et al., 2020). No systematic, quantitative survey of fish has occurred within this area. Beyond fish, various seabird species and marine mammals inhabit the CAO, with ringed seals and polar bears the most widespread and abundant of the latter (PAME, 2016).

The CAO, like the Arctic as a whole, is rapidly changing. Climate change effects – primarily global warming and ocean acidification – are amplified in the Arctic and alter the CAO's environment. As temperatures warm, ice is lost, exposing sections of ocean for the first time in millennia. Within the next few decades, ice-free summers will start to appear in the CAO. Even today, the CAO's ice cover is becoming thinner and more dynamic as its marginal edge shrinks northwards in summer and grows southwards in winter. With the changes in sea ice conditions come changes in the CAO's cold-adapted ecosystem. Fish from southern Arctic and subarctic regions may expand into the CAO while sea ice-dependent species such as polar bears see their usable habitat reduced.¹

As yearly sea ice cover decreases, access to the CAO's fishable areas grows. Twenty percent of the CAO high seas consist of shallow water under 2000m in depth; the rest consists of deep basins. In the absence of sea ice, pelagic fishing would be possible throughout the entirety of the CAO high seas and bottom trawling possible in the larger shallow areas, including the CAO's various ridges. Commercially-valuable fish resources have yet to be found and presently available data are insufficient to determine the fish biomass levels and trends required for effectively managing a sustainable CAO commercial high seas fishery. While fisheries experts have concluded that commercial fisheries are unlikely within the high seas portion of the CAO in the near term, there remains the possibility for a future influx in new fish species.

2.B. The Central Arctic Ocean Fisheries Agreement

The Central Arctic Ocean Fisheries Agreement (known formally as the Agreement to Prevent Unregulated High Seas Fisheries in the Central Arctic Ocean) represents a significant shift in the landscape of Arctic fisheries governance and precautionary resource management. Driven by the loss of Arctic sea ice, northwards expansion of fish species, an increase in global demand for seafood, and the general decline of the world's fish stocks, the CAOFA innovatively seeks to solve a resource overexploitation problem before it has even occurred (Molenaar, 2020). A novel agreement in many ways, it also serves as the first Arctic-specific treaty to include both Arctic and non-Arctic states and entities (Balton, 2021b). This subsection will briefly recap the CAOFA's development and describe its key provisions.

Arctic and near-Arctic high seas fishing has a mixed history. While the CAO has only recently become accessible, other areas of high seas have experienced varying degrees of cooperative and sustainable fisheries management (Harrison et al., 2020). Most influential to the CAOFA's eventual development was the intense overfishing of pollock in the Bering Sea's "Donut Hole" region of high seas in the late 1980s and early 1990s by distant water fishing states (DWFS).

The drastic collapse of this fishery over only a few vears – which led to the eventual establishment of a regional fisheries management agreement only after stocks had crashed - offered forewarning for the consequences of failed high seas fishery management in the far north. With past successes and failures as a backdrop, momentum for what would become the CAOFA was first initiated by the United States in the 2000s which, recognizing the increasing accessibility of Arctic waters, began the process of negotiating an agreement with other states to manage migratory and transboundary fish stocks in the Arctic (Molenaar, 2020). This was bolstered by a 2012 open letter signed by two thousand scientists from several countries urging governments to apply the precautionary approach to preemptively prevent an ecological disaster in the CAO by developing regulations for fishing in the region (Vylegzhanin et al., 2020). During this time, the five CAO coastal states (Canada, Denmark in respect of Greenland and the Faroe Islands, Norway, Russia, and the United States) began discussions which ultimately led to the 2015 adoption of the Oslo Declaration. A preliminary, non-legally binding agreement that recog-

CAOFA Signatories

- Canada
- Denmark
- (Greenland, Faroe Islands
- Norwa
- Russia
- United States
- China
- Iceland
- Japan
- South Korea
- European Union

nized the interest non-Arctic states might have in Arctic fisheries, the Oslo Declaration envisaged negotiations between the five coastal states and five DWFS with interest in and/or capacity for CAO fishing (China, Iceland, Japan, South Korea, and the European Union). With these negotiations culminating in the CAOFA's signing in October 2018 and entry into force in June 2021, the CAOFA's implementation is now under way.

The objective of the CAOFA is to "prevent unregulated fishing in the high seas portion of the central Arctic Ocean through the application of precautionary conservation and management measures as part of a long-term strategy to safeguard healthy marine ecosystems and to ensure the conservation and sustainable use of fish stocks" (Article 2). To achieve this, the agreement includes a variety of provisions, including:

Selected provisions of the CAOFA.

- Bans all commercial fishing for 16 years from entry into force, with automatic five year extensions unless one or more parties object (Article 13).
- Instructs parties to establish a Joint Program for Scientific Research and Monitoring (JPSRM) within two years of entry into force (Article 4(2)).
- Requires parties to authorize exploratory fishing activities only pursuant to certain guidelines and regulations to be determined (Articles 2 and 5(d)).
- Establishes consensus decision making among members for all questions of substance (with a question deemed to be of substance if any party considers it as such) (Article 6).
- > Requires the incorporation of indigenous and local knowledge within the JPSRM (Articles 4 and 5).
- Obligates parties to develop a data sharing protocol within two years of entry into force and to share relevant data with each other (Article 4(5)).
- > Determines that the United Nations Fish Stock Agreement's (UNFSA) dispute settlement provisions apply to any disputes arising between CAOFA parties, regardless of whether or not that party is also a party to the UNFSA (Article 7).
- Stipulates that the CAOFA shall not undermine or conflict with existing international fisheries management mechanisms (Article 14(4)).

Finally, as mentioned in subsection 2.A., the CAOFA's agreement area is defined as the high seas portion of the Arctic Ocean roughly centered around the north pole. Notably, the portion of that area near Svalbard and Greenland overlaps with a section of the North-East Atlantic Fisheries Commission's (NEAFC) convention area (see Figure 1). Given the CAOFA's assurance that it will "neither undermine nor conflict with the role and mandate of any existing international mechanism relating to fishery management," it can be assumed that the area of overlap will remain under NEAFC's jurisdiction (while also remaining under the mandate of the CAOFA), something which NEAFC itself has emphasized (CAOFA, 2018; NEAFC, n.d.).

2.C. Broader Arctic Governance

While the first treaty dedicated to the CAO, the CAOFA is only one in a long list of international agreements applicable to the Arctic (Vylegzhanin et al., 2020). The United Nations Convention of the Law of the Sea (UNCLOS), among many other provisions, established the legal framework that defines the high seas to which the CAOFA applies. Likewise, UNFSA strengthens the UNCLOS provisions relating to cooperation on straddling and highly migratory fish stocks. The International Convention for the Prevention of Pollution from Ships (MARPOL) and other International Maritime Organization (IMO) instruments govern various shipping activities, the Convention on Biological Diversity (CBD) guides species' use and conservation throughout the Arctic, and the Arctic Council's three legally binding agreements - the 2011 Agreement on Cooperation on Aeronautical and Maritime Search and Rescue in the Arctic, the 2013 Agreement on Cooperation on Marine Oil Pollution Preparedness and Response in the Arctic, and the 2017 Agreement on Enhancing International Arctic Scientific Cooperation – all further regulate aspects of Arctic activities. These examples are only some among multitudes.

To contextualize the political landscape into which the CAOFA is emerging, a brief discussion of the broader state of Arctic relations is beneficial. Since 1996, the Arctic Council has operated at the nexus of Arctic intergovernmental cooperation. A high-level intergovernmental forum rather than an intergovernmental organization with the power to adopt legally binding decisions, the Arctic Council's membership comprises of the eight Arctic states (Canada, Denmark, Finland, Iceland, Norway, Russia, Sweden, and the United States), six permanent participants representing Arctic indigenous peoples, and various observer states (like China and the United Kingdom), IGOs, and NGOs. Of these many parties, only the eight Arctic states have decision-making rights. Notably, the CAOFA's negotiation, adoption, and present implementation have all taken place outside the scope of the Arctic Council or any other intergovernmental body. As a legally binding instrument combining Arctic states and non-Arctic parties with interests in the high north, the success of the CAOFA's implementation can be seen as an experiment from which much can be learned regarding alternative measures and approaches of Arctic governance. Furthermore, at the time of writing, geopolitical tensions have left pan-Arctic cooperation tenuous. Russia is presently excluded from the Arctic Council's limited resumption of activities (following a months-long pause of all operations) and banned or excluded from relevant organizations like the International Council for the Exploration of the Sea (ICES). The uncertainty around the Arctic's political future elevates the importance of a successful CAOFA implementation. Presently, all CAOFA parties remain engaged in discussions, making it a unique forum in the Arctic's current state.

Lastly, mention must be made of the ongoing negotiations towards a legally binding agreement regarding the conservation and sustainable use of biodiversity in marine areas beyond national jurisdiction (known as the BBNJ agreement). This envisioned agreement and the CAOFA relate considerably, with the BBNJ agreement's negotiations addressing:

...the conservation and sustainable use of marine biological diversity of areas beyond national jurisdiction, in particular, together and as a whole, marine genetic resources, including questions on the sharing of benefits, measures such as area-based management tools, including marine protected areas, environmental impact assessments and capacity-building and the transfer of marine technology (UN General Assembly, 2017).

Most applicable of those topics are the "measures such as area-based management tools, including marine protected areas," of which the CAOFA can be argued as one (Balton, 2019). While the BBNJ agreement is still under negotiation and the extent to which it will address fisheries management remains unknown, there is a high likelihood both agreements' implementations will overlap in time and interplay between them will be required (Balton, 2019). Despite the likely congruence between the two agreements' purposes, important questions regarding both the consequences if all CAOFA parties do not accede to the BBNJ agreement as well as the control BBNJ parties that are not CAOFA parties will have over the decision CAOFA parties might make regarding a future CAO RFMO will remain unanswered for some time (Balton, 2019).



FIGURE 1: CAOFA agreement area (High Seas of the Central Arctic Ocean) and NEAFC's convention area showing their overlap in stripes. Based on Arctic Portal map.

3. THE PRECAUTIONARY APPROACH

At the core of modern fisheries management (and, ideally, environmental policy itself) lies the precautionary approach. In these contexts, the precautionary approach – sometimes also referred to as the precautionary principle – addresses uncertainty regarding knowledge of the environment and potential impacts upon it. The precautionary approach demands that, when faced with such uncertainties, caution should be taken, and that higher uncertainty requires more caution. The precautionary approach also dictates that uncertainty around an action or activity's impact is not a reason to forgo efforts to mitigate risk or to assume that no substantial harm will be caused. With its objective being to "prevent unregulated fishing in the [CAO] through the application of precautionary conservation and management measures...," the CAOFA holds the precautionary approach at its heart (CAOFA, 2018).

The last few decades have seen the precautionary approach evolve considerably in both the context of fisheries and beyond. First debuting within international policy in the 1970s, the precautionary approach became more widely adopted in the 1990s, including as parts of the CBD and the Rio Declaration on Environment and Development (both 1992). Of massive consequence to international fisheries, in 1995, UNFSA² required the application of the precautionary approach in accordance with Article 6 and Annex II. Among other stipulations, UNFSA directs states to be "more cautious when information is uncertain, unreliable or inadequate" and that "the absence of adequate scientific evidence shall not be used as a reason for postponing or failing to take conservation and management measures" in Article 6.2. That same year, the Food and Agriculture Organization of the United Nations (FAO) published both its Code of Conduct for Responsible Fisheries and its Precautionary Approach to Fisheries guidelines. The former urges the widespread usage of the precautionary approach while the latter provides detailed technical guidance for its implementation. In the over two decades since, the precautionary approach has become a nearly universal facet within RFMOs and viewed as essential to science-based fisheries management (Ogawa & Reyes, 2021).



The CAOFA represents a uniquely robust operationalization of the precautionary approach. By banning commercial fishing until sufficient knowledge is acquired to facilitate sustainable management, the CAOFA has, in effect, reversed the freedom of high seas fishing in favor of precaution. While revolutionary in terms of international fisheries, this concept can more broadly also offer precedent to the Arctic's wider governance architecture. As sea ice diminishes, Arctic activities, including resource extraction and shipping, will increase. These activities carry with them inherent environmental risks, the level of which may be highly unknown. In the face of this uncertainty and rapid change, precaution of the CAOFA's magnitude could be incorporated within future Arctic regimes to better safeguard the Arctic environment.

An examination of the CAOFA's implementation behooves careful consideration of the precautionary approach due in particular to the CAO's lack of previous exploitation, serious exploration, or holistic governance regime. Building the CAOFA's governance architecture in this unprecedented region means conceptual principles, not just state-based priorities, can guide design and past RFMO missteps can be avoided. As will be explored throughout this report, actions focused on short-term benefits and inter-party politics can undermine fisheries management and, ultimately, the sustainability of fish resources and ecosystems at large. Therefore, a clear understanding of the precautionary approach is crucial to promoting good governance of the CAO.

Ensuring that any diversion from the principles and best practices of the precautionary approach that might result from inter-party politics is kept to a minimum can benefit both the Arctic environment and the parties to the CAOFA. Selected fisheries-relevant best precautionary practices are as follows, with a comprehensive collection of best practices found in Appendix B (Cooney, 2004; de Bruyn et al., 2012):

- > The burden of proof regarding the safety and/or sustainability of an activity should be placed not on those defending a resource but instead on those seeking to use it. For fisheries, this means that any harvesting activities should be allowed if and only if they are first proven to be safe and sustainable by those wishing to fish.
- > Adaptive management that iteratively evaluates implementation should be a fundamental practice.
- > An ecosystem approach to management should be utilized. This is explored further in item 4.H.iii.
- > Information sharing, monitoring, and transparency measures should be robust. These are explored further in section 4.
- > Catch limits, multiple reference points, and predetermined management actions based on stock and ecosystem status should be established. These are explored further in section 4.
- Strong compliance measures including the usage of IUU vessel lists, pre-approved vessel lists, and sanctions should be utilized. These are explored further in section 4.

4. RFMO GOVERNANCE & LESSONS LEARNED

High seas and transboundary fisheries cover much of the world's oceans. Facilitating a majority of these fisheries' governance are RFMOs. Organized through multilateral treaties and bound by international law, RFMOs are composed of multiple states collectively engaged in the management and conservation of fisheries (Haas et al., 2019). While varying greatly in structure and implementation, all RFMOs serve as both a forum for cooperative fisheries management and a means to assess, regulate, and enforce sustainable harvesting of fish stocks in which multiple states are interested. While the CAOFA is not an RFMO, as a multilateral fisheries agreement it has many inherent parallels. Management decisions will need to be made, fish stock and ecosystem data will need to inform actions, and decision making will need to be effective. Moreover, the CAOFA is the first legally binding part of a stepwise process that may lead to a future CAO RFMO. As such, examining RFMO best practices can best inform both the present and the future. Experts have identified a variety of best practices that RFMOs should incorporate. For RFMOs already in existence, however, these practices are difficult to implement. As will be discussed, many factors – such as fully allocated stocks (which limit new entrants when existing members are reluctant to give up portions of their own allocations) and reliance on historic catch for determining states' allocations – undermine the longterm sustainability of fisheries.

Leaning heavily on the analyses of experts collected from the literature, this section examines various best practices that an ideal RFMO would utilize along with reasons why those practices generally fail to be implemented. Many of these best practices are not in use, nor have ever been used, by any RFMO. Instead, they have been identified by experts as practices that an ideal RFMO should implement in place of existing RFMOs' methods. While some best practices apply solely to RFMOs in operation, others offer lessons to the CAOFA's interim regime or to Arctic governance at large. Each best practice's applicability will be highlighted. Those applying solely to RFMOs in operation should be thought of as ideal destinations towards which CAOFA parties can build in the years leading up to a potential CAO RFMO. Based on the ongoing development of the CAOFA's JPSRM and exploratory fishing regime, these two topics are each later offered their own sections in which a bulk of their best practices are collected. Best practices applying to Arctic governance at large are both discussed when first mentioned as well as summarized in section 9.

Before proceeding, a brief overview of RFMO structure is necessary. In general, RFMOs are run by a decision-making body (consisting of representatives from all member parties³) which is advised by a scientific committee (SC)⁴. The SC gathers data to determine the sustainable catch levels of the RFMO's managed stocks. While each RFMO differs, that knowledge then determines each stock's total allowable catch (TAC)⁵ which is then divided among all participating parties.⁶ Once determined, a party's allocation may be applied to any vessels flying that party's flag in whatever way the party chooses (Davis et al., 2022). Most RFMOs determine and negotiate their TACs and allocations annually, and decisions within RFMOs are generally made by consensus.

Finally, clarification of what this report determines as an "ideal RFMO" must be made. Building on the previously identified precautionary approach best practices and synthesizing the literature, this report considers an ideal RFMO to be one that, among other aspects, promotes long-term fish stock and ecosystem sustainability, allows science to inform management without political interference, maintains optimal compliance, limits IUU fishing⁷, and effectively and efficiently fosters cooperation between parties. While not exhaustive, these characteristics will be broadly considered when collecting RFMO best practices and building recommendations for the CAOFA.

4.A. Allocation

The allocation of fishing rights is arguably an RFMO's most important task since, to most parties, the amount of fish it is permitted to catch (its allocated quota) represents the tangible output of joining an RMFO. Although there are other reasons for accession, parties generally join RMFOs to ensure the resources of the shared fisheries in which they fish (or want to fish) remain stable to maintain fish resources in perpetuity. In the absence of such collective management, fish stocks become overexploited and fisheries collapse. Since each party's goal is to harvest as much fish as they can for as long as possible, the guarantee of a certain amount of fish to harvest in perpetuity is the benefit a party gets for cooperating and avoiding the tragedy of the commons (the depletion of an open access resource, like



high seas fish, due to uncoordinated and noncooperative extraction). In other words, regular allocations of a sustainable fishery are a party's reward for cooperating. As such, parties' perceived inequities in allocations tend to be the main reasons for non-compliance with RFMO procedures and regulations (Lodge et al., 2007; Cox, 2009). This means that the basic requirement of allocation is to ensure no state is worse off acting cooperatively than independently.

Due to their interconnectedness, this subsection will discuss all aspects of RFMO allocation, from TAC setting to quota apportionment.

4.A.i. Setting the TAC

Before quotas can be allocated to member parties, a fishery's TAC must first be set. While treated differently by individual RFMOs, setting TACs is arguably the aspect of an RFMO's management in which science is most directly involved. To successfully manage a stable fishery, an RFMO needs to know how much fish is available and how much can be harvested sustainably in perpetuity. Hypothetically, in a perfect world where knowledge is absolute (and rule compliance guaranteed), RFMOs would know the fishery's true maximum sustainable yield (MSY) and simply set that as its TAC. In reality, all scientific measurements carry uncertainties (particularly within fisheries science), and compliance can be unreliable. To account for these, TACs are generally set below the scientifically determined MSY. While this "buffer" must ultimately be set by the managers (i.e., the RFMO's member parties and/or RFMO staff reporting to them), this would represent the only influence managers should have on TAC setting within an ideal RFMO. To achieve best practice, RFMOs must keep TAC setting and quota allocation entirely separate.

TAC setting is where this report's identified ideal RFMO component of allowing science to inform management without political interference most explicitly applies. A fishery can only remain stable if harvesting does not exceed its MSY, and it is an RFMO's SC that determines the level of sustainable harvest. An ideal RFMO would simply adopt the SC's recommended TAC and then apportion that TAC among its member parties. In practice, this is rarely the case (Pew, 2012).

Traditionally, scientific inputs for deciding the TAC are often unlinked and open to negotiation, opening the door to political influence over these convention-mandated, science-based management decisions (Holmes & Miller, 2022). Furthermore, RFMO member parties often consider other factors beyond their SCs' recommendations when setting TAC. These factors can include individual parties desiring a larger allocation, accommodating new members into the RFMO, and various political disagreements (Lodge et al., 2007). For example, individual parties may often negotiate for larger TACs knowing that it will ultimately increase the size of their own allocations. Whenever non-scientific factors cause an RFMO's TAC to be set higher than its SC's recommendations, risk of fishery overexploitation and potential stock collapse is increased, undermining the essence of the RFMO.

In the face of these challenges, experts have identified management procedures (MPs)⁸ – systematic allocation schemes that, among other actions, automatically set TACs based on transparent, scientific inputs - as best practice in RFMO allocation (Butterworth, 2007; Seto et al., 2021; Holmes & Miller, 2022). Utilizing a predetermined framework for decision making, MPs consider multiple elements such as management objectives, indicators of stock status, monitoring programs, and assessment methods to objectively determine TACs. When designing an MP, discussions between RFMO member parties should be focused not on the size or breakdown of the fishery's ultimate allocation but instead on weighting principles (Seto et al., 2021). Only then can the parties' collective intentions (which, as previously discussed, ultimately center around the sustainability of the fishery and being better off working collaboratively than independently) be reflected in the MP's structure. At the core of MP design are formulas that, once agreed upon and developed, take standardized data inputs and automatically calculate TACs. By accounting for uncertainty and adjusting TAC accordingly, MPs directly align with the precautionary approach. While inherently requiring member parties to negotiate and agree upon their structure, once in place, MPs remove political influence from TAC setting and allow science to lead the way (Lodge et al., 2007). MPs should be tested prior to selection through management strategy evaluation (MSE), a process that simulates fishery harvest strategies to determine how well they achieve the RFMO's objective (Pew, 2016a). Once implemented, an MP's adaptive management should be facilitated in the form of periodic evaluations of fishery data to ensure the MP is achieving the desired outcomes. MPs avoid common pitfalls with TAC setting that can undermine sustainable fishery goals, including: limiting variabilities in stock assessments due to a lack of standardization; properly considering longer-term trade-offs (traditional approaches generally deal only with the here and now); minimizing lengthy haggling and politics; and removing the usual default of not changing TACs from one year to the next in the face of too much uncertainty or not enough time (Butterworth, 2007).

While MPs have not yet been widely adopted, the Commission for the Conservation of Southern Bluefin Tuna (CCSBT) offers an example of how they can be successfully used. The 2000s saw CCSBT facing an overfished stock status and criticism for not heeding scientific advice, particularly for not reducing TACs despite strong evidence of stock decline and a failing rebuilding initiative (de Bruyn et al., 2012; Holmes & Miller, 2022). In the face of these developments, the CCSBT began using MSE to test candidate MPs which led to the adoption of the "Bali Procedure" in 2011, an MP that systematically and scientifically set TAC every three years. A marked success, the "Bali Procedure" increased CCSBT spawning stock by over 100% between 2009 and 2020 while still regularly increasing catch limits (CCSBT, n.d.; CCSBT, 2021; Holmes & Miller, 2022). Even more, following best precautionary practice by implementing adaptive management, the CCSBT developed a new MP in 2019 called the "Cape Town Procedure" that incorporates new data and an updated rebuilding objective (CCSBT, n.d.). Following the CCSBT's success, the International Commission for the Conservation of Atlantic Tunas (ICCAT) adopted a harvest control rule in 2017 that saw similar success to that of the CCSBT. As of writing, there are now at least 20 active MPs expected for RFMO stocks in the coming years (ICCAT, 2017; Holmes & Miller, 2022).

While MPs represent expert-identified RFMO TAC setting best practice, other strategies that ensure independent science-based management exist that may complement MPs in practice. The separation of the technical evaluation and advisory roles of the CCSBT's SC is one such method. The CCSBT's Stock Assessment Group (a subcommittee) oversees the technical work of stock assessments while the SC acts as the commission's advisory body, making recommendations on conservation, management, and optimum stock use strategies (Cox, 2009). The CCSBT also exemplifies a further technique for promoting independent science-based management by assigning leadership and advisory roles to individuals from nations outside of the CCSBT member parties. Both the Stock Assessment Group and SC are chaired by non-CCSBT member party nationals, and an Advisory Panel to the Scientific Process of CCSBT (composed similarly of non-CCSBT member party nationals) advises stock assessment and scientific processes.

Ultimately, these discussions around TAC setting best practices focus on the primary goal of maintaining science's objective influence over management decisions. An RFMO implementing best practices would incorporate as many methods as possible to ensure the long-term, precautionary involvement of science independent of political influence. Of those, MPs are the most robust option, automatically setting TACs based solely on scientific inputs. When coupled with structural arrangements such as dedicated stock assessment/TAC setting bodies and the incorporation of non-member party nationals, MPs can effectively promote sustainable fish stock management.

While thus far discussed only in the context of operational RFMOs, these concepts are immediately relevant to both the CAOFA and the larger Arctic governance sphere. Firstly, should an RFMO ultimately be established in the CAO, it is crucial that knowledge of the CAO ecosystem be as robust as possible (as will be further discussed in item 4.H.i. and section 6 of this report). Secondly, the coming years of CAOFA research and exploratory fishing should incorporate aspects of the aforementioned TAC-related best practices. Separating science and decision making should be done at every opportunity, with separate science and decision making bodies paramount. Furthermore, planning for a potential MP should begin, including the early identification of key scientific inputs to be standardized, over the next decade(s) (while avoiding any premature preparations for commercial fishing that such planning might stimulate). Finally, given the role science plays in understanding and managing activities in the changing Arctic environment, finding ways within governance regimes to allow science to structurally influence management is crucial. Separate and independent science bodies as well as strategies designed around scientific inputs (like MPs) can be adapted far beyond fisheries in the Arctic and beyond.

4.A.ii. Quota Allocation

As just discussed, setting TAC and quota allocation as entirely separate endeavors is RFMO best practice. Once the amount of fish available for harvest is determined, however, determining the size of each party's share is still challenging. Here, politics and negotiations cause RFMO gridlock with each member party trying to attain the largest possible allocation. Beyond that, differences between coastal states and DWFS, considerations for developing states, and historical fishing effort all further muddy the waters, as do fully allocated stocks' inherent problems with flexibility. Traditionally, RFMO quota allocations have most often been applied based on historical catch records. While these offer a readily quantifiable metric, this method is inherently flawed. Historical catch as a criterion forces both new and existing members to block decision making until their

capacity to participate matches their aspirations. It can also lead to interested states avoiding allocation discussions or waiting to join an RFMO until their fishing activity matches their ultimate desired share. Worst of all, without a robust TAC setting method, allocation negotiations can regularly lead to stock overexploitation.

Outside of historic catch, RFMOs use a variety of criteria to determine allocations, some of which align with this report's definition of an ideal RFMO and/or are of notable significance to the CAO. While by no means an exhaustive list, these criteria include:

- The Inter-American Tropical Tuna Commission (IATTC) and ICCAT's considerations of each party's contribution to and compliance with their conservation, research, and knowledge sharing measures;
- 2) various RFMOs' considerations of parties' compliance;⁹
- ICCAT's consideration of a party's compliance with conservation measures and responsibilities around data submissions and research;
- CCSBT's consideration of the rights of coastal states (which may ultimately apply heavily to the CAO¹⁰); and
- 5) the Western and Central Pacific Fisheries Commission (WCPFC), ICCAT, and others' considerations of the needs of coastal communities which are dependent mainly on fishing (which could be applied to Arctic indigenous people and local communities). Many of these align with best practice and should be considered as criteria if/when a CAO RFMO is developed.

The rest of this item will move from discussing existing practices to identifying those that, while not currently implemented, have been identified as best practices by the literature. The most basic of these is expressing parties' fishing rights not as a specific tonnage or effort level¹¹ but instead as a percentage of TAC (Lodge et al., 2007; Cox 2009). Utilizing specific tonnage or effort level metrics builds inflexibility into allocation formulas as parties seek to maintain their quota sizes. They also tend to negatively impact conservation and management measures similarly to the aforementioned issues with TAC setting. In general, few if any RFMOs explicitly use proportional allocation rights. As such, for RFMO quota allocation best practices, percentage allocations are a necessary place from which to start.

A key best practice identified by a variety of experts is the use of independent review and/or dispute resolution regarding allocation decisions (Lodge et al., 2007; Cox, 2009). Although independent review of RFMO allocation decisions is rare, some RFMOs like WCPFC, ICCAT, and the Northwest Atlantic Fisheries Organization (NAFO) have implemented similar internal measures. Like other RFMOs, ICCAT has a review panel that decides on allocations for specific stocks. Across these RFMOs, however, panels are composed of member party representatives and, therefore, are extensions of the RFMOs' general decision-making bodies (Cox, 2009). Regarding independent dispute resolution pertaining to allocations, NAFO has a mechanism where member parties objecting to such measures must provide an explanation before their objection is referred to an independent ad hoc panel which ultimately makes a recommendation to NAFO as a whole (Cox, 2009). The South Pacific Regional Fisheries Management Organisation (SPRFMO), as well, has a robust review system which is discussed further in subsection 4.C below. Finally, WCPFC has recognized the important role independent experts can play in the allocation process and has commissioned external advice when addressing allocation issues in the past (Lodge et al., 2007). Despite these examples, there are few independent RFMO allocation reviews, and such strategies should be implemented by RFMOs targeting best practices.

While not identified specifically as a best practice, experts have suggested the trading of allocations between RFMO member parties as an effective strategy for smoothing out the allocation process (Lodge et al., 2007; Cox, 2009). Already existing within RFMOs such as ICCAT, NAFO, and NEAFC, tradeable allocations essentially copy the cap-and-trade system of emissions trading. RFMOs implementing a traditional allocation scheme where each party's tonnage is fixed and allocations are not tradeable essentially only have the "cap" part of cap-and-trade systems. By incorporating allocation trading, the same economic efficiencies found within emissions trading schemes would be realized within RFMOs. Allocation trading would maximize a fishery's cooperative surplus, thus incentivizing greater levels of cooperation between parties, addressing the effectively and efficiently fostering cooperation between parties concept that this report presents as part of an ideal RFMO. Furthermore, as explored below, tradeable allocations are one technique to address the problem of RFMO new entrants.

Last are a handful of best practices that, due to their scope and/or specificity, are offered their own following subsections and only briefly mentioned here. As alluded to above, a massive gap in RFMO structures is how to accommodate new entrants. Traditionally, RFMOs have accommodated new members by raising the TAC to create new allocations which, as previously discussed, can lead to overexploitation and stock collapse. Since existing RFMO member parties are reluctant to see reductions to their own allocations, new entrants are an unsolved problem for existing RFMOs. This topic and its associated best practices are discussed further in subsection 4.B. Transparency is another RFMO gap for which experts have suggested best practices. Applying to aspects far beyond RFMO allocations, experts have identified the need for increased transparency across international fisheries. Transparency is explored further in subsection 4.D. Finally, monitoring and ensuring compliance with allocations and conservation measures is an ongoing battle for RFMOs. Subsection 4.E dives deeper into this topic.

Any future CAO RFMO would be in a unique (and fortuitous) position in that there are no historic catch records within the CAO. Not only does this remove the most common pitfall among RFMO allocation schemes, it also eases negotiation pressures as no CAOFA party has any existing CAO catches they would otherwise seek to defend. No RFMO has yet been developed in the CAO's entirely unexploited ecosystem and, thus, the CAOFA would be remiss not to take advantage of the chance to avoid existing RFMOs' allocation missteps. First and foremost would be ensuring that no proxy historic catch records (most likely from exploratory fishing) are created between now and the development of any future CAO RFMO. As will be discussed in section 5, exploratory fishing is an integral part of the CAOFA's next 15+ years of implementation. One objective of the CAOFA parties should be ensuring that the exploratory fishing regime does not become a de facto commercial fishery, as has occurred elsewhere. By decoupling parties' exploratory fishing efforts from any future CAO RFMO allocations, both the historic catch problem associated with existing RFMO allocations will be addressed while also aiding in maintaining the non-commercial nature of CAO exploratory fishing. However, existing RFMOs' considerations of parties' contributions to and compliance with conservation, research, and knowledge sharing measures as criteria for allocations could be adapted to the CAOFA's exploratory fishing. Including CAOFA parties' compliance with the as yet to be decided knowledge sharing and exploratory fishing procedures as criteria for a future CAO RFMO's allocations could improve parties' compliance over the next 15+ years while setting precedents for a future CAO RFMO's parties' cooperation.

Developing the foundation for the CAOFA's structural incorporation of independent review and dispute resolution for allocations and beyond can be started now. While this concept will emerge in later discussions (particularly section 4.C.), the consideration of its applicability to any future CAO RFMO allocations should not be lost during the next 15+ years. Incorporating it in the CAOFA's implementation will make its incorporation in a potential future CAO RFMO a far easier task. Disputes between parties are, of course, by no means limited to disagreements in allocations. Independent review and dispute resolution will aid the CAOFA across the board. These concepts can be further applied to any Arctic forum where disputes may arise.

Finally, brief discussion regarding the needs of coastal communities which are dependent mainly on fishing as an allocation criteria is prudent. Although no party to the CAOFA can be wholly considered as depending on Arctic fish stocks, many communities rely heavily on Arctic wildlife for subsistence and/or economic prosperity. Mandated not just by many RFMOs but also by UNFSA itself, participatory rights for RFMO members should account for the needs of such communities. The inaccessibility of any fish in the high seas portion of the CAO means coastal Arctic communities will likely not depend on them in the near term. Despite that, those stocks' influence on near-shore wildlife and the unforeseeable future of environmental Arctic change nevertheless demands that those communities' needs be considered if the CAOFA and future CAO fisheries agreements are to be implemented equitably.

4.B. New Entrants

The problem of how best to admit new RFMO members (and cooperating non-members) in a way that maintains stock stability while not upsetting existing members is one that an RFMO built from scratch may be best suited to solve. UNCLOS upholds states' rights to fish on the high seas while affirming that RFMOs and fisheries agreements be negotiated where multiple states' interests overlap. UNFSA builds from these principles by asserting that where an RFMO already exists, any states with "a real interest in the fisheries concerned" may become members without preclusion or discrimination (Article 8(3)). Despite that, no RFMO has enacted a successful mechanism for incorporating new entrants in a way which does not significantly undermine fishery sustainability (Lodge et al., 2007). Stocks are fully allocated in nearly all RFMOs, leading to one of two strategies for accommodating new members: (1) Giving a portion of members' existing stocks to the new party, or (2) Raising TAC to create new allocations given to the new party. Where sustainable fishery management is concerned, neither is ideal. RFMO parties generally refuse quota reductions due to loss aversion and the endowment effect while raising TAC risks overexploitation and stock collapse.

In practice, existing RFMOs deal with new entrants in a variety of ways (Lodge et al., 2007; Cox, 2009). Some,

including NEAFC and NAFO, effectively deny new entrants on the basis that their stocks are fully allocated.¹² Others, such as CCSBT and ICCAT, admit new entrants without reducing the allocations of new members. While CCSBT has raised its TAC to accommodate new members in the past, in 2003 it also set aside a quota pool of 900 metric tons for non-contracting parties, most of which was later offered to Indonesia to encourage cooperation.

The *de facto* status across certain RFMOs is that, if fish stocks are to avoid the risk of overexploitation, opportunities for new entrants are limited to new fisheries when and if they are established. While experts have identified new entrant best practices, the aforementioned issues associated with fully allocated stocks and members' reluctance for reduced quotas likely stop those practices from ever being implemented within an existing fishery. The novelty of a potential CAO RFMO means it can succeed where others have failed.

After consulting the literature, three new entrant solutions rise to the surface (Lodge et al., 2007; Cox, 2009). The first builds on the discussion in item 4.A.ii. of tradeable allocations. Allowing quotas to be traded (either permanently or temporarily) gives new entrants the ability to buy their way into an RFMO while compensating existing members for their reduction in fishing opportunities. While flexible, tradeable allocations could still functionally limit new entrants' opportunities if states are unwilling to trade. The second solution, utilized by a number of domestic fisheries (including within Norway and the US), annually requires all quota holders to surrender some of their quotas for reallocation to new entrants, both existing and new parties, or to specific categories of members (such as young fishers). The final, and perhaps most comprehensive, solution involves initially setting aside a certain portion of quotas for potential new members at a fishery's inception. A forethinking approach, this strategy can be made more attractive to existing members by allowing those set-aside quotas to be leased by existing participants on a short term basis.

Like allocations, the new entrant issue is one that few, if any, existing RFMOs have solved. The nature of the impediments preventing solutions, however, are ones in front of which a potential CAO RFMO can position itself. Perhaps most obviously (but nonetheless most importantly), the new entrant problem can be minimized if the parties to the CAOFA encourage the participation of those non-member parties that may eventually have "real interest" as soon as possible. Article 10(2) of the CAOFA allows this. The fewer new entrants to a potential CAO RFMO, the smaller the new entrant conundrum. Following that, however, it would be prudent for CAOFA parties to begin considering the strategies a future CAO RFMO might use to incorporate new entrants, conversations that would also offer guidance should a new party seek membership during the CAOFA's current exploratory phase.

With the Arctic attracting more states' interests than ever before, careful consideration must be made across all current and future Arctic governance regimes regarding the inclusion of new members. Whether it be from the outset or after initiation through a clearly defined mechanism, the flexibility and global perspective required to interact with the Arctic going forward should be reflected in the memberships of Arctic fora.

4.C. Decision Making

As with all international fora, RFMOs exist to facilitate cooperation between states. Inevitably, then, decisions must be made. The sheer breadth and variety of decisions made within RFMOs, however, could fill books. This report will highlight only a handful of the most common expert-identified RFMO decision making missteps and best practices.

At the highest level, RFMOs generally make decisions through consensus. Although myriad nuances apply, consensus is not considered best practice (Lodge et al., 2007). Requiring consensus can easily result in one state having an effective veto by refusing to budge in discussions, halting the decision making process.¹³ Best practice therefore involves measures to either break or avoid this regular RFMO gridlock, both of which experts and existing RFMOs have explored to varying degrees.

Many RFMOs have avoided consensus-caused gridlock by way of "opt out" provisions in their founding instruments whereby states can simply choose not to be bound by various measures to which they disagree (Guggisberg, 2018). Often these opt outs are related to the TAC, as has happened within NEAFC and ICCAT, among others. An obvious misstep that undermines the essence of collaborative resource management, states opting out of decisions – particularly those having to do with catch limits – puts stocks at risk of collapse. As such, opt out provisions should be actively avoided.

One potential solution to the consensus problem of note is the use of sub-coalitions. While not applicable to smaller RFMOs with only a handful of members, RFMOs with larger memberships can benefit when parties with similar interests negotiate jointly (Lodge et al., 2007). From an economic theory perspective, sub-coalitions increase the long-term stability of RFMOs by effectively reducing the number of participants.¹⁴ Sub-coalitions of states exist in RFMOs, with the WCPFC's Pacific island country members of the South Pacific Forum Fisheries Agency an example. Within the CAOFA, the most apparent potential for sub-coalitions would be the separation of the five CAO coastal states and the five DWFS. Given present tensions and disagreements between various CAOFA states, however, the possibility of sub-coalitions of this sort being formed in the near term is likely quite low.

Various RFMOs have measures through which decisions can be made in a timely manner while still allowing states to object and seek the decision's review (Lodge et al., 2007). The WCPFC has the ability to appoint a conciliator to resolve disputes on issues requiring consensus. Both the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR) and the South East Atlantic Fisheries Organization (SEAFO) allow disagreeing members to join a census before seeking that decision's review by panel. Of all RFMOs, SPRFMO offers a notably robust example.

To manage the consensus issue while also avoiding opt outs, SPRFMO implemented an innovative procedure whereby conservation and management measures (which includes TAC setting) bind parties, even when a measure was only adopted by a majority of parties and not consensus (Guggisberg, 2018). Objections to these measures are permitted only if "the decision unjustifiably discriminated in form or in fact against the member of the Commission or is inconsistent with the provisions of [the SPRMFO's founding] Convention or other relevant international law" (SPRFMO Convention, 2015). If objecting, a state must still adopt equivalent measures, and a review panel consisting of three experts from a pre-prepared list is established to oversee a hearing within 30 days of the panel's establishment before having 15 more days to transmit findings and recommendations. Between the SPRFMO convention's entry into force in 2012 and 2018, two members - Russia and Ecuador filed objections, the reviews of which were both administered by the Permanent Court of Arbitration in The Hague. Russia's 2013 objection regarding Chilean jack mackerel quotas was found to indeed be discriminatory, although Russia's alternative measures were deemed not to be equivalent and the panel recommended alternatives. Ecuador's 2018 objection regarding its allocated quota of Chilean jack mackerel, on the other hand, was found not to be discriminatory, thereby making the relevant conservation and management measure binding. The timeliness and apolitical, independent nature of SPRFMO's objection and review process is seen as both efficient and equitable, ensuring that all states' interests are considered while maintaining the sustainability of the RFMO as a whole.

Consensus decision making can and will be a challenge throughout the CAOFA's implementation as it has already proven to be. As such, structural measures for mitigating these challenges should be developed. The CAOFA should follow the lead of existing RFMOs in implementing a mechanism that allows objecting states to seek independent dispute resolution while still permitting continued operations. Not only will this set a precedent for a future CAO RFMO, it would immediately enhance CAOFA negotiations by reducing gridlock and expediting action.

The CAOFA offers a real test of how decisions involving both Arctic and non-Arctic states within a legally binding framework in the Arctic may be made. As more nations become involved in the Arctic, the more difficult maintaining stability within management regimes will be. As such, the CAOFA's implementation should be seen as the first step in an iterative process of increasing the effectiveness of Arctic governance. Whether that be through sub-coalitions, automatic independent arbitration, voting, or some other process entirely, the Arctic community should be ready to learn from the CAOFA's decision making successes and shortcomings.

4.D. Transparency

Experts have identified the lack of transparency as a challenge which RFMOs and the fishing industry as a whole are facing. Whether in the process of quota allocations, the reporting of scientific knowledge, or the disclosure of fleet catches, a call for increased transparency is a common theme. While experts advocate for increased transparency across all aspects of RFMOs, a selection of specific recommendations follows (Stimson, n.d.; Lodge et al., 2007; Seto et al., 2021; Cox, 2009, Ewell et al., 2020):¹⁵

While many of the above recommendations apply solely to operational RFMOs, many others can apply to the CAOFA's present implementation. Scientific knowledge can be reported, values can be weighted, standardized data and information can be shared, IGOs and NGOs can be made observers, and monitoring and traceability can be applied to CAO exploratory fishing. More holistically, within both the CAOFA and Arctic fora as a whole, transparency should be pursued at every opportunity.

4.E. Monitoring & Compliance

The monitoring of and states' compliance with regulations is necessary for RFMOs to maintain stable fisheries and sustainable management regimes. While effective conservation and management measures can be adopted by RFMOs, they are ultimately only effective if implemented by members and complied with by individual fishing vessels.

Perhaps the most basic monitoring and compliance measure any RFMO should implement, yet also equally the most important and one mandated by UNFSA Article 18, is VMS. These satellite-based systems track fishing vessels in real time, relaying positions to flag states and/ or RFMOs as well as being capable of incorporating catch reporting and quota monitoring services, among others (Pew, 2017). Since its first use by NAFO, NEAFC, and CCAMLR in the late 1990s, VMS has become the standard across RFMOs, most of which make it mandatory (Lodge et al., 2007). Full (100%) VMS coverage of both fishing and transshipment vessels is best practice (Lodge et al., 2007; de Bruvn et al., 2012; FAO, 2020). While VMS coverage is an essential monitoring and compliance practice that also improves transparency within an RFMO, further nuance is needed to arrive at

- > All research and findings from RFMO SCs should be reported objectively, completely, and in a timely manner.
- Complete information on RFMO member fleets including number, size, gear types, and catch should be plainly disseminated.
- > Systematic TAC setting mechanisms like MPs should be implemented.
- > All quota allocation parameters should be explicitly disclosed.
- > An explicit review process should be agreed upon at the time an allocation decision is made.
- > The values of both individual parties and the collective should be explicitly weighted in allocation negotiations and decisions.
- > Standardized catch data and information should be shared across all members and participating non-members.
- > Seafood traceability should be mandated for major seafood importing states.
- Enhanced monitoring and reporting of fishing activities should be implemented including requiring vessel monitoring systems (VMS) for all fishing vessels and making VMS data publicly available and increasing observership.¹⁶
- RFMOs should facilitate the greater participation of observer intergovernmental organizations (IGOs) and nongovernmental organizations (NGOs), especially in discussions around highly contentious issues.

best practice. VMS data are reported differently among RMFOs. Some utilize indirect reporting where data are relayed first to a vessel's flag state before then being passed to the RFMO, while others utilize direct reporting where data are relayed to both a vessel's flag state and the RFMO simultaneously. Direct reporting of VMS data to an RFMO is best practice to avoid the potential of flag states manipulating data, thereby further increasing monitoring, compliance, and transparency.

Similar to VMS, onboard monitoring of fishing activities by independent observers is becoming an RFMO standard. While VMS allows RFMOs to know *where* vessels are at any time, it cannot relay *what* is happening onboard. Observers fill that gap. While duties and mandates vary greatly across flag states and RFMOs, observers are generally tasked with either collecting scientific data or monitoring compliance; sometimes they are tasked with both. A dangerous job, observers have regularly been victims of harassment, intimidation, disappearance, and death. Nevertheless, observer coverage is a crucial tool in monitoring and compliance, and an ideal RFMO should include a robust observer program as a core best practice.

While valuable for scientific data collection, observers should be mandated to execute compliance monitoring as part of an RFMO's monitoring and compliance measures.¹⁷ Best practice dictates 100% compliance-monitoring observer coverage for all fishing vessels operating within an RFMO's convention, with observers mandated access to fisheries logbooks and fish stocks onboard vessels (de Bruyn et al., 2012). As of 2019, however, only three RFMOs - the Convention on the Conservation and Management of Pollock Resources in the Central Bering Sea (CCBSP), NAFO, and SEAFO – required 100% coverage, with others such as CCAMLR requiring varying percentages of coverage across managed fisheries (Ewell et al., 2020). To ensure authenticity regarding observer data, best practice would require observers to be of a different nationality than the flag state under which their observed vessel flies, a measure no RFMO has yet to adopt (Ewell et al., 2020). Complete reporting of all raw observer data should be made publicly available; currently, no RFMO implements this best practice, with some publicly publishing limited data types and others only selectively passing data to certain NGOs (Ewell et al., 2020). As of 2019, only five RFMOs mandated that observers record IUU sightings, a measure that is deemed best practice (Lodge et al, 2007; Ewell et al., 2020). Given the IUU potential inherent in transshipment activities, observer coverage for transshipments at sea is considered a best practice, one which has been implemented by five RFMOs.¹⁸ Remote electronic monitoring (REM) – an onboard system of video surveillance, sensors, and

satellite monitoring – has been proposed as a complementary measure to observer coverage (Ewell et al., 2020). A more cost-effective measure that removes the potential for observer mistreatment, REM could be used in tandem with observers to reach 100% at sea compliance monitoring for an RFMO. Despite that, it can be inferred that 100% observer coverage is still best practice and REM an effective back-up option. Finally, all RFMOs are to some degree failing to protect observers' safety. Regardless of observers' level of inclusion, RFMOs should create comprehensive measures to ensure the safety and validity of observers and observer programs. A first step would be incorporating the International Observer Bill of Rights into RFMOs' mandates which, beyond safety considerations, describes the rights observers should hold (Ewell et al., 2020).

Effective monitoring can only result in RFMO member compliance if sufficient sanctions are implemented in the case of noncompliance. The two most serious are officially listing member vessels as IUU vessels and reducing members' quotas (Lodge et al., 2007). A straightforward and largely effective strategy, quota reductions based on members' levels of compliance with RFMO regulations ultimately put the onus on flag states to manage their own fleets in accordance with any given RFMO's standards as well as punish them for failing to do so. Published IUU vessel lists and pre-approved vessel lists (sometimes referred to as blacklists and whitelists, respectively) are effective measures in compliance when noncompliance is linked with vessels' inclusion (for IUU vessel lists) or removal (for pre-approved vessel lists). These measures are discussed further in the following subsection. Both of these approaches should be present in any RFMO implementing compliance best practices.

A set of further strategies used to bolster RFMO monitoring and compliance fall under the category of port state measures (Lodge et al., 2007). These, as their name suggests, comprise measures used when foreign vessels are in port. For monitoring, port state measures can include checking licenses, vessel histories, catch and gear inspections, and observation of transshipments. Some RFMOs, like the Indian Ocean Tuna Commission (IOTC), have specifically established programs detailing port-based inspections required by all members, and NAFO requires port states to inspect all vessels landing catches from within NAFO's jurisdiction. For compliance, port states are able to implement sanctions for suspected or confirmed IUU vessels such as denial of access, prohibiting landing or transshipment of catches, and refusing other port services including refueling, resupplying, and repairs. The NEAFC tightens things by mandating their members designate a limited number of specific ports where catches must be offloaded. Globally, the FAO Port State Measures Agreement details a variety

of strategies port states may use to specifically target IUU fishing. While only a brief overview of port state measures, these examples demonstrate the broad opportunities for monitoring and compliance offered once vessels leave RFMOs' waters.

As with all resource management regimes, RFMOs require robust monitoring and compliance measures. Many of the aforementioned strategies should not only be considered for any future CAO RFMO but also be incorporated into the exploratory phase of the CAOFA's implementation. As will be discussed in section 5, CAO exploratory fishing should include 100% satellite and independent observer coverage. Similarly, appropriate penalties should be systematically defined by the CAOFA parties ahead of exploratory fishing. Lastly, with Arctic activities only set to increase substantially, robust monitoring and compliance schemes should be established across Arctic fora and management regimes.

4.F. IUU Vessel Lists & Pre-Approved Vessel Lists

IUU vessel lists and pre-approved vessel lists are important tools for facilitating RFMOs' compliance and transparency, with the latter considered a more stringent measure than the former (Lodge et al., 2007). Published registries of vessels explicitly disallowed from fishing opportunities due to prior engagement in IUU fishing, IUU vessel lists are a common practice across the world's RFMOs. While RFMOs listing non-member vessels that engage in IUU fishing within their areas of compliance is widespread, fewer RFMOs (including CCAMLR, IATTC, ICCAT, and SEAFO) have systems for listing vessels flying under member flags as IUU vessels. As mentioned in subsection 4.E., listing member vessels as IUU vessels is an important part of any robust compliance scheme. Pre-approved vessel lists, however, offer further rigor.

A pre-approved vessel list is an exhaustive registry of all vessels authorized to fish within an RFMO's area of compliance. Essentially the opposite of an IUU vessel list, multiple RFMOs including CCSBT, IATTC, IOTC, and NAFO incorporate pre-approved vessel lists, generally declaring that all unregistered vessels are unauthorized to fish in their areas. Notably, SEAFO and WCPFC explicitly state that all unregistered vessels are considered to be engaging in IUU fishing (or supporting activities such as transshipment as discussed in subsection 4.F.). Pre-approved vessel lists flip the rights for vessels to fish, establishing access to an RFMO's fisheries as a privilege while increasing ease of both compliance and transparency. Simply, an inspector need only check whether a vessel is on an RFMO's published pre-approved vessel lists as a first pass to determine its legitimacy.

Published registries of vessels explicitly disallowed from fishing opportunities due to prior engagement in IUU fishing, IUU vessel lists are a common practice across the world's RFMOs.

A pre-approved vessel list is an exhaustive registry of all vessels authorized to fish within an RFMO's area of compliance

IUU vessel lists shared across RFMOs are considered by experts to be imperative in limiting IUU fishing globally since IUU vessels are unlikely to limit their activities to a single RFMO's jurisdiction. As such, best practice would be the establishment of an IUU vessel lists across all RFMOs. If unfeasible, however, regional IUU vessel lists are an option. For example, NEAFC and NAFO have a common IUU vessel list where a vessel listed by one RFMO's members i automatically listed by the other's (Lodge, et al., 2007).

Finally, the listing – either as IUU or pre-approved – of transshipment vessels must be mentioned. As will be further discussed in the next subsection, transshipments are often rife with IUU activities. Developing a dedicated transshipment IUU vessel list or pre-approved vessel list enhances RFMOs' IUU-prevention measures and is considered best practice. An IUU vessel list or pre-approved vessel list can be incorporated directly into the CAOFA's implementation, with a pre-approved vessel list ideal. As will be explored in section 5, the CAOFA's exploratory fishing regime should strive to limit all IUU and *de facto* commercial fishing activities. Establishing a strict pre-approved vessel list for exploratory fishing vessels would be one such measure to do so. Likewise, any CAO IUU vessel list or pre-approved vessel list should be informed by those of neighboring RFMOs, namely NEAFC and NAFO's common IUU vessel list. Given both the heavy overlap in membership and the required logistics for accessing any CAO fishing opportunities, collaboration with nearby RFMOs on IUU vessel lists or pre-approved vessel lists is an obvious measure of efficiency. Lastly, the flipping of rights to privileges that pre-approved vessel lists create, along with their enhanced transparency and compliance, can inform other Arctic regimes. While requiring alignment with the many mandates of UNCLOS and wider international law, certain Arctic activities like shipping may benefit from a more stringent level of access however that might ultimately be implemented.

4.G. Transshipment

Transshipment, the process where harvested fish is transferred between a fishing vessel and a transport vessel (commonly called "reefers") either in port or at sea, is a common practice in modern fisheries (Miller et al., 2018; FAO, 2020). Allowing fishing vessels to continuously fish for months on end, transshipment has improved fishing efficiency while exacerbating IUU activities. As transshipment regularly occurs at sea (and therefore out of sight of fishing authorities), IUU activities associated with transshipments are rampant.¹⁹

It is important that any RFMO seeking to limit IUU activities and maintain the health of their stocks establish clear regulations regarding transshipment. As mentioned in the previous subsection, dedicated IUU vessel lists and pre-approved vessel lists for transshipment vessels are one measure that would improve transshipment regulation, with the FAO considering pre-approved vessel lists to be best practice (FAO, 2020). Similarly, the FAO recommends that all vessels engaging in transshipment within an RFMO should be required to be flagged to a member or cooperating non-member of that RFMO. While many of both the literature's recommended transshipment strategies and existing RMFOs' implemented measures utilize techniques that apply across RFMO operations (such as seafood traceability programs, VMS, and transparent reporting), some RFMOs implement transshipment-specific measures. Most notably, SEAFO bans all at-sea transshipment, only permitting fish to be transshipped in its members' ports and requiring authorization from both the port state and the vessel's flag state.

Given the CAO's remoteness, transshipment should be carefully considered throughout the CAOFA's implementation. Strict regulations like SEAFO's would provide both the CAOFA's exploratory fishing and any eventual commercial CAO fishery(ies) a robust means of controlling transshipment and limiting IUU activities.

4.H. Miscellaneous

Here, three miscellaneous best practices that are especially applicable to the CAOFA's short term implementation are briefly discussed: reference points, the establishment of a secretariat, and an ecosystem approach to fishery management.

4.H.i. Reference Points

Reference points represent a crucial tool for RFMOs implementing best practices and precaution. Ultimately, RFMOs are successful when they allow multiple parties to harvest fish while maintaining the stability and health of the fisheries and fish populations. Reference points allow fisheries managers to measure the degree to which health and stability is being maintained by acting as the base metrics against which periodic measurements are compared. Three types of reference points exist: limit reference points and target reference points (both of which are outlined in UNFSA Annex II), and trigger reference points (Pew, 2016b). Limit reference points define the point above which overexploitation is possible and fishing is no longer sustainable. In practice, scientific monitoring data indicating that a fishery has moved beyond its limit reference point signals that fishery's managers to immediately take actions to return the stock to its target level. Target reference points, as such, represent fisheries' predetermined ideal states of management (TACs or similar measures should be set to achieve outcomes matching target reference points). A precautionary approach to fisheries management would ensure that limit and target reference points are separated by a healthy buffer to account for scientific uncertainty, IUU fishing, and other negative pressures. Trigger reference points, used less frequently than the other two types, are usually set between limit and target reference points. These allow managers to implement incremental actions to prevent a fishery from reaching or exceeding its limit reference point.

An ideal RFMO implementing best practices should have robust reference points with a high degree of certainty in both their determination and the measurements compared against them. These reference points should be set by independent, apolitical science and be combined with explicit rules dictating predetermined actions should the reference points be approached or exceeded. Management procedures that automatically set TACs, as discussed in subsection 4.A., are best practice schemes that should be intrinsically connected with reference points. One example of a combined reference point-MP approach in practice can be found within U.S. fisheries (NOAA Fisheries, 2021). The Magnuson-Stevens Act mandates that all U.S.-managed stocks be governed by limit reference points, target reference points, and TACs (called "overfishing limits", "acceptable biological catch", and "annual catch limit" within U.S. fisheries, respectively). A limit reference point is first set by an SC, after which a target reference point is recommended that cannot exceed the limit. Generally, target reference points are set below limit reference points, with the degree to which the targets are reduced corresponding to the level of scientific uncertainty. Finally, a TAC is then set which cannot exceed the fishery's target reference point and can be set lower than the target to accommodate ecosystem, economic, and compliance concerns, among others. A robust MP with interconnected reference points and TAC such as those U.S. fisheries employ can be considered best practice.

The CAOFA's mandate to understand the CAO ecosystem and fishing potential uniquely positions it to identify and obtain all the requisite information to preemptively establish robust reference points with a high degree of certainty should a CAO RFMO or similar agreement eventually exist. Furthermore, based both on expert recommendations and the CAOFA's own provisions, reference points should be established not just for the CAO's fishable species but also by-catch species, connected species (such as higher trophic level species like seals and whales), and the ecosystem as a whole. This would allow CAO managers and scientists to not only measure and adaptively manage operations based on the status of fish stocks but also the entire CAO ecosystem. Lastly, the concept of trigger reference points can be adapted to inform the potential establishment of commercial fishing in the CAO in linkage with Article 5(1)(c) of the CAOFA. Specific scientific markers that, if met, would suggest the CAO can support sustainable commercial fishing in line with the precautionary approach could be identified. These would then be regularly compared against collected data to determine whether or not a sustainable commercial might be feasible. Doing so would allow independent, apolitical science to directly inform the potential ultimate establishment of an RFMO or similar agreement in the high seas portion of the CAO.

4.H.ii. Secretariat

As is made clear throughout this report, sustainable and effective fisheries management requires many activities. RFMOs administrate these activities through their secretariats, crucial bodies for receiving VMS data, organizing management, coordinating quotas, etc. There is uncertainty around whether or not the CAOFA parties will establish a secretariat (Baker, 2021). Given the myriad activities that a research and exploratory fishing-based fisheries scheme will require, the CAOFA parties should establish a secretariat or similar administrative body to facilitate the next 15+ years of the agreement's implementation.



4.H.iii. An Ecosystem Approach to Fisheries Management

In general, fishery impacts on the wider ecosystem have traditionally been given little attention. A significant gap across RFMOs, best practice dictates the development of programs dedicated to understanding trophic interactions and habitats and dynamic measures to limit the impacts of fishing on ecosystems. Detailed monitoring (especially of mesopredators), seasonal and/or regional fishing constraints based on wildlife patterns, gear restrictions, precautionary moratoria of certain activities until their impacts are fully understood, and protected area establishment are only a handful of examples (Lodge et al., 2007).

The safeguarding of healthy marine ecosystems is a core part of the CAOFA's objective and described in Article 2 of the agreement. Traditionally, an ecosystem approach to fisheries management has fallen victim to fish stock-focused management and planning. Given past RFMO missteps, the CAOFA's implementation should intrinsically follow an ecosystem approach to fisheries management from first research to potential CAO RFMO.

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5. EXPLORATORY FISHING

Broadly encompassing any fishing activities undertaken primarily to collect data, exploratory fishing generally proceeds and informs the establishment of new commercial fisheries. Not just applying to areas like the high seas portion of the CAO that were not previously fished, exploratory fishing is also part of developing fisheries that utilize novel techniques and gear as well as those that target new species (Lodge et al., 2007). Core to exploratory fishing is the precautionary approach. One of its key objectives is to ensure that harvesting does not occur faster than information needed to sustainably manage the fishery is obtained, and Article 6(6) of the UNFSA mandates that cautious conservation and management measures be adopted as soon as possible within exploratory fisheries. With no generally accepted definition, exploratory fishing is implemented inconsistently across RFMOs and beyond. Traditionally the focus of a relative lack of regulation, the limited data and untouched profits inherent in prospective fisheries lead to management challenges not usually prioritized by fisheries managers and experts (Caddell, 2018). Most notably are those exploratory fisheries which have operated for extended periods of time without collecting adequate data. In essence, these can be considered de facto commercial fisheries and fundamentally undermine the precautionary purpose of exploratory fishing.

Exploratory fishing will be a key part of the CAOFA's next 15+ years of implementation. Explicitly defined within the agreement as "fishing for the purpose of assessing the sustainability and feasibility of future commercial fisheries by contributing to scientific data relating to such fisheries" (Article 1(e)), the CAOFA's exploratory fishing parameters and regulations are yet to be determined. Given that exploratory fishing will quite likely be the only permitted type of CAO harvest for at least the next 15 years, its adherence to best practices is crucial. With its development still in progress, the design of the CAOFA's exploratory fishing is something which can be actively influenced.

This section will first examine the CAOFA's text on exploratory fishing, highlighting both areas of weakness and opportunities for action, before collecting exploratory fishing best practices from existing RFMOs and the literature.



5.A. CAOFA Text on Exploratory Fishing

The CAOFA permits exploratory fishing to be conducted by vessels flying the flag of one of its parties pursuant to collectively determined measures for doing so. As required by the agreement, these measures are to be established by June 2024 (three years from entry into force) and should be amended as necessary. Article 5, paragraph 1, point (d) of the CAOFA outlines requirements for those measures. Those requirements, presented verbatim, are as follows:

- (i) exploratory fishing shall not undermine the objective of this Agreement,
- (ii) exploratory fishing shall be limited in duration, scope and scale to minimize impacts on fish stocks and ecosystems and shall be subject to standard requirements set forth in the data sharing protocol adopted in accordance with Article 4, paragraph 5,²¹
- (iii) a Party may authorize exploratory fishing only on the basis of sound scientific research and when it is consistent with the Joint Program of Scientific Research and Monitoring and its own national scientific program(s),
- (iv) a Party may authorize exploratory fishing only after it has notified the other Parties of its plans for such fishing and it has provided other Parties an opportunity to comment on those plans, and
- (v) a Party must adequately monitor any exploratory fishing that it has authorized and report the results of such fishing to the other Parties.

The most notable aspect of the CAOFA's exploratory fishing text is the lack of collective oversight required for a party to commence exploratory fishing evident in point (iv) above. As will be discussed in the following subsection, RFMOs generally require the official receipt and approval of a party's proposed exploratory fishing details before that party is allowed to authorize any activities. This legal weakness in the CAOFA opens the door to potential misuse of exploratory fishing operations, increasing the risk of a *de facto* commercial fishery and/ or general unsustainable or irresponsible harvesting.

Despite point (iv)'s weaknesses, the text does offer the possibility of meaningful regulation. Point (ii) mandates that exploratory fishing adhere to specific requirements which could be molded to ensure adequate sustainable practices. "Adequately monitor" in point (v) implies the potential for mandatory monitoring criteria. Finally, and perhaps most importantly, point (iii) requires that all exploratory fishing be authorized based on "sound scientific research" and when consistent with the JPSRM, offering perhaps the most robust avenue for regulations.²² These options should be carefully considered when designing the CAOFA's exploratory fishing protocols to avoid undermining the agreement's objective. With point (iii) mitigating, to some extent, point (iv)'s frailties, ensuring a strong JPSRM is both necessary and a perfect place from which to start.

5.B. Exploratory Fishing Best Practices

Exploratory fishing has traditionally not been the focus of intense research or analysis. As such, little information exists on the efficacy of the various exploratory fishing measures and arrangements in practice across RFMOs. Likewise, individual exploratory fishing schemes tend to have less-strictly defined regulations compared to their commercial counterparts. There is no universal definition for an exploratory fishery which leads to discrepancies between RFMOs. Examining existing exploratory fishing measures and their analysis in the literature can inform the development of the CAOFA's exploratory fishing regime. This subsection will collect exploratory fishing best practices from existing RFMOs and fisheries experts before presenting their applicability to the CAOFA's implementation.

Perhaps the most fundamental exploratory fishing best practice implemented by RFMOs is the requirement for parties to submit a detailed proposal²³ for potential exploratory fishing endeavors to gain prior authorization before commencing (Lodge et al., 2007; Caddell, 2018). Along with harvesting, impact mitigation, and catch monitoring plans, these proposals generally include a data collection plan which outlines gear types, target species, and bycatch mitigation measures, among others (Lodge et al., 2007; Harris, 2021). These proposals are given to RFMOs' SCs for review, although review processes are not always clearly defined and can vary (Harris, 2021). While SCs are allowed to give advice regarding a proposal, as of 2021 only NEAFC's SC is explicitly authorized to suggest whether or not a proposal should be approved. As discussed in the previous subsection, the CAOFA's lack of mandated prior authorization is a major weakness in its exploratory fishing provisions, one whose potential side effects should be mitigated. Strict, stringent regulations around the aspects of the CAOFA's exploratory fishing that can be controlled are therefore crucial.

Best practice dictates that exploratory fisheries utilize reference points (both target and limit) in the same way commercial fisheries should (Lodge et al., 2007).²⁴ Given the level of scientific uncertainty inherent in exploratory fisheries, these reference points should be set highly conservatively and be adaptively managed as new information becomes available. Since an RFMO's SC sets reference points, this best practice can logically be extended to require the initial completion of adequate scientific research prior to the authorization of any exploratory fishing. The existing RFMO that best exemplifies the usage of exploratory reference points is SPRFMO which explicitly mandates that its SC give recommendations and advice regarding "precautionary reference points" (Harris, 2021). Given the CAOFA's goal of increasing knowledge on the high seas portion of the CAO's latent fishing potential while safeguarding its healthy marine ecosystems and ensuring the conservation and sustainable use of fish stocks, the establishment of reference points through scientific research prior to any exploratory fishing activities should be prioritized. Once exploratory fishing is underway, those reference points should be modified as knowledge regarding the CAO grows.

A best practice that immediately follows from the incorporation of reference points - but one that is not commonplace among RFMOs - is the use of catch limits similar to a commercial fishery's TAC (Lodge et al., 2007). Like exploratory reference points, these catch limits should be set cautiously given the relative uncertainty surrounding exploratory fishing. Managing exploratory catch limits should follow the same best practices that this report details for setting TAC, particularly those avoiding the pitfall of political influence hindering the fishery's scientific management. As discussed in item 4.A.i., best practice for setting catch limits involves designing systematic strategies (like management procedures) that set limits automatically using scientific inputs. This strong SC oversight should be incorporated in exploratory fishing.²⁵ Furthermore, important to any catch limit setting scheme is its ease of being adaptively managed. Knowledge regarding an

exploratory fishery and its ecosystem(s) will inherently change throughout its operation. Therefore, systematically including clear strategies for changing the management measures – especially catch limits – to align with new knowledge is paramount. Exploratory fishing's primary purpose of expanding knowledge of fish stocks and ecosystems suggests that it is one of the aspects of an RFMO that should be most objectively guided by science. As such, the CAOFA's exploratory fishing should be designed to remove political influence over the setting of catch limits, reference points, data collection plans, and other measures. The need for establishing scientifically-driven catch limit setting (and, thereafter, quota determining) measures is exacerbated by the potential for new members to the CAOFA. Given the risks inherent in raising catch limits²⁶ to accommodate new entrants, an appropriately systematic allocation scheme for exploratory fishing opportunities should be developed. Following best practices for TAC setting and scientific independence during the CAOFA's exploratory phase not only offers the agreement's exploratory fishing the greatest chance at success but also sets a precedent for the implementation of best practices by a future CAO RFMO.

An example of the importance of strong SC oversight as well as the best practice of individual member exploratory quotas is offered by CCAMLR's Ross Sea exploratory fishery (Caddell, 2018). The fishery generally receives a comparatively high number of vessels notifying their intent to harvest what is a relatively small collective allocation. While CCAMLR's SC has repeatedly warned that the commission's exploratory fisheries are being overfished and could become unsustainable, the SC's lack of strong oversight means that harvesting continues (Caddell, 2018; Harris, 2021). Especially perpetuating the problem is the lack of individual member quotas resulting from unresolved sovereignty questions in Antarctic waters.²⁷

Another misstep that best practices should be used to avoid can be found within CCAMLR's exploratory fisheries. Various CCAMLR exploratory fisheries are undersubscribed, leading to an insufficient amount of data to both manage their ongoing operation as well as determine the efficacy of commercial activities. These fisheries, which virtually remain open in perpetuity, essentially promote fishing without adequate knowledge in return, arguably making them de facto commercial fisheries. As previously mentioned, this type of development should be actively avoided, with best practice entailing a clear time limit on exploratory fishing activities. Various RFMOs implement such time limits. For example, SPRFMO operates exploratory fisheries for a limit of 10 years, after which time it will either close that fishery or redesignate it as a commercial one (Caddell,

2018). NEAFC, on the other hand, takes a more active approach to its time limits, authorizing any new bottom fishing activities based on the results of all exploratory fishing activities from the previous two years (MacLean, 2018). Inherent to both of these time limit strategies is structured adaptive management whereby (ideally) an RFMO's SC periodically reviews an exploratory fishery's operations and, based on its sustainability and status, recommends actions to be taken. Effective adaptive management of this type naturally requires objective, complete, and timely reporting of research and data from all exploratory fishing activities. One mechanism that could fit into the CAOFA's exploratory fishing protocols (which, as mentioned, mandate consistency with the JPSRM) is prohibiting future exploratory fishing by parties until the results of their previous fishing activities were both reported and accepted through the JPSRM. As for the wider best practice of exploratory fishing time limits, while the CAOFA includes an initial 16 year duration with possible five year extensions, the above RFMO examples suggest clear adaptive strategies in the case CAO exploratory fishing operations yield inadequate information before the first time limit arrives.

As with commercial fisheries, monitoring and compliance measures should be robust and effective to ensure the sustainability of any exploratory fishing regime. For monitoring, 100% satellite and observer coverage is clearly defined as best practice. While most RFMOs do not mandate complete satellite or observer coverage for their commercial fisheries (as discussed in subsection 4.E), many do so for their exploratory fisheries. NAFO, NPFC, NEAFC, SEAFO, and CCAMLR all require observer coverage, with NAFO and NPFC also requiring satellite monitoring (MacLean, 2018; Harris, 2021). Similar to commercial fisheries, further monitoring strategies can be implemented in the form of port state measures.²⁸

While the compliance measures previously discussed in this report can equally apply to exploratory fishing, some RFMOs have implemented additional exploratory-specific strategies to varying degrees of success. CCAMLR has largely utilized compliance measures based largely on carrot (rather than stick) techniques such as a tagging lottery to incentivize effective monitoring programs (Caddell, 2018). While stronger sanctions remain theoretically in place for repeat offenders, CCAMLR has a record of poor data management mostly due to a low commitment of particular vessels towards implementing research plans as well as practical errors in setting research hauls (Caddell, 2018). As such, the threat of more permanent consequences for noncompliance with procedures would likely help mitigate this effect (Caddell, 2018). SPRFMO utilizes different measures, instead implementing cautious²⁹ exploratory fishing operations to which access is treated as a privilege, not a

right. Members and other parties engaging in SPRFMO's exploratory fishing are banned from future exploratory fishing until all information from its previously-authorized activities has been provided to the Commission. Based on precautionary principles and CCAMLR's record of noncompliance, it can be posited that SPRFMO's stick-like, privilege-focused approach to exploratory fishing compliance may be the more effective method and one from which the CAOFA's implementation can draw.

Finally, other notable miscellaneous measures and examples include the following (Caddell, 2018):

- The NEAFC gives preference to exploratory fishing operations that utilize gear and/or methods with the least amount of bottom contact, ultimately prioritizing activities that demonstrate the least potential ecological harm.
- The CCAMLR's exploratory fishing operations were initially very slow and rife with complications as its SC spent excessive time and resources evaluating applications in good faith for relatively little data in return. To rectify this, the process was streamlined and its cost was ultimately placed on the applicants.
- The CCAMLR has experienced a dearth in requisite knowledge regarding the wider ecosystem (including dependent and related species) in the information reported back from exploratory fishing vessels. Fishers naturally prioritize the stock assessment over ecosystem-focused measurements and this gap has yet to be addressed by CCAMLR, thereby limiting its ability to manage the fisheries in line with the precautionary approach.

Exploratory fishing will be a core activity of the CAOFA's implementation. Given the regulatory handicap from which the CAOFA's exploratory fishing regime is starting (namely the lack of required collective approval over members' activities), it is imperative that all exploratory fishing measures be as stringent and precautionary as possible. As with commercial fisheries, science should be allowed to guide management as independently as possible. Sufficiently-comprehensive, non-harvest-based research³⁰ should be completed prior to the authorization of any exploratory fishing operations, allowing, inter alia, the establishment of highly conservative reference points. Following that, a systematic, scientifically-driven catch limit setting scheme in the mold of an MP should be established with quota allocations entirely decoupled. Appropriately stringent monitoring and compliance measures should then be established ahead of any authorized CAO exploratory fishing. Full (100%) VMS and observer coverage should be mandated along with appropriate port state measures (potentially including the authorization of only select ports for landing and transshipment). To bolster compliance, along with treating exploratory fishing opportunities as a privilege and establishing punishments for non-complying vessels, a pre-approved vessel list for exploratory fishing vessels should be implemented. Finally, clear adaptive management procedures should be designed and enacted within the scopes of clear exploratory fishing time limits.



6. JOINT PROGRAM OF SCIENTIFIC RESEARCH AND MONITORING

Understanding the CAO's environment, fish stocks, and ecosystem will be essential for successfully implementing the CAOFA. That understanding, as mandated by the agreement, will occur under the auspices of the Joint Program of Scientific Research and Monitoring. Intended to complement parties' existing science programs, the JPSRM and its framework must be established by June 2023 (two years from the CAOFA's entry into force) and its relevant scientific body is to meet at least once ahead of each (biennial) meeting of the CAOFA's parties. While the creation of a dedicated science body as part of the CAOFA is not explicitly required, the agreement's signatories established a Provisional Scientific Coordinating Group (PSCG) in 2019 that is expected to transition into a permanent body (PSCG, 2020; Baker, 2021).

The JPSRM and any science body established as part of it will be the CAOFA's science arm and likely play a similar role within the CAOFA as SCs play within RFMOs. While this allows insights to be clearly drawn from existing RFMOs, it also means that the JPSRM will likely be the example on which a potential CAO RFMO's SC is modeled. Despite the clear RFMO comparisons, the JPSRM's place in the wider Arctic should also be considered. At the time of writing, the Arctic Council – including its science groups – are operating in a limited capacity without Russian participation, as are the International Council for the Exploration of the Seas (ICES) and other organizations and programs. As previously mentioned, how the geopolitical challenges surrounding Russia will affect the CAOFA is largely unknown. As of October 2022, Russia continues to participate in CAOFA meetings, implying that, once established, the JPSRM will be an active scientific forum involving all Arctic Ocean coastal states and bevond.

This report has already detailed a variety of best practices regarding the relationship between science bodies and fisheries management. While centering around the assurance of scientific independence and science-driven management decisions, these have mostly focused on specific activities such as TAC setting and reference points. To build upon these, this section will focus more broadly on the general make-up and operation of science bodies by briefly outlining examples of best practices and examples of fisheries- and Arctic-relevant scientific cooperation that might be used to inform the JPSRM's development.

Based upon expert opinion and the PSCG's precedent, it appears clear that the CAOFA parties should establish a standing science body as part of the JPSRM (Young, 2018; PSCG, 2020; Baker, 2021). This body will serve as the main source of scientific advice to the agreement's parties while supporting and/or conducting the CAOFA's requisite scientific research. From an RFMO perspective, the need for impartial science is clear. The means of achieving an adequate level of impartiality, however, are debated and a wide degree of implementation strategies exist. Some RFMOs, like IATTC, employ a full staff of scientists supervised by the organization while others, like ICCAT, only employ a small number of scientists and rely on panels or committees of national representatives to offer scientific analysis (Lodge et al., 2007). The IATTC has notably been praised for its production of independent scientific advice, indicating that in-house science may be best practice³¹ (Baker, 2021). While these represent two ends of the spectrum, balanced alternatives exist. One proposed strategy utilizes economies of scale, suggesting that related RFMOs (such as those managing tuna stocks) employ a single staff of scientists (Lodge et al., 2007). Another strategy, employed by WCPFC, involves a scientific committee composed of national representatives that employs independent science experts to provide basic and impartial data and advice (Lodge et al., 2007). Indeed, this hybrid model is similar to a proposed structure for the CAOFA's science body that utilizes both in-house advice prepared by a scientific committee as well as external advice obtained from relevant independent entities including ICES, the North Pacific Marine Science Organization (PICES), and indigenous organizations (Baker, 2021).

Many multilateral scientific collaborations have existed in the CAO, and experts have advocated for the creation of a CAO-specific intergovernmental science organization in the mold of ICES and PICES (Balton & Zagorski, 2020, Vylegzhanin et al., 2020). While, based on the CAO's many knowledge gaps and the successful precedents of ICES and PICES, an organization of this type is something towards which the Arctic community should still strive, the time and nature of the CAOFA's implementation likely mean it is not the right mechanism for doing so. The fractured nature of present-day Arctic state relations as well as the specific timeframe and mandate of the JPSRM would suggest that the CAOFA's science body be new and independent for at least the foreseeable future. Nevertheless, the successes and failures of a CAOFA science body can inform any eventual CAO-specific intergovernmental science organization's creation. Given this, insights can be gained for the CAOFA's science body by examining the structure of existing Arctic and near-Arctic science bodies and endeavors such as ICES, PICES, and the Arctic Council's working groups.

The Arctic Council has been the *de facto* nexus of multilateral Arctic cooperation since its formation in 1996. The council's activities are conducted through six working groups (WGs), each of which differ slightly in their makeup and management. Of focus for this examination will be the Protection of the Arctic Marine Environment (PAME), Conservation of Arctic Flora and Fauna (CAFF), and Arctic Monitoring and Assessment Programme (AMAP) WGs. Like all Arctic Council WGs, these three include representatives from all Arctic Council member states, permanent participants, and accredited observers, as well as have biennially rotating chairmanships (and vice-chairmanships of which there is no set amount) filled in turn by each member state (Arctic Council, 2016). Beyond that, each WG differs. AMAP's governing board is composed of the WG's chair, vice-chairs, and an executive secretary, whereas CAFF's governing board consists of representatives from each member state and each permanent participant (Arctic Council, 2016; CAFF, n.d.). Both AMAP and PAME guide their work through iteratively developed two-year work plans, and PAME and CAFF mandate each project be assigned a lead (which for CAFF may be either a member state or permanent participant representative). Ultimately, all Arctic Council WGs are overseen and report to the Arctic Council ministers.

Independent intergovernmental science organizations like ICES and PICES offer different approaches to those of the Arctic Council's WGs. ICES is organized by two separate committees: a Science Committee (SCICOM) that oversees all scientific work and an Advisory Committee (ACOM) which provides advice to clients regarding fisheries and marine ecosystem matters. While the SCICOM has a wide membership including representatives from all ICES member countries plus those from other groups (including the chairs of the SCICOM's nested steering groups), the ACOM is comprised of exactly five members, one representative from each member country organized into a single chair role and four vice-chairs (ICES, n.d.). Both committees report to the council which consists of two representatives from each member state. While PICES also includes two representatives from each member state on its governing council, its operations (aside from matters of finance and administration) are overseen by a single Science Board which reports to the council, including advice to contracting parties (PICES, n.d.a; PICES n.d.b; PICES n.d.c).

Analyzing the structures of RFMO SCs, the Arctic Council WGs, ICES, and PICES alongside the many best practices presented in this report yields a few notable avenues through which the JPSRM could design an effective science body and program. While any CAOFA science body will ultimately report to the 10 parties, the independence of that body could be encouraged by borrowing the rotating chairmanship method utilized by the Arctic Council's WGs, an option which was included in the PSCG's proposed rules of procedure during its first meeting in 2020 (PSCG, 2020). Similarly, the WGs' inclusion of observers could be borrowed, something which was also included in the PSCG's proposed rules of procedure. An option which is not present in the WGs, ICES, or PICES is the incorporation of non-member nationals in leadership positions as is utilized by CCSBT.³² Nevertheless, if authentically independent science is to be maximized, then non-member nationals could be considered. Likewise, CCSBT's organizational separation of stock assessments and scientific advice groups resonates with ICES' SCICOM and ACOM distinctions. Given that the JPSRM and its science body will need to oversee CAO research while also informing fishery management, separate science and advice groups could be beneficial.

Finally, the importance of effective information sharing and transparency must be underlined. To best understand and model the fish stocks and ecosystems of the high seas portion of the CAO, knowledge and data from all parts of the CAO and its surrounding Arctic seas must be incorporated. While some regions (like the Barents, Beaufort, and Chukchi Seas) have adequate information that is internationally accessible, other seas (such as the Russian Kara, Laptev, and East Siberian) do not. This is not likely due to a lack of existing information but instead a lack of knowledge sharing (Snoeijs-Leijonmalm et al., 2020). Information sharing and transparency must be cornerstones of the JPSRM and all CAOFA activities.

The success or failure of the CAOFA's science body will play a large role in defining the success or failure of the CAOFA's implementation as a whole. If done well, the science and organizational insights that will emerge from the JPSRM could pave the way for sustainable CAO high seas fisheries, a potential CAO-focused intergovernmental science organization, effective multilateral cooperation between both Arctic and non-Arctic states, and an enhanced understanding of the CAO and beyond. Given the uncertain circumstances presently surrounding the Arctic Council, the JPSRM's establishment will hold important insights into the future of Arctic science and collaboration.

7. INCORPORATING INDIGENOUS AND LOCAL KNOWLEDGE

The CAOFA is a notable agreement for many reasons, one of which is its inclusion of indigenous and local knowledge (IK and LK). Recognizing that Arctic residents – many of whom are members of Arctic indigenous communities – have significant interest in the status of the CAO, Articles 4 and 5 of the CAOFA mandate that IK and LK be incorporated into the JPSRM (CAOFA, 2018; Balton, 2021b). The effective and equitable co-production of knowledge with IK and LK holders is a vast and increasingly-growing field; therefore, this section will only summarize a handful of best practices, examples, and directly-applicable details for the benefit of the CAOFA's implementation. To more accurately represent the nuances within IK and LK as well as to highlight both its similarities and differences with science, this section will utilize the term "knowledge acquisition" to describe the engagement of science, indigenous, and local knowledge in gaining an understanding of the CAO and beyond.

When seeking how to involve indigenous and local people, communities, and knowledge, it is best to look no further than those people themselves. While naturally only representative of a portion of Arctic residents, the Inuit Circumpolar Council's (ICC) Circumpolar Inuit Protocols for Equitable Engagement (ICC, 2022) is a fruitful place to start. In it, eight protocols are presented and defined to guide external parties in working with Inuit people and communities during knowledge acquisition and more. Those protocols are as follow:

Inuit Circumpolar Council's Circumpolar Inuit Protocols for Equitable Engagement

- 1. 'Nothing About Us Without Us' Always Engage with Inuit
- 2. Recognize Indigenous Knowledge in its Own Right
- 3. Practice Good Governance
- 4. Communication with Intent
- 5. Exercising Accountability Building Trust
- 6. Building Meaningful Partnerships
- 7. Information, Data Sharing, Ownership and Permissions
- 8. Equitably Fund Inuit Representation and Knowledge.

While all vital, a few are particularly applicable to IK's incorporation within the CAOFA. Protocol 2 directs external parties to recognize IK as a systematic way of knowing that must not be translated, integrated into, or validated by science. Misconceptions of IK's spatial, thematic, and temporal scopes are common in collaborations between scientists and IK holders (Wheeler et al., 2020). When any two knowledge systems are brought together, it is important for each one to be respected as a whole system of knowledge and on its own merits (Ellam Yua et al., 2022). Protocol 7, *inter alia*, dictates that IK

holders must be acknowledged and receive credit for their involvement and expertise. Protocol 8 emphasizes the need to address inequities in funding structures and for culturally appropriate practices, sentiments echoed elsewhere (Wheeler, et al., 2020; Baker, 2021). Finally, Protocol 1 underlines the importance of including indigenous communities and IK holders from the beginning. While IK and LK members have been involved to some degree throughout the development of the CAOFA, the manner in which they have been involved has left room for improvement.

Representatives from Arctic indigenous communities were involved in the negotiation of the CAOFA and have continued to be involved in its early implementation. They were, however, not involved solely as representatives of indigenous communities but instead firstly as members of their national delegations, undermining the essence of including them in the first place.³³ A letter from James Stotts, the president of ICC Alaska, to the delegates at the first meeting of the PSCG highlights this inadequacy, stressing that "the three ICC representatives [included in the CAOFA's negotiations] were there as members of [their] respective national delegations, not as ICC" (PSCG, 2020). The context in which this letter was included further exemplifies this inadequacy. Despite the meeting's need to develop schemes for the incorporation of IK and LK, no indigenous representatives were able to attend "due to scheduling conflicts" (PSCG, 2020). The misalignment between this outcome and the aforementioned ICC protocols would suggest the meeting was not an example of equitable, ethical engagement. There appears a clear need to improve the involvement of indigenous people, local communities. and IK and LK holders within the context of the CAOFA.

There exist clear precedents for the intrinsic participation of indigenous and local peoples in Arctic fora via the Arctic Council and its WGs. With full consultation rights in connection with the Council's negotiations and decisions as permanent participants, indigenous people are authentically represented within the Arctic Council. Although without voting privileges within the Arctic Council itself (which, as previously mentioned, is a forum without the power to adopt legally binding decisions), the permanent participants not only have representation within the WGs but, in the case of CAFF, are incorporated as board members. A similar strategy to the Arctic Council's permanent participants – where indigenous peoples represent themselves through dedicated indigenous organizations – would offer the CAOFA a more holistic, ethical, and equitable way to incorporate indigenous people, local communities, and IK and LK holders.

8. RECOMMENDATIONS

This report has explored various best practices, missteps, and examples which may inform the CAOFA's successful implementation. With independent science and the development of ecologically sustainable practices and long-term cooperation the focus, the following selected recommendations – collected from RFMOs, experts, and other relevant sources – are synthesized from the above discussions and presented in summary.

8.A. Decision Making & Operations

- Parties to the CAOFA should acknowledge the difficulties inherent in consensus decision making and consider structural strategies for ameliorating those challenges such as the independent dispute resolution.
- > When disagreements occur, parties should return to the CAOFA's guiding principles and the parties' shared values to arrive at a solution. A recommended place to start would be the principles, outlined in the CAOFA itself, upon which all 10 parties have previously agreed. Further common ground can be found in the shared desire to protect the fish stocks and CAO ecosystems in perpetuity.
- Clear strategies for incorporating new members to the CAOFA's exploratory fishing regime should be made, potentially borrowing aspects of tradeable allocations and/or setting aside quotas for redistribution. These strategies should be iterated and evaluated to inform best practice for any eventual CAO RFMO. When such strategies are implemented, it is essential that the fishable portion of CAO stocks which can be considered the "currency" available to fund CAOFA exploratory fishing and any eventual commercial fishing not be overcommitted.
- > Structurally incorporating independent review of CAOFA decisions should be pursued.
- > Maximizing transparency should be a focus of all aspects of the CAOFA's implementation.
- Robust monitoring and compliance strategies including 100% VMS (reported directly to a CAOFA secretariat/administrational body), 100% observer coverage, and quota reductions for noncompliance should be implemented both within the CAOFA's exploratory fishing regime and any eventual CAO RFMO.
- A pre-approved vessel list should be established for the CAOFA's exploratory fishing regime. Neighboring RFMOs' IUU vessel lists and pre-approved vessel lists should be incorporated into the CAOFA's pre-approved vessel list.
- Strict transshipment regulations (such as banning all transshipments at sea) and effective port measures (such as identifying specific ports at which CAO-harvested fish is required to be landed or transshipped) should be considered.
- > A CAOFA secretariat should be established.
- Objective, complete, and timely reporting of research and data should be maximized. One way of accomplishing this within the CAOFA would be prohibiting exploratory fishing by parties until the results of their previous fishing activities were both reported and accepted through the JPSRM.

8.B. Conservation & Management

- A management procedure that systematically sets catch limits (TAC) based on predetermined and standardized scientific inputs should be established for the CAOFA's exploratory fishing regime and be clearly targeted for any eventual high seas CAO RFMO. Management procedure effectiveness should be maximized using management strategy evaluation techniques that are adaptively managed.
- Reference points should be set using robust, independent science for both the CAOFA's exploratory fishing regime and any eventual high seas CAO RFMO. These reference points should be set more conservatively with a larger buffer between limit and target points where uncertainty is high.
- > Best practice dictates the complete separation of setting TAC and allocating quotas, something which both the CAOFA's exploratory fishing regime and any eventual CAO RFMO must ensure is maintained.
- Assigning management leadership roles to non-CAOFA member nationals should be considered to minimize bias.
- Fishing rights and quotas should be expressed as a percentage of total allowable catch, not as tonnage or effort.

8.C. Exploratory Fishing

- CAOFA parties' exploratory fishing efforts should be kept intrinsically unrelated to any eventual CAO RFMO allocations.
- > Avenues for robust regulation should be sought in the CAOFA's language regarding exploratory fishing.
- Detrimental effects from the CAOFA's lack of collective approval regarding exploratory fishing should be mitigated and minimized.
- > The oversight of exploratory fishing management of a CAOFA science body should be maximized.
- > Individual party quotas should be established for all exploratory fishing.
- A clear timeline, time limit, reporting timeline, and adaptive management strategy should be established for the CAOFA's exploratory fishing regime.

8.D. Joint Program of Scientific Research and Monitoring

- Any CAOFA science body should incorporate full membership of all states (as implied by Article 4(6) of the agreement) and be led by a rotating chair system.
- > Separate scientific assessment and advice groups should be established.
- > Regular, transparent data sharing should be a constant in all scientific activities.

8.E. Incorporating Indigenous & Local Knowledge

- Indigenous people, local communities, and IK and LK holders should be holistically incorporated into the CAOFA's implementation and their authentic representation – whereby they can represent themselves through dedicated indigenous organizations – should be facilitated.
- Best practices identified by indigenous people and local communities should be followed when engaging and incorporating indigenous people, local communities, and IK and LK holders.

9. LESSONS FOR BROADER ARCTIC GOVERNANCE

This report, while focused primarily on fisheries governance and recommendations within the confines of the CAOFA, naturally collects lessons which can inform the evolution of Arctic governance as a whole. This section will first summarize these lessons from the above text before framing them within the context of the evolving state of Arctic governance writ large.

- As Arctic activities increase in the face of environmental change, the precautionary approach's increased incorporation within Arctic governance can safeguard Arctic ecosystems and people by temporarily banning certain activities to assess their potential impact on the Arctic. Of particular relevance is considering who bears the burden of proof regarding activities' safety and/or sustainability. As activities like shipping and resource extraction increase in the Arctic, the precautionary approach dictates allowing those activities' proliferation only if and when those seeking to start them prove no significant environmental or social harm will result.
- > Adaptive management should be fundamental within Arctic governance and management regimes.
- Iterative science and knowledge acquisition will be evermore crucial as the Arctic's environment and economy changes. Securing science's ability to objectively influence management decisions (be they about fisheries, shipping, development, etc.) is vital to ensuring their impacts are fully understood and controlled. Separate science and decision making bodies and predetermined protocols akin to management procedures are some strategies that could achieve this.
- Managing an evolving membership and new entrants' rights to finite resources and/or activities is a fisheries problem that will increasingly apply to fora across the Arctic. The region is of global significance with more states increasing their interests in the far north. As old Arctic arrangements are updated and new ones developed, encouraging the participation of all states with real interest in Arctic activities as early as possible will limit the effect of the new entrant problem. Moreso, clearly defined mechanisms for apportioning membership rights for states joining after initiation will further mitigate conflict and complications.
- Arctic governance is evolving, with the CAOFA one step in a larger progression. Within this progression, existing strategies for decision making (like those within the Arctic Council) may become increasingly unapplicable to new Arctic arrangements as memberships increase and issues complexify. As such, new decision making strategies such as sub-coalitions and systematic independent arbitration (including via non-member state nationals) should be explored, particularly where requiring consensus can cause gridlock. These strategies should then be iteratively evaluated and improved to increase the efficiency of Arctic decision making as a whole.
- > Transparency should be maximized across all aspects of Arctic governance. Practices including complete reporting of states' activities, timely and objective sharing of data and research, standardizing information formats and procedures, and full disclosure of decision making rationale can improve the overall effectiveness of Arctic collaboration.
- Effective and systematic monitoring and compliance measures should be an intrinsic part of Arctic governance. Predetermined monitoring strategies akin to 100% VMS and independent observer coverage can improve the success of Arctic arrangements. Robust compliance mechanisms including IUU vessel lists, pre-approved vessel lists, and sanctions (such as reduction in states' opportunities) to encourage compliance should be designed.

- The concept of reference points, while seemingly specific to fisheries, can be adapted to a wide variety of Arctic topics. The process of setting specific targets and goals before commencing an activity and adaptively managing those targets and goals once the activity is underway can improve both collaboration and management of limited resources/activities in the face of uncertainty. Of particular note is the reference point best practice of setting a buffer between a system's possible activity (be that fish harvests, vessel transits, etc.) and its allowed one, and increasing that buffer's size when uncertainty is high.
- As demonstrated by the CAOFA's existence, the need for Arctic Ocean science and knowledge acquisition is increasing. Given the uncertain state presently surrounding the Arctic Council and its working groups, organized, multilateral science outside the auspices of the Arctic Council like that which might occur through the CAOFA could become the new norm. New strategies for organizing Arctic science should be explored and iteratively implemented, evaluated, and improved.
- > Indigenous people and local communities should be intrinsically included across Arctic fora. Where included, they should be representing themselves.

While the CAOFA's implementation will determine the future of the CAO's high seas fishing activities and ecosystem health, perhaps the CAOFA's greatest value - from a broader Arctic governance perspective, at least - is as a testing ground for new forms of high north collaboration and management. The implementation of the above lessons within the confines of the CAOFA can ultimately be lessons themselves used to inform the ongoing evolution of Arctic governance. This is especially true with the CAOFA being both an example of a forum outside the auspices of the Arctic Council as well as one that equally incorporates non-Arctic states and entities. Success regarding these lessons can point the way to successes across the Arctic, while failures will suggest that Arctic states are still unable to agree upon coordinated, effective governance. Evidence suggests that bringing Arctic-interested parties into the same room together is powerful for encouraging effective collaboration and good governance (Young & Kim, 2021; Steinveg, 2020). With new states now in the Arctic room on even footing for the first time, the CAOFA will put this notion to the test.

The Arctic has long operated as a unique region of international cooperation. As more non-Arctic states become involved with Arctic governance, whether or not to continue upholding the Arctic's tradition of low tensions and partnership is a decision that must be made (Hong, 2021; Young & Kim, 2021). Indeed, the precedent within Arctic relations is one of compartmentalization, of not allowing conflicts elsewhere to hinder high north collaboration (Balton, 2021a). Despite ongoing geopolitical tensions that have fractured relationships between Arctic states, the CAOFA's implementation continues with all nations at the table. It appears the precedent, at least to some degree, continues.



10. CONCLUSION

The CAOFA is a novel agreement that can be seen as an experiment in the implementation of best practices for fisheries management, scientific collaboration, the precautionary approach, and Arctic governance as a whole. While the health of the CAO depends on the CAOFA's successful implementation, the precedents and insights gained from however things transpire may affect Arctic governance for years and decades to come.

The realm of Arctic governance is becoming an increasingly crowded place. The best practices presented throughout this report and their possible eventual implementation can inform the next era of Arctic fora. From this report alone, insights can be drawn towards good governance on behalf of the entire Arctic. As more nations become involved in the Arctic, decision making will become more difficult. With the CAOFA as a precedent for including broader membership in Arctic matters, it appears valuable to incorporate all states interested in the Arctic sooner rather than later. Similarly, the CAOFA is another step towards a more holistic inclusion of indigenous people and local communities in the development of multilateral Arctic management. As more steps are taken, assurance must

be made that they are continuously representing themselves. Finally, as the precautionary approach guides Arctic fishing, so too can it guide other endeavors. As shipping, resource extraction, and other human activities grow in the Arctic, those implementing the activities should be the ones first proving them safe.

Our planet's intact ecosystems grow fewer in number each day. Too often has the environmental narrative been one of sorrow at a piece of nature gone forever. The CAOFA's implementation offers us the opportunity to learn from some of our best practices and missteps to maintain the health of a vast piece of marine wilderness humanity has yet to exploit. If done successfully, the ripples will be felt far beyond the far north.



ENDNOTES

¹ Most Arctic fish species are not directly associated with sea ice but are instead part of the seafloor biota (Snoeijs-Leijonmalm et al., 2020).

² UNFSA is known formally as the 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.

³ Parties to RFMOs are either individual states or regional organizations or entities like the EU.

⁴ Not all RFMO science bodies are called "science committees," and some RFMOs do not have in-house science bodies at all. For example, the North-East Atlantic Fisheries Commission (NEAFC) fields its scientific advice from the International Council for the Exploration of the Sea (ICES). For the sake of this report, "science committee (SC)" will refer to any body that provides scientific advice to an RFMO whether or not that body is called a science committee or if it exists in-house.

⁵ Some RFMOs use "effort" as a measurement instead of catch (which is generally measured in tons/metric tons of fish). Effort can be measured as the total number of vessels and/or the number of days an individual vessel is allowed to harvest in a year. As is the literature's default, "TAC" will be used in this report to refer to all measures of total allowable harvest.

⁶ If the total available resources of a fishery were conceptualized as a pie, then TAC would represent the total size of the pie that the RFMO is serving and allocations would represent the size of slice each party is given.

⁷ Illegal, unreported, and unregulated (IUU) fishing refers to all fishing that breaks fisheries law or occurs outside the egis of fisheries laws and regulations (Pew, 2013). As such, IUU fishing undermines the essence of fisheries agreements and RFMOs.

⁸ Systematic allocation schemes that automatically set TACs based on scientific inputs go by many names including management procedures, management plans, harvest strategies, and harvest control rules. There is no standardized terminology or design for these schemes and each include differing levels of structures and scope. This report uses "management procedure (MP)" to collectively refer to these schemes.

⁹ See subsection 4.E.

¹⁰ See section 2.

¹¹ See endnote 6.

¹² Lodge et al. (2007) argues that the strategy of limiting new members' fishing opportunities to new fisheries on the basis of fully allocated stocks works better for RFMOs for which all coastal states are already members.

¹³ The *de facto* veto caused by required consensus decision making is obviously not limited to RFMOs. One of its countless appearances was made in the discussions between CAOFA parties regarding rules of procedure. Consensus was unable to initially be made, severely delaying decision making.

¹⁴ Economic theory dictates that the difficulty of maintaining stability within a cooperative management regime increases almost exponentially as the number of participants increases (Lodge et al., 2007).

¹⁵ The need for transparency is not limited to expert advocacy. UNFSA Article 12 mandates RFMO transparency, stating: "States shall provide for transparency in the decision-making process and other activities of subregional and regional fisheries management organizations and arrangements" (UNFSA, 1995).

¹⁶ See subsection 4.E.

¹⁷ Porter (2010) showed that North Pacific fisheries observers tasked with compliance monitoring were more effective at detecting violations than regular or random inspections both in port and at sea.

¹⁸ To more robustly safeguard against transshipment-based IUU activities, SEAFO notably bans at-sea transshipments outright (Ewell et al., 2020).

¹⁹ Among others, transshipment at sea allows IUU vessels to avoid detection, refrain from entering ports, launder fish by mixing IUU catches with legally caught ones, and transport fish to ports of states outside the membership of the RFMO in which the fish were caught (Lodge et al., 2007).

²⁰ Reference point best practice dictates that increasing uncertainty should correlate with more conservative reference points. Similarly, higher uncertainty should result in a larger buffer between limit and target reference points (Pew, 2016).

²¹ Article 4, paragraph 5 mandates that, as part of the JPSRM, parties shall both adopt a data sharing protocol as well as share relevant data according to that protocol's guidelines.

²² Regulations that could find their home in point (iii) include quota limits, gear type, and location. Since, as discussed throughout this report, scientists (through SCs in RFMOS) are the ones who determine a fishery's sustainability, it is likely through a science-driven angle that exploratory fishing oversight can be achieved within the CAOFA. A strong pre-determined framework, particularly if combined with compliance measures, could help mitigate any potential missteps in sustainably and responsibly implementing the CAOFA's exploratory fishing. It should also be noted that the phrase "sound scientific research" suggests the requirement of sufficiently comprehensive, non-harvest-based research prior to any exploratory fishing authorization (Harris, 2021).

²³ Proposals for exploratory fishing are often referred to as "notices of intent".

²⁴ See item 4.H.i.

²⁵ The best practice of strong SC oversight can be extended to apply to the approval or disapproval of exploratory fishing proposals. As mentioned above, only NEAFC's SC is explicitly authorized to provide advice on whether or not a proposal should be approved.

²⁶ See item 4.A.i.

 27 The Ross Sea exploratory fishery utilizes an "Olympic-style" allocation scheme where vessels of all members may harvest within the fishery until the collective quota is exhausted.

²⁸ See subsection 4.E.

²⁹ Indeed, SPRFMO's exploratory fishing regime can be considered the most extensive in operation (Caddell, 2018). Initially modeled off of CCAMLR, it has since transcended both CCAMLR's level of precaution and UNFSA's as a whole. SPRFMO exploratory fisheries (which any fishery based on location, species, or gear that has not been fished for at least 10 years is considered) are only authorized after the commission adopts cautious conservation and management measures both in respect of the fishery and the entire ecosystem.

30 See footnote 23.

³¹ It must be noted, however, that maintaining a large staff of scientists is expensive (Baker, 2021).

32 See item 4.A.i.

³³ The three delegations including representatives from Arctic indigenous communities during the CAOFA's negotiation were Canada, the United States, and Denmark (on behalf of Greenland and the Faroe Islands) (Balton, 2021b).

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APPENDICES

Appendix A: Abbreviations & Acronyms

ACOM	Advisory Committee (of ICES)	
AMAP	Arctic Monitoring and Assessment Programme	
BBNJ	Biodiversity beyond national jurisdiction	
CAFF	Conservation of Arctic Flora and Fauna	
CAO	Central Arctic Ocean	
CAOFA	Central Arctic Ocean Fisheries Agreement	
CBD	Convention on Biological Diversity	
CCAMLR	Commission for the Conservation of Antarctic Marine Living Resources	
CCBSP	Convention on the Conservation and Management of Pollock Resources in the Central Bering Sea	
CCSBT	Commission for the Conservation of Southern Bluefin Tuna	
DWFS	Distant water fishing states	
FAO	Food and Agriculture Organization of the United Nations	
IATTC	Inter-American Tropiocal Tuna Commission	
ICC	Inuit Circumpolar Council	
ICCAT	International Commission for the Conservation of Atlantic Tunas	
ICES	International Council for the Exploration of the Sea	
IGO	Intergovernmental Organization	
IK	Indigenous knowledge	
IMO	International Maritime Organization	
IOTC	Indian Ocean Tuna Commission	
IUU	Illegal unreported and unregulated	
JPSRM	Joint Program for Scientific Research and Monitoring	
LK	Local knowledge	
LME	Large marine ecosystem	
MP	Management procedure	
MSE	Management strategy evaluation	
MSY	Maximum sustainable vield	
NAFO	Northwest Atlantic Fisheries Organization	
NEAFC	North-East Atlantic Fisheries Commission	
NGO	Nongovernmental Organization	
PA	Precautionary approach	
PAME	Protection of the Marine Environment	
PICES	North Pacific Marine Science Organization	
PSCG	Provisional Scientific Coordinating Group	
REM	Remote electronic monitoring	
RFMO	Regional fisheries management organization	
SC	Scientific committee	
SCICOM	Science Committee (of ICES)	
SEAFO	South East Atlantic Fisheries Organization	
SPRFMO	South Pacific Regional Fisheries Management Organisation	
TAC	Total allowable catch	
UNCLOS	United Nations Convention on the Law of the Sea	
UNFSA	United Nations Fish Stocks Agreement	
VMS	Vehicle monitoring systems	
WCPFC	Western and Central Pacific Fisheries Commission	
WG	Working group (of the Arctic Council)	

Appendix B: Precautionary RFMO Best Practices

TABLE 1: Precautionary approach best practices for RFMOs collected and paraphrased from Table 2 of de Bruyne et al. (2012).

CRITERIA	BEST PRACTICES
Overarching objectives	• Contains ecosystem considerations, precautionary approaches, and facilitates science-
	informed decision making
Precautionary approach	 Portion of TAC allocated to ecosystem considerations
decision rules	Rebuilding targets for depleted stocks
	Robust suite of indicators and metrics of ecosystem structure, function, productivity and
	services at multiple scales
	 Control rule includes estimated exploitable biolitass tiffesholds where more conservative harvest rates apply – fishing ceases when limits reached
	Catch limits account for uncertainty
Limit reference points	Minimum-average historical biomass
	MSY a limit for fishing effort not a target
	• Fishing not allowed when stocks below a predetermined proportion of carrying capacity
Target reference points	Constant exploitation yield or fishing mortality targets
	Spawning stock biomass rebuilding target (e.g., MSY)
Access control	 Combination of measures including, but not limited to:
	Allocation schemes
	Closed areas/season
	 vessel/gear licensing Moratoriums etc.
Bycatch reduction	Byoatab TACs
Byeaten readention	 Shifting seasons/areas to avoid incidence of bycaught species
	 Minimum size/corresponding to mesh/hook size requirements
	Mesh length requirements
	• Innovative methods to reduce entanglement (e.g., nighttime fishing, pingers, limits on
	soak time, use of tori poles)
	 Safe handling technique training for released species
	 Measures to regulate bycatch in recreational and charter boat fisheries
Habitat protection	Habitat mapping schemes
	Closed areas for target, associated and dependent species
	Pollution monitoring
Technolog	Restriction on gear type in sensitive habitats
Interim massures (recovery plans	Conservative management procedure framework
Capacity reduction	Kebuilding plans Cleared versal registry
schemes	Closed vessel registry Elect communication scheme
	 Quotas for members and cooperating non-members
	UUU control measures
Evaluation	Adaptive management
	Predetermined rules for when TAC is deemed too risky
Code of conduct	Education effort – disseminate code of conduct to contracting party fishing vessels
	• Identification guides and gear/fishing method modifications to protect seabirds, turtles,
	and sharks
Research program	 Ecosystem monitoring program with structured data collection protocols that
	incorporates
	 Socioeconomic data Fishing impacts on sensitive habitats and species
	 Ecological relationships between species/habitat
	 Population assessments for non-target species
	Holistic ecosystem models
	Climate change considerations
Experimental fisheries	 Requirements for experimental & exploratory fishery monitoring and assessment
	Restrictions on number of new entrants
Monitoring & compliance	100% real time observer coverage
	• VMS
	Catch and trade documentation schemes involving exchange of data with other RFMOs
	 Minimum standards for data collection and submission of national reports to KFMO Joint inspection schemes between members and independent inspectors.
	 Fund for canacity building that considers needs of developing states
Penalties for non-	IIIII vessel lists and nre-approved vessel lists
compliance	 Prohibition of landings and transshipments from non-complying parties
~	• Trade and/or quota restrictions and/or sanctions





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