

Innovative Incentive-Based Tools in Reform of Highly Migratory Fisheries at Project Development and Regional Scales





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DECEMBER, 2018

ACKNOWLEDGEMENTS

This report was prepared for the World Wildlife Fund, Inc. (WWF-US) under a grant from the World Bank's Ocean Partnerships for Sustainable Fisheries and Biodiversity Conservation-Models for Innovation and Reform (OPP). This paper was prepared under the technical direction of Vishwanie Maharaj, Oceans, WWF-US. Additional contributors include Richard Barnes (University of Hull) representatives of the OPP projects (Bay of Bengal, Eastern Pacific, Caribbean and Western Central Pacific) and members of the multidisciplinary Global Think Tank (GloTT) under OPP. This report serves as a technical reference for the seminal publication arising out of GloTT deliberations on the lessons learned from developing OPP projects and insights from existing innovative incentive programs applied to highly migratory fisheries with a high seas component.

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Abbreviations

ABNJ	Area Beyond National Jurisdiction	IVQ	Individual Vessel Quota
AIDCP	Agreement on the International Dolphin Conservation Program	IUU	Illegal, Unreported or Unregulated
AK	Alaska	LL	Long Line
ALB	Albacore	MCS	Monitoring, Control and Surveillance
BET	Bigeye Tuna	MPA	Marine Protected Area
BFT	Bluefin Tuna	MSY	Maximum Sustainable Yield
BOBP-IGO	Bay of Bengal Programme Inter-Governmental Organisation	MT	Metric Tons
CCAMLR	Convention for the Conservation of Antarctic Marine Living Resources	NAFO	Northwest Atlantic Fisheries Organization
CCSBT	Commission for the Conservation of Southern Bluefin Tuna	NCP	Non-Contracting Party
CCM	Commission members, cooperating non-members and participating territories	NEAFC	North East Atlantic Fisheries Commission
CMM	Conservation and Management Measure	NGO	Non-Governmental Organization
CNM	Cooperating Non-Member	NMFS	National Marine Fisheries Service
CPC	Contracting Party	NOAA	National Oceanic and Atmospheric Administration
CPUE	Catch-Per-Unit-Effort	OPP	Ocean Partnerships for Sustainable Fisheries and Biodiversity Conservation – Models for Innovation and Reform
CSP	Coastal States Principle	PL	Pole and Line
DAS	Days at Sea	PNA	Parties to the Nauru Agreement
DWFN	Distant Water Fishing Nation	PO	Producer Organization
EEZ	Exclusive Economic Zone	PS	Purse Seine
EPO	Eastern Pacific Ocean	RBM	Rights Based Management
EU	European Union	RFMO	Regional Fishery Management Organization
FAD	Fish Aggregating Device	SBFT	Southern Bluefin Tuna
FFA	Forum Fisheries Agency	SEAFO	South-East Atlantic Fisheries Organization
FQA	Fixed Quota Allocations	SEAFPO	Southeast Pacific Fisheries Organization
GEF	Global Environmental Facility	SIDS	Small Island Developing State
GFCM	General Fisheries Commission for the Mediterranean	SKJ	Skipjack Tuna
GloTT	Global Think Tank	SSRU	Small Scale Research Units
HCR	Harvest Control Rule	SWO	Swordfish
IATTC	Inter-American Tropical Tuna Commission	TAC	Total Allowable Catch
IBSFC	International Baltic Sea Fishery Commission	TAE	Total Allowable Effort
ICCAT	International Commission for Conservation of Atlantic Tunas	TIS	Trade Information Scheme
ICES	International Council for the Exploration of the Sea	UK	United Kingdom
ICM	Incentive Compatible Management	UN	United Nations
ICNAF	International Convention for the Northwest Atlantic Fisheries	UNFSA	UN Fish Stocks Agreement
IDCP	International Dolphin Conservation Program	UNCLOS	UN Convention on the Laws of the Sea
IOTC	Indian Ocean Tuna Commission	USA	United States of America
IQ	Individual Quota	VDS	Vessel Day Scheme
ITQ	Individual Transferable Quota	WCPFC	Commission for the Conservation and management of Highly Migratory Fish Stocks in the Western and Central Pacific
		WCPO	West Central Pacific Ocean
		YFT	Yellowfin Tuna

0m
0m
0°
B

H-UP H R 70
T 5°

G 3.0
P 1

DEPTH
WATER
C1
C2
C3

FISH HISTORY

WATER TEMP. 0.0°C
20min



0°08.277N
150°30.766W

DR 3



Introduction

Stocks, such as tunas, billfish, and sharks, that migrate between areas beyond national jurisdictions (ABNJ) and national jurisdictions present complex management challenges. Globally tuna fisheries alone produce large amounts of fisheries wealth, over \$10 billion¹ annually, and account for up to 8 percent of all seafood traded internationally (Pew 2016). However, these stocks are in trouble, with one-third overexploited, 37.5 percent fully exploited, and only 29 percent not fully exploited. While there is biophysical data about these resources, there is a critical need to find innovative ways to build upon and improve management frameworks to achieve sustainable social, economic, and environmental outcomes. The World Bank's project Ocean Partnerships for Sustainable Fisheries and Biodiversity Conservation—Models for Innovation and Reform (OPP) responds to these challenges and seeks to fill critical knowledge gaps, with a focus at both the global and regional levels. At the global level, the OPP will facilitate a collaborative process across all four regional projects under the World Bank's GEF ABNJ program to provide advice on sustainable management of shared highly migratory fisheries and conservation of associated marine biodiversity.

This is being undertaken through a small but potentially influential, Global Think Tank (GloTT) comprised of a multidisciplinary group of globally experienced specialists, with input from each of the four regional projects, together with other experts that can inform the deliberations to address project challenges and conceptualize

a broader, longer-term innovative vision for ABNJ management. This activity responds to GEF's call for knowledge that informs and influences international debates and processes related to the management of shared stocks. This report will review the use of incentive-compatible mechanisms, such as rights-based

Management of common pool, or open access, fishery resources is a challenge and command-and-control regulatory frameworks tend to lead to a race to fish. The race to fish leads to overfishing and the dissipation of resource rents. Incentive-based management shows promise in correcting the common pool or open access problem.

management (RBM) and market measures in use across transboundary stocks, with an eye to making suggestions that will enhance future implementation of these types of interventions. This work is but a small part of the overall work of the GloTT and the World Bank's GEF ABNJ project.

Management of common pool, or open access, fishery resources is a challenge and command-and-control regulatory frameworks tend to lead to a race to fish. The race to fish leads to overfishing and the dissipation of resource rents.² Incentive-based management shows promise in correcting the common pool or open access problem. More

1 All dollar amounts are U.S. dollars except as noted.

2 Resource rent can be defined simply as the price an owner of the fishery can charge users of the resource.

specifically, incentive-compatible management (ICM) that includes market-based tools and rights-based management (RBM) has been shown to rationalize fishing fleets. Rationalization produces smaller, more profitable fleets. Higher profits are driven by product price increases from higher quality products or entirely new products being developed, coupled with a reduction in fishing costs as the fleet shrinks. Incentives, both push and pull incentives, increase stewardship and ends overfishing. In addition, some tuna fisheries face conflicts between the PS and LL gears over allocation of the catch, and rights-based regimes offer solutions to this tough allocation issue.

This report explores the interplay between ICM and RFMO management, and successes and lessons learned in the pre-implementation, implementation, and design phases of ICM projects across select RFMOs. This report begins by developing a framework for ICM and discussing the application of these tools in a broad sense. Next, the report summarizes the incentive-compatible activities that are in planning or underway across the globe, with a focus on pre-implementation, implementation, design, and performance, where available. Finally, the report concludes by drawing inferences from the pre-implementation and implementation successes so that they can inform future movement toward the use of incentive-compatible intervention in transboundary fisheries to enhance ecological, social and economic outcomes.

ICM: A Response to the Common Pool Fishery Problem

Historically, fishery management can be characterized by top-down mortality controls including time/area closures and gear restrictions. These measures are developed through a political process that is charged and adversarial (Wilens 2006). The charged politics and adversarial

decision-making are particularly evident in the management of straddling stocks through RFMOs. As a result, marine ecosystems are in dire straits: the political process has become paralyzed while fishery value is destroyed. Wilens (2006) posits that the disagreement over the right course of action at the commission level is driven by failure to agree on the root cause of the fishery problem, which is that fishery resources are often commonly held. As a result, players seek to separately maximize their share of the TAC, not aggregate economic value.

The divide is profound and relates to very different philosophies of human actions. Typically, fishery biologists believe the failure is the result of “bad behavior” of the fishers themselves. Ludwig et al. (1993) typified the sentiment of this camp when they stated, “shortsightedness and greed of humans underlie difficulties in management of resources.” Fishery management governed under this philosophy focuses then on severely regulating “bad” behavior that promotes overexploitation. In this light, this camp believes the only response is to ratchet regulations down even tighter.

On the other side of the ideological spectrum, economists and others believe the focus should be on the problem that causes the bad behavior, not the symptoms such as bycatch mortality and overfishing driven by the race to fish. Command and control, or top down management, drives the race to fish. For every tightening of mortality controls, fishermen increase capacity to out catch the next guy and maintain the same level of harvest as they enjoyed before the tightened control. This race to fish, dissipates all rents in the fishery through increased costs and overcapitalization. Fishing industry groups then turn to trying to capture the political process to seek rents. All of this behavior is driven by insecurity of access.

Exacerbating this problem is weak fisheries policy at national and international levels. Fisheries are

generally seen as a problem sector at best, or as the employer of last resort at worst (Cunningham et al. 2009). Generally, these sectors generate low and declining GDP shares, or the true economic activity is not completely captured in GDP. General characterization of most national management is discordant. Nations use poorly directed policies fraught with unintended consequences. Often the resource is viewed as a “free good” driving rent-seeking behavior, leading often to selling or leasing rights to foreign countries for substandard returns to the nation.

The distorted incentives created by open access resources, managed by top-down mortality controls, induce wasteful competition for the resource and wasteful competition with managers and management bodies. These systems are focusing on the symptoms of the open access problem and not the root cause. Almost exclusively, these nations only focus on resource conservation or employment maximization (Cunningham et al. 2009). In addition, SSFs, as they transition to more modern technologies, reduce employment while increasing fishing capacity. Combine that with a development focus of increased value-added in fishery products and the rates of resource exploitation can soar even higher. Anything managers do to decrease exploitation and increase stocks rapidly evaporates under open access. Without the proper incentives and secure access rights, all conservation sacrifices can be taken by free riders and rents are dissipated. This is particularly pronounced in straddling stocks where new entrants must be allowed by law (Munro 2007).

Not considering incentives also increases vulnerability. Fishers and local communities are subject to large swings in harvests, sometimes necessary for stock management goals. As a result of these management failures, governments swing towards blunt tools such as marine-protected areas, closures, bans, and consumer boycotts (Cunningham et al. 2009). While these blunt tools may enhance stocks,

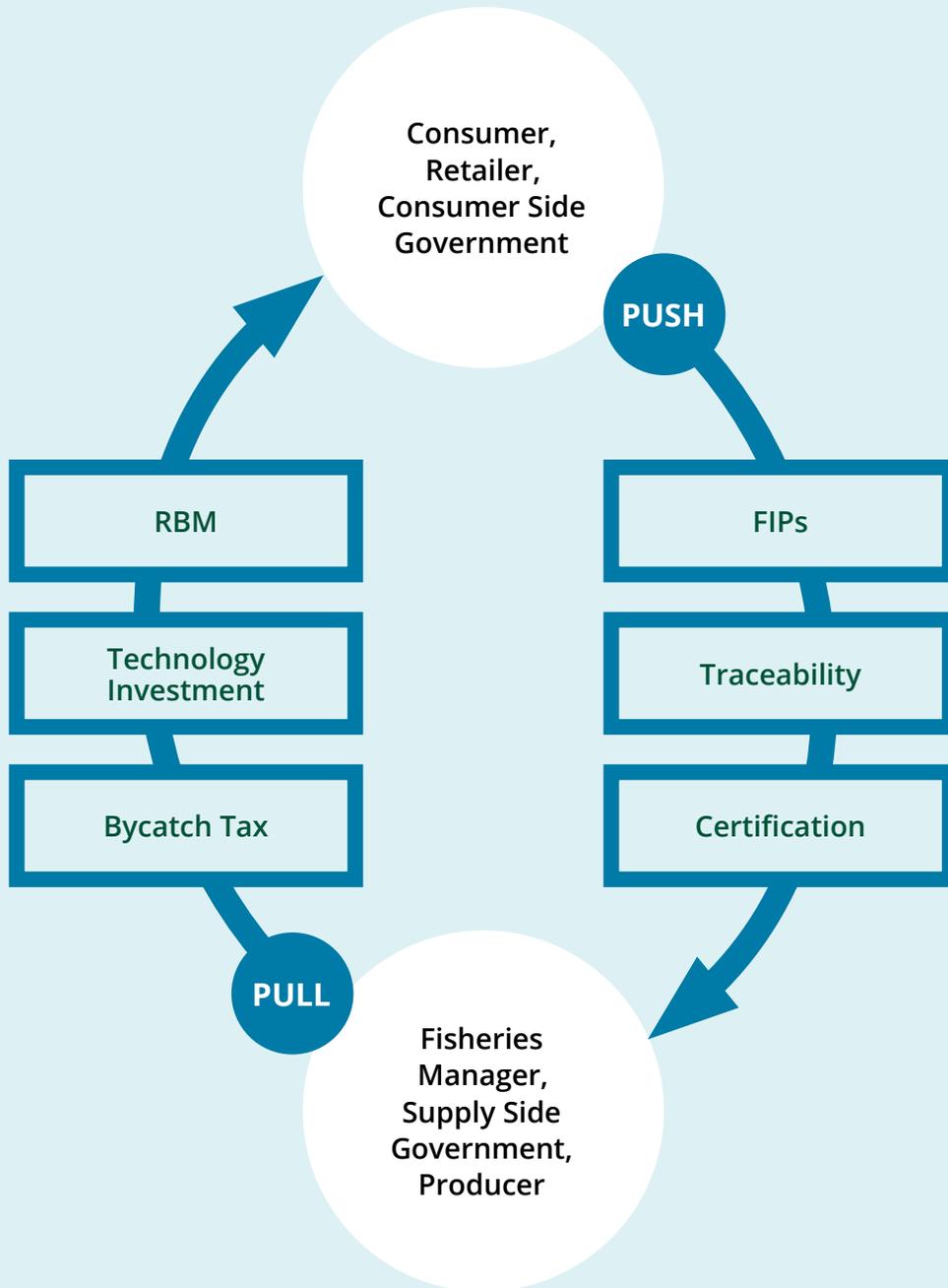
they can increase vulnerability. Because fisheries are viewed as “problem sectors,” they are often vulnerable to changes in other primary economic sectors in their home economies, increasing vulnerability further (Cunningham et al. 2009). ICM approaches can enhance security and resiliency for SSFs and developing coastal states.

Most economists now agree that the problem with fisheries management is not the result of bad behavior resulting from short-sighted commercial fishermen. Instead, the failures of fisheries management are based on common pool, or open access, resource problems combined with the institutional setting that has governed past management decisions, which have not taken fisher incentives into account in management decisions. Without the right incentives and/or secure access, management is a zero-sum game. Over-investment into fishing capacity and free riding, particularly in the international management of straddling stocks, dissipates any potential profits before, during, and after rebuilding. ICM, and particularly RBM, have been successfully used around the world to address the open access problem. ICM realigns incentives, such that they are compatible with stewardship and conservation objectives. The capitalization of foregone wealth into communities or the privately owned share of the quota changes behavior and maximizes resource values, now and into the future.

Push Versus Pull Incentives

It is very important to understand whom to incentivize when designing incentive-compatible interventions. Is it States, RFMOs, consumers, or fishers? Defining the incentives into two broad groups, push or pull, helps narrow the focus considerably. Figure 1 diagrams the two basic types of incentives: push and pull. Push incentives originate on the consumer side of the seafood equation. These incentives can include

Figure 1. Push Versus Pull Incentives

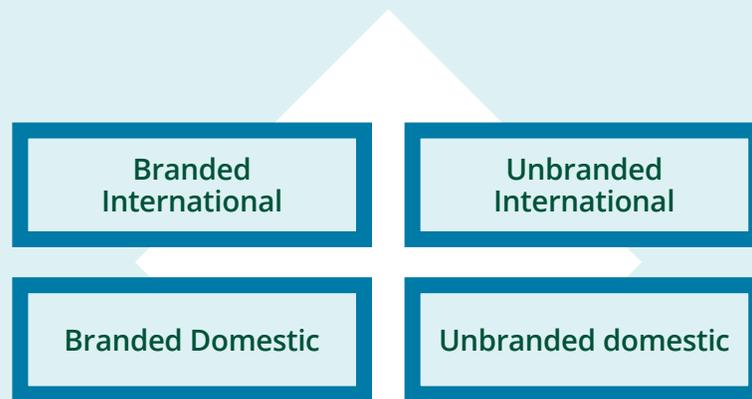


consumer labels or certifications that are driven organically by consumers, retailers demanding a certain level of certification or traceability, or certifications or labels that are driven by importing State governments. Another term for this type of intervention that will be used in the rest of this discussion is market-based incentives. For this report market-based incentives include fishery improvement plans (FIPs) that lead to certifications, Marine Stewardship Council (MSC) certifications (or other independent certification bodies), and/or traceability requirements. These incentives encourage consumers to increase purchases of sustainable seafood in hopes that increased demand and enhanced prices for these types of products encourage high production of sustainable products using sustainable practices.

The push incentives concern the production side of the seafood supply chain. These kinds of incentive-compatible interventions include, but are not limited to, technology investment (bycatch

reduction devices for instance), bycatch taxes, Coasian bargaining, and RBM. These incentives act by directly impacting the production function of the harvesting firm or the value generated for States' leasing of access rights. Taxes on bycatch, for instance, increase the cost of catching fish that are discarded, creating an incentive to avoid bycatch. RBM can increase dockside prices and reduce fishing costs, generating higher profits and incentivizing more sustainable harvesting practices. Defining these separately helps in the discussion but does not mean that they are mutually exclusive. An approach focusing on one type of incentive may be the best course of action, or it may be that a combination of programs is needed to achieve the conservation goals in international ABNJ fisheries. While market-based incentives are covered in this report, RBM is the primary focus to address the common pool or open access problem.

Figure 2. Market-Based Incentives Matrix (Roheim 2016).



Market-Based Incentives

Market-based incentives require a set of enabling conditions that are similar in some regards to the enabling conditions for RBM or other incentive-compatible activities. Certifications require that seafood come from sustainable activities. Those activities have to be defined, verified, and monitored by an independent verification body. Generally, requirements include that the fisheries operate under sustainable harvest control rules

Market-based incentives are expected to result in price premiums or some other benefit to the industry.

However, the costs of fishery improvements are often incurred before any price premium emerges, if it does at all. As a result, fishery improvement projects (FIPs) are typically funded by industry, outside investors, or through other creative strategies such as joint ventures.

(HCR) and ensure no unsustainable bycatch or other environmental damages. Part of the verification process involves the ability to track seafood through the value chain to ensure that the fish being sold as certified can indeed be traced back to the sustainable process. Market-based incentives are expected to result in price premiums or some other benefit to the industry.³

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often requires the creation of an entity that can shepherd the process through to certification.

Evaluating the effectiveness of planned interventions is difficult and not without controversy. There is wide literature on the topic across other resources, such as forest products, and a growing literature in fisheries. The reader is directed to the following sources for more evaluation reading: Roheim, Santos, Asche 2011; Sogn-Gronvag et al. 2013, 2014; Asche et al. 2015; Stemle, Uchida and Roheim 2016; Blomquist et al. 2014; Bronneman and Asche 2015. Roheim 2016 developed a matrix to assist with the assessment and development process, displayed in Figure 2. The discussion that follows Figure 2 is taken from Roheim (2016). All but unbranded domestic market-based incentives have clear successes in passing incentives back to the harvester to improve sustainability.

Branded international is the most recognized process whereby the value chain demands sustainable seafood. That is, consumers in North America, the European Union, and Oceania demand the purchase of certified products from both their domestic producers and from the seafood they import. The incentives are aligned around NGO pressure points, brand risk, and developed country markets. The brand risk can fall on the final market, to middle chain partners, or to NGOs who support the value chain. This type requires some level of traceability, which may include monitoring of IUU and human rights concerns as well as stock sustainability concerns. The purchasing of these types of products disregards branded primary products, such as canned tuna, because the importers develop relationships with suppliers around the world whom they trust to meet the market's or importer's requirements.

³ Secure access to premium markets is another expected benefit of certification programs.

⁴ It has been somewhat difficult to empirically detect price premiums within some certification programs.

Unbranded international involves importers in developed countries buying products such as fresh/frozen, processed, or packaged selecting sources based on trust relationships. This is not as clear or transparent as branded. However, as long as one firm along the value chain has a brand that requires traceability, it may still result in a conservation incentive passing back to the harvester.

Branded domestic relies on brand risk being important. One version involves branded products sold in domestic markets. In this case, the tactics of NGO pressure to create brand risk if fisheries are not sustainable and the tactics of NGOs to develop the demand for sustainable seafood seem to be effective. Another version involves internationally branded retailers functioning within the market. In this case, large retailing chains have set procurement rules that require certified product. The brand risk in this case is driven by shareholders and developed-country consumers with the goal of avoiding any negative publicity. Even in the developing world, some domestic value chains are beginning to require sustainability branding and traceability.

Finally, unbranded domestic is the case in which it is not clear if market-based incentives can be effective. In this case success may rely on the local processor. Generally, developing countries export higher valued seafood products to the developed markets and import lower valued products (Asche et al. 2015). But because high quality and lower quality fish come from the same fishery, the certifications above for developed countries may drive the local demand to be sourced from a certified fishery. Conversely, developing countries might seek to improve their lower valued fisheries to gain access to developed markets. However, if there is not an export opportunity to the developed world, it is unclear if a market-based incentive would have a role.

There are a host of issues with market-based incentives. One critical issue is that each

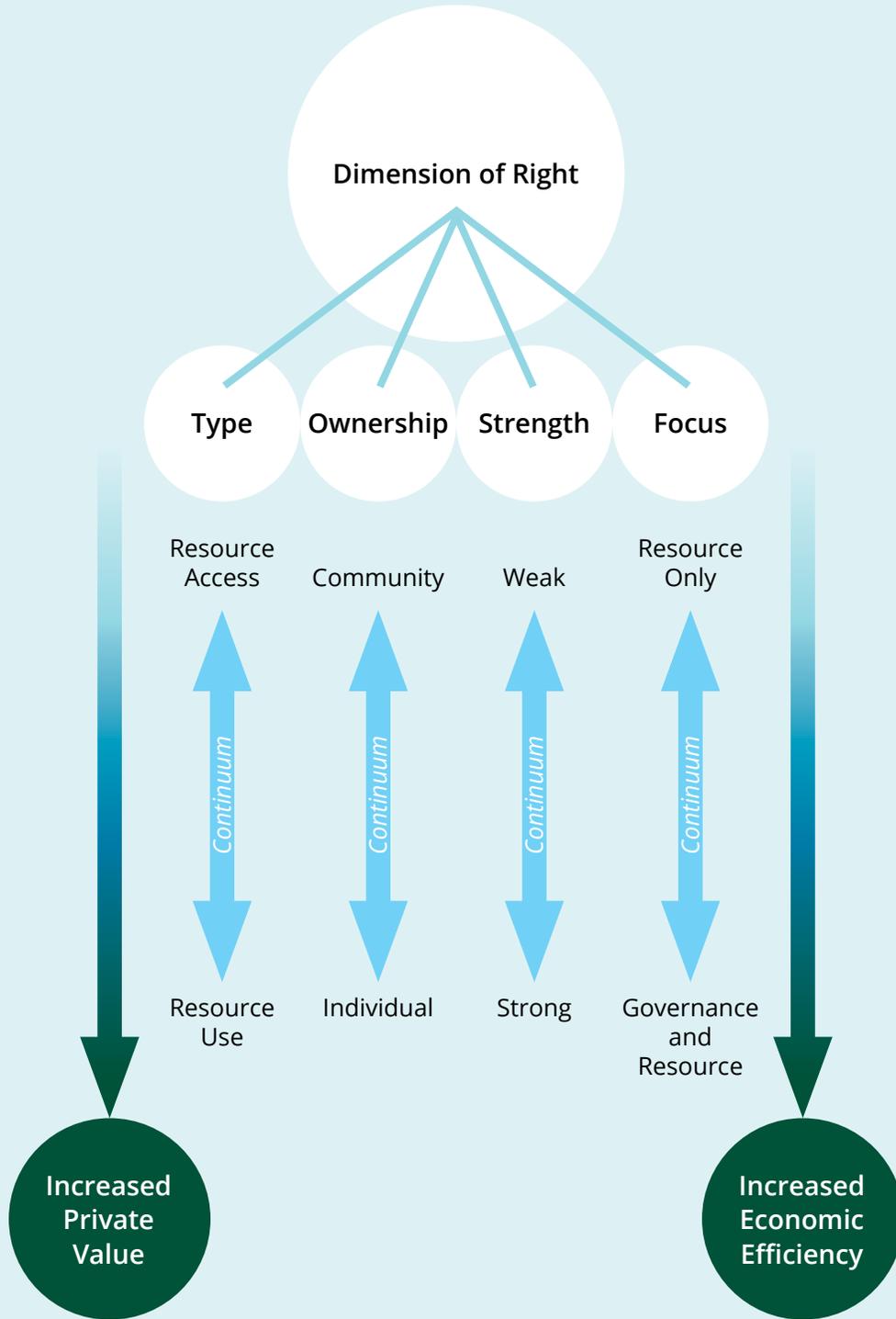
certification body that has emerged has defined sustainability in different terms. This can add to consumer confusion about what the products' price premium purchases, and ultimately results in the dilution of the label's effectiveness. Also, if you view the fish as the principal, there is a principal agent problem with certification. That is, as demand for certification increases, the incentive is to reduce certification quality. Certifiers are competing for clients and they get paid more if they certify a fishery and become the insurer of that certification. They also compete by promising certifications. There is also a vertical dimension at work. What are the incentives at the local level versus the incentives further up the supply chain at the sub-national, national, sub-regional, and regional levels?

RBM and the First Best

RBM can be a complicated area of ICM, with many dimensions and nuances. The important point to make within the context of this report is that there is the ideal securitization of rights, considered the first best strategy, that produces the maximum economic efficiency, but it is rarely, if ever, attained. There are a number of reasons that the first best cannot be attained or may not be desirable, particularly in ABNJ fisheries. This section relies on the expanded detail included in the RBM Technical Appendix to this document and summarizes the characteristics of the first best, and why it is that either the first best is unattainable—based on international laws, fishery conditions, or social practices—or whether the first best is undesirable due to fairness, equity, or distributional concerns.

RBM can be separated into four basic dimensions: right type, right ownership, right strength, and right focus (Schlager and Ostrom 1992; Ostrom 2008). All of these dimensions exist on a continuum as demonstrated in Figure 3 in the RBM matrix. As one moves to the right on each

Figure 3. Rights-Based Management Matrix.



dimension, resource rents increase and economic efficiency increases. Additionally, private value increases as well, which might be viewed positively or negatively depending on the culture and history of the fishery use in the region. These dimensions are all separate concepts and are not mutually exclusive. For example, it is possible to have the management right assigned to the government, while the resource right is assigned to the individual. It is also possible to have the management right assigned to the community, but have the resource right largely be an open access regime. Resource rights can be further delineated into access rights and use rights, where effort-based rights are largely access rights and individual or group quotas are use rights. Finally, this matrix assumes that the right-most end point of each continuum represents the first best definition of that dimension. For example, the literature contains counter-factuals that detail community-based ownership regimes that are more efficient than an individual right in practice. However, there is wide agreement that a first best individual right is more economically efficient than a well-designed community-based right.

The first best is a strong individual right to both the resource and management, but only in terms of economic efficiency. There is a lot of criticism of strong individual rights along fairness, equity, and livelihood grounds. Additionally, as seen in the summaries below, there are many goals that are important in the communities that support global tuna fisheries that recommend attenuation of the strong rights to meet other objectives besides economic efficiency and rent maximization. The efficiency, or resource value, outputs also follow that continuum. That is to say, even though the rights are weaker, there are still efficiency gains in moving away from regulated open access. In the use of RBM and market-driven interventions in global tuna fisheries, there are many issues, not the least of which are inadequate or incompatible legal frameworks, the subject of another summary. Other issues include heterogeneity

across fishers, across nations, and across RFMOs. Generally, the more homogeneous, the easier reform is, and moving towards RBM can be significant reform undertaking. It must be noted that any meaningful reform is a serious undertaking, however, and often RBM can be an easier sell to stakeholders because there will be resource rents to distribute.

Additionally, in tuna fisheries there are conflicts between the haves and the have-nots. The haves are nations that developed fishing infrastructure and processing capacity before many of these RFMOs were established. Typically, they have been fishing the high seas and in the EEZs of small island developing states (SIDS) and coastal developing states, and therefore have some claim to those resources. The have-nots, on the other hand, are the SIDS and coastal developing states that now want to pursue their development aspirations to fish their own EEZS and the high seas. When most of the world's tuna resources are nearing fully-exploited or over-exploited, the stage is set for conflict. For fairness and equity, development aspirations must be recognized, but recognizing them without also cutting harvest somewhere else is a recipe for continued declines. It is against the haves' best interests to take all the cuts, setting the stage for gridlock in the RMFO process. To alleviate the conflict and move forward, it is sometimes necessary to step away from the first best or make other concessions.

Beyond those labels, design of these programs needs to be cognizant of who bears the costs of conserving stocks and who receives the benefits. While that issue exists for State-based RBM programs, the problem is exacerbated across sovereign nations. Some nations have huge investments in shore-side processing employment, and any cut impacts not only their fishermen but also large chunks of processing employment. Distribution of fisheries wealth can be a very important reason to back away from the first best.

Finally, everyone has to agree to an RFMO solution. Most RFMOs run by consensus, making large changes quickly nearly impossible. This is why the discussion below will circle back to progressive nudging, graduality, and incrementalism. State-based RBM projects move at the speed of lightning compared to RFMO-based projects, and it is important to use stakeholder-driven processes, market projects, and infrastructure projects to incrementally move upwards on the continuum to stronger rights, more sustainability, and better fisheries value if RBM is to be pursued. It is important to start slowly to avoid conflict and to enhance equity and fairness.

The best strategy may be one that minimizes negotiations with multiple sovereign nations at the RFMO level. One example of rights-

based strategies undertaken in transboundary stocks—the vessel day scheme implemented by a subgroup of Forum Fishery Agency members—was undertaken across a small group of homogeneous nations to avoid the legal and institutional problems of implementing rights at the larger RFMO level. The real takeaway here is not to let the perfect (the first best) be the enemy of the good. There are benefits to be had in moving in a more incentive-compatible direction even if it is impossible or undesirable, to move to a strong individual right. The technical appendix discusses the details of what defines the first best in terms of right securitization and what specific items drive the shift away from the first best to create incentive-compatible reforms in ABNJ fisheries that can be successful.

Global Experience with Incentive-Compatible Management

In this section, regional experiences with ICM in ABNJ fisheries are highlighted, including completed or ongoing market-based and RBM interventions, and also including projects proposed in the larger OPP plan for these regions. This section will detail the region-by-region pre-implementation and implementation strategies that have been successfully nudging management in the direction of sustainability and higher returns through ICM. While this is not an exhaustive list of all ICM applied in ABNJ fisheries, a wide range of fisheries were included, mostly focusing on global tuna fisheries and regions of focus for the OPP. For each region, the underlying fishery problem is detailed, and then implementation, design, and performance of RBM tools are discussed. Additionally, any market-based tools that have been applied are highlighted. Finally, for each region, the current pilot projects under the OPP are detailed.

Atlantic Ocean

Highly migratory species in the Atlantic are managed by the International Commission for the Conservation of Atlantic Tunas (ICCAT). Their convention area covers the entire Atlantic Ocean. This section examines state-level RBM activities in the United States to manage their BFT quota and pilot projects in the Caribbean to reduce billfish mortality and improve tuna value chains.

The LL fleet in the United States targets YFT and SWO in the Gulf of Mexico (GoM), and mostly

SWO in the Atlantic. Both species are currently managed by ICCAT. The East Coast tuna PS fleet also catches BFT, but there, effort has been falling for years. The entire fishery fleet also has high bycatch of bluefin tuna (BFT), turtles and other protected species. Rationalizing commercial fishing has become a hot topic in the United States, and NMFS has been a strong advocate for an increase in the use of RBM programs in other fisheries including halibut, another transboundary species. ICCAT has also set TACs and allocated those TACs across the following species in addition to BFT (east and west): SWO (north and south), BET (for major players), ALB (north stock only), and YFT (only since 2012).

Problem

Atlantic bluefin tuna stocks are in trouble both in the Western and Eastern Atlantic. Safina and Klinger (2008) believe the Western Atlantic stock is in danger of extinction in the near future. Years of exceeding quotas and lack of management action have driven the species to near commercial extinction. As recently as 2008, scientists recommended a worldwide total allowable catch (TAC) between 8,500 and 15,000 MT to recover the stock (Safina and Klinger 2008), but ICCAT set the TAC at 22,000 MT. This year, ICCAT has increased this TAC to 28,000 MT with plans to increase it to 36,000 MT by 2020.⁵ Many NGOs are concerned that these increases will jeopardize stock recovery efforts. In addition to ICCAT setting TACs that are believed to be too high, landings in the Eastern Atlantic continue to exceed their assigned TACs by as much as 240 percent (Safina

⁵ <https://www.undercurrentnews.com/2017/11/22/iccat-to-boost-atlantic-bluefin-quota-to-36000t-by-2020>.

and Klinger 2008). On top of the TAC overages, it is suspected that there is a high amount of illegal fishing of the Eastern Atlantic stock, further jeopardizing the recovery of BFT.

While the Eastern stock is different than the Western stock, there is significant mixing (Safina and Klinger 2008). Eastern catch quotas are higher. Eastern fishing capacity is higher. There is more illegal fishing in the Eastern Atlantic. BFT landings in the Eastern Atlantic regularly exceed the set quotas. The Eastern landing of Western fish could be quite high. As a result, 2003 was the last year the U.S. tuna fleet was able to land its complete quota, and in 2008, the fleet was only able to land 25 percent of its allowed quota. The activities in the Eastern Atlantic are impacting recreational fishermen, commercial fishermen, processors, wholesalers, and retailers in the United States negatively.

An ICCAT initiated independent review of its organization and the management of bluefin tuna (BFT) concluded that ICCAT management was an “international disgrace” (Hurry, Hayashi, and Maguire 2008, p. 2). Because of the incredible value of this species, the incentive is great to bust quotas, fish illegally, and place pressure on politicians to keep the fishery landing more fish than is recommended by scientists. Additionally, ICCAT lacks the political will to make the tough choices necessary to recover this species. As a result, Monaco submitted a proposal to include Atlantic BFT in Appendix I of the Convention on the International Trade in Endangered Species (CITES), and that motion was rejected at the CITES meeting of the Conference of the Parties in 2010 (American Free Press 2009). BFT has now been entered into a 15-year recovery plan (Aranda et al. 2012). All CPCs were required to submit capacity management plans, develop vessel lists, and put in place provisions to manage their quota allocation. This is the only ICCAT fishery that requires annual capacity management plans.

Historic domestic management in the GoM and Atlantic tuna fisheries can be characterized by top-down mortality controls including total allowable catches, time/area closures, and gear restrictions. Of the total US quota, 8.1 percent has been allocated to the LL sector (NMFS 2104). In the GOM, the LL fleet targets YFT and SWO, and primarily SWO in the Atlantic, but it has a substantial bycatch of BFT that must be discarded dead under previous regulations. Landings plus dead discards have been significantly over that sub-quota in recent years. While this sub-quota was busted, during the same time the United States was not catching its total quota of BFT. However, dead discards continued to grow, prompting the United States to explore ways to reduce dead discards in the LL fishery through tools besides the top-down input controls that had failed to work.

Implementation

As with halibut and SBFT in Australia, the United States has decided to manage the BFT bycatch problem in the GOM using a State-based individual quota system. This is only possible here, as in the other State-based ITQs, because ICCAT has set an overall TAC for BFT, and has allocated that TAC to individual CPCs who are then free to manage as they wish (Squires 2014). This combines international common property and limited duration CPC use rights (Maharaj 2016). Because the BFT quota wouldn't be successful without ICCAT country quotas and because ICCAT was one of the first and is still the only RFMO with country quotas for most managed species, a short digression on ICCAT allocations is warranted.

ICCAT was established in 1966. The original convention does not mention TACs or allocation and has never been amended to explicitly recognize either. Some delegations in the past have said that “a system of quotas is foreign to the spirit of the Convention” (ICCAT 1982, p. 79). ICCAT first considered TACs and allocation for YFT

in 1971, but decided it was too difficult, mainly due to lack of data and assessment capability. Many argued that ICCAT could not set a TAC without hard State allocations, and many said both TACs and allocations were unacceptable. For BFT, the topic of allocation did not arise until 1982. Agreement on TACs and allocation for BFT was difficult and had to be reached through closed-door negotiations between the delegation heads only. No formula was used but the allocation was purportedly set based on historical catches, monitoring needs, and economic factors. One delegation, Cuba, was not a party to the negotiations, and the TAC and allocations spawned much controversy. Negotiations should not have been carried out in private, and the larger ICCAT body objected to the idea of quotas. The 1982 assessment was thrown out, and many argued the TAC and allocation should also be thrown out in favor of the 1974 mortality measures. The TAC was increased in 1983 and the same allocation scheme was maintained.

The above two processes set a precedent for SWO, Eastern and Mediterranean BFT, and North Atlantic ALB. In these fisheries, ICCAT first froze mortality, creating an implicit allocation. Second, it moved to adopt a TAC and allocations based on history across a referent period. However, there was considerable political capture carried out behind the scenes. Many States received exemptions to allow small-scale fishing nations and coastal States to participate. These exemptions were put in place based on coastal State equity claims. There were many objections in the contentious process, making consensus difficult. In the end, even with the exemptions, coastal States were very dissatisfied.

Initial allocations and allocating to new entrants are very acrimonious within ICCAT. Between 1983 and 1991 allocations used stock status, historical catches, proximity to coastal States, need to provide data for stock assessments, and some consideration for small and developing States as criteria, although there was no quantitative

formula used (Grafton et al. 2010). Overall, historical catches carried the day, prompting coastal States with low catches to press for different criteria. Due to these objections, the allocation was changed in 2001.

ICCAT has not adopted a formal allocation process, and instead uses direct negotiation between parties (IOTC 2011a). These negotiations, however, are guided by a set of guidelines laid out in Recommendation 01-05 and listed in Box 2. These guidelines took three years and several meetings to develop. Allocations developed under these guidelines are valid for three years and are not transferable, except temporarily and with prior approval.

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From Box 1 (next page), the guidelines account for artisanal, subsistence, and small-scale coastal fisheries, and should use socioeconomic factors, food security, and income and employment (Meski 2010). These guidelines must be applied "in a manner that encourages efforts to prevent and eliminate over-fishing and excess fishing

Box 1. ICCAT Allocation Criteria

I. Qualifying Criteria: Participants will qualify to receive possible quota allocations within the framework of ICCAT in accordance with the following criteria:

- Be a Contracting or Cooperating Non-Contracting Party, Entity or Fishing Entity
- Have the ability to apply the conservation and management measures of ICCAT, to collect and to provide accurate data for the relevant resources, and, taking into account their respective capacities, to conduct scientific research on those resources

II. Stocks to Which the Criteria Would Be Applied: These criteria should apply to all stocks when allocated by ICCAT.

III. Allocation Criteria:

A. Criteria Relating to Past/Present Fishing Activity of Qualifying Participants:

- Historical catches of qualifying participants
- The interests, fishing patterns and fishing practices of qualifying participants

B. Criteria Relating the Status of the Stock(s) to Be Allocated and the Fisheries

- Status of the stock(s) to be allocated in relation to maximum sustainable yield or, in the absence of maximum sustainable yield, an agreed biological reference point, and the existing level of fishing effort in the fishery, taking into account the contributions to conservation made by qualifying participants necessary to conserve, manage, restore, or rebuild fish stocks in accordance with the objective of the Convention
- The distribution and biological characteristics of the stock(s), including the occurrence of the stock(s) in areas under national jurisdiction and on the high seas

C. Criteria Relating to the Status of the Qualifying Participants

- The interests of artisanal, subsistence, and small-scale coastal fishers.
- The needs of the coastal fishing communities, which are dependent mainly on fishing for the stocks
- The needs of the coastal States of the region whose economies are overwhelmingly dependent on the exploitation of living marine resources, including those regulated by ICCAT
- The socio-economic contribution of the fisheries for stocks regulated by ICCAT to the developing States, especially small island developing States and developing territories from the region
- The respective dependence on the stock(s) of the coastal States, and of the other States that fish species regulated by ICCAT
- The economic and/or social importance of the fishery for qualifying participants whose fishing vessels have habitually participated in the fishery in the Convention Area

- The contribution of the fisheries for the stocks regulated by ICCAT to the national food security/ needs, domestic consumption, income resulting from exports, and employment of qualifying participants
- The right of qualified participants to engage in fishing on the high seas for the stocks to be allocated.

D. Criteria Relating to Compliance/Data Submission/Scientific Research by Qualifying Participants

- The record of compliance or cooperation by qualifying participants with ICCAT's conservation and management measures, including for large-scale tuna fishing vessels, except for those cases where the compliance sanctions established by relevant ICCAT recommendations have already been applied
- The exercise of responsibilities concerning the vessels under the jurisdiction of qualifying participants
- The contribution of qualifying participants to conservation and management of the stocks, to the collection and provision of accurate data required by ICCAT, and, taking into account their respective capacities, to the conduct of scientific research on the stocks

IV. Conditions for Applying Allocation Criteria: The allocation criteria should be applied in a fair and equitable manner with the goal of ensuring opportunities for all qualifying participants.

- The allocation criteria should be applied by the relevant Panels on a stock-by-stock basis.
- The allocation criteria should be applied to all stocks in a gradual manner, over a period of time to be determined by the relevant Panels, in order to address the economic needs of all parties concerned, including the need to minimize economic dislocation.
- The application of the allocation criteria should take into account the contributions to conservation made by qualifying participants necessary to conserve, manage, restore, or rebuild fish stocks in accordance with the objective of the Convention.
- The allocation criteria should be applied consistent with international instruments and in a manner that encourages efforts to prevent and eliminate over-fishing and excess fishing capacity, and ensures that levels of fishing effort are commensurate with the ICCAT objective of achieving and maintaining MSY.
- The allocation criteria should be applied so as not to legitimize illegal, unregulated, and unreported catches, and shall promote the prevention, deterrence, and elimination of illegal, unregulated, and unreported fishing, particularly fishing by flag of convenience vessels.
- The allocation criteria should be applied in a manner that encourages cooperating Non-Contracting parties, Entities, and Fishing Entities to become Contracting Parties, where they are eligible to do so.
- The allocation criteria should be applied to encourage cooperation between the developing States of the region and other fishing States for the sustainable use of the stocks managed by ICCAT and in accordance with the relevant international instruments.
- No qualifying participant shall trade or sell its quota allocation or a part thereof.

capacity and ensures that levels of fishing effort are commensurate with the ICCAT objective of achieving and maintaining MSY.⁶ These guidelines are extensive and inclusive, and provide a strong basis, at least on paper (Cox 2009). However, due to the inclusiveness, it has been impossible to reach consensus on weighting. Instead, the criteria have been used qualitatively. Since 2002, these guidelines have also been used to expand ICCAT membership with additional allocations justified on existing fishing patterns or aspirations (MRAG 2009). For instance, in 2002 Mexico was allocated 25t of SWO in recognition of its aspirations. The 2002 SWO rebuilding plan included allocations to the traditional parties plus Morocco, Mexico, Barbados, Venezuela, Trinidad/Tobago, the United Kingdom, France, China, and Chinese Taipei in recognition of existing fisheries or aspirations. For Eastern Atlantic and Mediterranean BFT, the 2002 allocations added Libya and Morocco. Both had abandoned the allocation discussion previously, yet continued to fish. It was hoped that by granting the quota, they would behave. As a result, the total BFT TAC was significantly higher than the scientifically established TAC by allocating catch quotas to new entrants.

This experience with SWO and BFT is unfortunately similar to other stocks. BET was allocated in 2004, but allocations are not set in stone. It was the result of a negotiated process, but based mostly on recent historical catches and not restrictive. South Atlantic ALB is still an Olympic fishery. North Atlantic ALB was first allocated in 2002 recognizing existing parties, allowing the carryover of 50 percent of the allocation from year to year. This allocation set aside a portion of the TAC for other contracting parties in a small competitive pool.

ICCAT also has recommended total landings limits for sailfish (west and east statistical stocks), for combined white marlin and roundscale spearfish

(oceanwide) and for blue marlin (oceanwide). Landings-limit proportions have been allocated between signatory nations, seemingly without recognizing the impacts of increasing harvests by other fleets upon billfish stock sustainability. Illegal fishing and poor data reporting are also primary concerns for Atlantic billfish species, all of which have experienced overfishing for at least a decade.

There is growing dissatisfaction with allocation in ICCAT. The Commission's powers are viewed as weak relative to Article VII, calling for quota allocations. The non-binding nature of the current criteria is also driving the dissatisfaction. Additionally, many feel the criteria are overly ambiguous and feel the process is not transparent enough. Currently, it is felt that the ICCAT criteria constitute nothing more than a "shopping list" that States use to pursue their national interests using equity arguments (Butterworth and Penney 2004, p. 181).

ICCAT has explicitly discussed tradability in an ad hoc allocation working group, and there has been widespread dislike of selling or trading quotas. Some contracting parties have argued that if allocation were set correctly, there would be no need to trade. However, ICCAT does allow temporary transfers, and those transfers have been successful. Many wanted prohibition on all trades or transfers, but there seems to be wide acceptance of temporary transfers. Right now, permanent transfers are prohibited and temporary transfers are only allowed if approved by the commission. However, Recommendation 2008-04 states:

Notwithstanding the *Recommendation by ICCAT Regarding the Temporary Adjustment of Quotas* [Rec. 01-12], in between meetings of the Commission, a CPC [Contracting Party] with a TAC allocation under paragraph 6 may make a one-time

6 ICCAT Recommendation 2001-25.

transfer within a fishing year of up to 15% of its TAC allocation to other CPCs with TAC allocations, consistent with domestic obligations and conservation considerations. The transfer shall be notified to the Secretariat. Any such transfer may not be used to cover overharvests. A CPC that receives a one-time quota transfer may not retransfer that quota. For parties with a quota allocation of 4 t, the transfer may be up to 100% of the allocation.

The Recommendation thus allows small, one-time quota transfers without prior approval. The ICCAT review panel was hesitant to go further over concerns about unreliable catch reporting. However, the review panel has recommended analyzing the creation of a quota trade market. As for the BFT dead discards and the implementation of the individual bycatch quota, by 2006 the industry had realized that dead discards were a serious problem, and besides the use of bait restrictions, weak hook restrictions, and time and area closures, were not getting any better. It was in that year that NOAA gave a six-year notice of proposed rulemaking and set about exploring alternative strategies to manage the dead discard problem.

HMS species in the United States are the only species complex not managed by a regional fishery management council. Instead, NMFS manages this fishery directly and uses stakeholder Advisory Panels (APs), which are seen by all stakeholders as open and transparent communication and policy creation bodies. The industry recognized there was a conservation issue and recognized that they faced too many regulations that were not working. As a result, they were ready for change. There was a sense that the dead discard issue had reached crisis levels. It was through the AP process that this Amendment was developed. However, it cannot be called a bottom-up process, as there is a definite regulator/regulated dynamic in U.S. HMS management. Planning and design were

handled directly by NMFS. There was no industry champion per se, but they had several early adopters that volunteered to test the monitoring equipment. NMFS also wrote the regulations for the monitoring system in a functional way instead of providing detailed engineering specifications. This gave vessel owners a lot of flexibility, and was a nod to industry that really helped with adoption. Also helpful was the fact that NMFS paid for all of the Electronic Monitoring (EM) hardware, installation, maintenance, and auditing, with no cost recovery to date.

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Overall, acceptance could be characterized by grudging acceptance. There was a lot of resistance to EM, particularly the use of cameras, for privacy reasons. Paying for the full cost of the system proved crucial. Additionally, now that the program has been in operation nearly three years, some captains view the data collected via the EM system to be helpful to their business. The captains are able to observe what is happening on the back deck, which both keeps the crews safer and helps with injury disputes that might arise. Another point about the EM implementation that has helped a great deal is that enforcement never kept a boat at the dock for a failed EM system, if the maintenance people had been called and NMFS had been notified. Additionally NMFS does not require the vessel to stop fishing if the EM system fails while on the water. This flexibility has bought a lot of good will with the harvesters.

Design

Highly migratory species in the United States are managed directly by NMFS. At the Highly Migratory Species (HMS) Advisory Panel Meeting in March 2012, NMFS released a white paper regarding options to reduce BFT interactions (NMFS 2012). This was preceded by a white paper describing the bycatch issue in the GOM in 2011. Their proposals included a fishery-wide, open access BFT catch cap that includes a complete closure for all gears when the cap is reached and an individual tradable catch quota or individual catch cap (ICC). The latter represents a step towards the use of RBM to control BFT interactions using an incentive-compatible approach. An ICC would allow harvesters to use the market to equate the marginal cost of bycatch avoidance with the marginal benefit of bycatch (Abbot and Wilen 2006). NMFS's stated objectives for this proposal include reducing dead discards and optimizing fishing opportunity. It will allow harvesters to retain and sell BFT and reduce dead discards. However, NMFS could ratchet down the total cap over time to reduce U.S. catch of BFT, even if it might not have a conservation impact for the stock as a whole. This proposal went on to become Amendment 7 to the 2006 Consolidated Highly Migratory Species Fishery Management Plan. The final rulemaking was signed in late 2014 to take effect 1 January 2015.

The stated goals of the individual bluefin quota (IBQ) include (NMFS 2014):

1. Limit the amount of bluefin landings and dead discards in the pelagic longline fishery;
1. Provide strong incentives for the vessel owner and operator to avoid bluefin tuna interactions, and thus reduce bluefin dead discards;
1. Provide flexibility in the quota system to enable pelagic longline vessels to obtain bluefin quota from other vessels with available individual quota in order to enable full accounting for bluefin landings and dead discards, and minimize constraints on fishing for target species;
1. Balance the objective of limiting bluefin landings and dead discards with the objective of optimizing fishing opportunities and maintaining profitability; and
1. Balance the above objectives with potential impacts on the directed permit categories that target bluefin tuna, and the broader objectives of the 2006 Consolidated HMS FMP and MSA.

Under this option, NMFS would allocate a portion of the LL category BFT quota to LL boats in the GOM (NMFS 2014). Once a vessel had caught their IBQ they would no longer be allowed to fish LL gear. Initial allocation would be set using catch history for boats permitted in the Atlantic tunas LL category that held the limited access SWO and shark permits as well, and that eligibility would be contingent on the vessel being "active." An active vessel is any permitted vessel that set LL gear at least once during the period of 2006-2012. As of final rulemaking, the universe of eligible vessels was 170. However, upon sending letters of eligibility to those 170 vessels, it was found that 35 vessels were no longer in service, so the universe of participants shrank to 135.

Allocation of the quota is based on the designated species and the ratio of BFT catch to HMS landings. This formula takes into account catch history and past avoidance of BFT catch. History that reflected avoidance of BFT bycatch would be rewarded with more IBQ. Designated species landings and BFT landings in weight would be calculated from dealer landing receipts and logbook data during the 2006-2012 fishing seasons. Vessels were then placed in bins according to their designated species landings (high, medium, and low), and each bin was assigned a score with the score of three being the highest landings. The ratio of BFT landings to designated species landings was calculated for each boat, and because these ratios are typically very small due to the bycatch nature

of the fishery, they were multiplied by 10,000. Vessels were likewise put into high, medium, and low ratio bins and each bin assigned a score with low ratios receiving the highest scores. The purpose of scoring low ratios highly is to reward BFT avoiders with higher quotas. A more detailed rationale for this reverse allocation is included in the full amendment, but the summary is that NMFS wanted to provide a strong incentive to those with highest interactions to modify behavior, as quota levels would no longer cover current fishing practices at the time.⁷ For those vessels with minimal interactions, there were immediate benefits to that fishing behavior: in the form of more IBQ they could lease to vessels with higher bycatch. These two scores were summed to achieve the vessel score. If a boat was a tuna highliner with low BFT bycatch, it would receive a score of six, which is the maximum score. If a boat had low tuna harvest but high BFT bycatch, it would receive a score of two, the lowest score possible.

Quota shares were divided into score bins with the bin's total quota proportional to the landings across the vessels in that bin. Using the scores determined in the binning above, the vessel is placed into a quota assignment bin and every vessel in that bin receives an equal share of the quota. There are only three quota bins. High scores of five to six are put in the same high bin and received 1.2 percent of the quota, which was equal to 1.64 MT at program inception. Medium scores, four, were given 0.6 percent of the quota or 0.82 MT in 2014. Finally, the lowest two scores, three to two, received 0.37 percent of the quota or 0.51 MT in 2014. Basically, the low category is allocated two average-sized BFT per year, medium slightly over three BFT, and the high bin slightly over six BFT per year. The total allocation to the LL fleet was nearly doubled for this IBQ, representing a substantial increase in mortality for this fleet. That increase was taken from the other sectors

in this fishery. All legal-sized BFT (>73 inches) are required to be landed against this quota and cannot be discarded.

The minimum IBQ required to depart on a trip in the Atlantic would be 0.125 MT whole weight or approximately 276 pounds and 0.25 MT (551 pounds) if fishing in the GoM. If a vessel is fishing in the Northeast Distant (NED) fishery, BFT catch in the NED would only count against the IBQ after the NED 25 MT set-aside was caught. All trade in quota is to be recorded electronically. Also, quota shares would be designated as either Atlantic or GOM shares, based on fishing history. However, if a split resulted in reducing a regional quota below the minimum, amounts above it would not be split. A vessel that fished in both oceans historically could be assigned both types of shares. Atlantic shares can only be used in the Atlantic, whereas GOM shares can be used in either location. These rules were intended to keep landings from increasing in the GOM.

Leasing is allowed from the beginning, but sales are banned for the first three years to avoid fleet consolidation. Sale would be considered after that three-year mark, and NMFS would establish excessive share and other limits on share accumulation as needed to comply with U.S. fishery laws. Leasing is allowed between LL and PS permit categories. Lease terms are one calendar year. Proportional shares would belong to the permit holder. By U.S. law, an IBQ conveys no rights, titles, or interest in any BFT until that fish is landed, and does not confer any right of compensation if the IBQ was taken away or the program was otherwise terminated. Only LL and PS category permits are limited entry, general category and angling permits are still open access. As such, only LL and PS permits can buy or lease quota. NMFS is under the mistaken belief that quota systems only work in limited access fisheries. For catch history purposes, any leased catch is attributed to the vessel that leased it.

7 Brad McHale, NMFS HMS Division, Personal Communication.



EM is required, both using vessel monitoring system (VMS) and onboard cameras and data loggers. Boats already had VMS, and the cost and installation of the EM equipment was paid for by NMFS. The only cost to the fisherman is the cost of mailing the hard drive to the audit contractor periodically. The rough cost of EM equipment was \$10,000 per vessel. Electronic monitoring equipment would include two video cameras, a recording device, video monitor, hydraulic pressure transducer, winch rotation sensor, system control box, and/or other equipment deemed necessary. The vessel operator would have to ensure that the recording device is capable of storing material for 120 days. The vessel operator is also responsible for installing cameras, such that haulback and handling of BFT can be observed. Observer coverage was 8 percent of all trips, and that coverage has been carried over.

The program took a phased approach to implementation. While the program started in January 2015, EM did not have to be installed until June of 2015. Some boats volunteered to have the equipment installed before the program started, and the remainder had to schedule a time with a number of pre-approved installers that moved to various ports. Some of the quota rules were phased in as well. During the first year, the program allowed fishers to balance quota only at the end of the year. If they had already expended their quota, they could still go fishing before acquiring the trip level minimum described above. The trip level accountability measures were held off for a year. There were many changes in 2015 with the IBQ, compliance requirements, and two new closed areas. NMFS felt this phased-in approach would enhance success. It turned out that everyone was able to balance their bycatch account through leasing quota when necessary, and there were no boats left with quota debt.

An interesting issue emerged that has somewhat eased the bycatch restrictions. There are only six vessels in the U.S. PS fleet, and their effort has been low and decreasing for years. The PS fleet has a large allocation of BFT quota. Because the fleet appeared to be hoarding quota, not fishing it and not leasing it, NMFS began taking that quota back and redistributing it to the LL fleet. If a vessel was inactive for an entire year, they would only be allocated 25 percent of their quota in the next year. This freed up a lot of quota, and allowed NMFS to conduct an in-season quota distribution using that quota. This allayed many initial concerns from the LL fleet about quota risk, and allowed the market for lease quota to develop and grow. Many LL boats felt there was too much risk in leasing out quota early in the season because the allocations were relatively small, and fishers never know when they might run into a heavy BFT set. These injections of retired PS quota helped reduce their risk and increased trades.

In years two and three (2016 and 2017), accountability measures changed. All vessels wanting to fish pelagic LL gear were required to have the minimum IBQ allocation. In the Gulf of Mexico, that was 0.25 MT whole weight or 0.125 MT whole weight to fish in the Atlantic, with the larger amount required in the Gulf of Mexico due to the larger average size of the bluefin tuna in that region. Those two minimum allocations reflect the historical averages of bluefin in each area. If a vessel exceeded their quota on a particular trip, it could continue the trip but would need to balance its quota before taking another trip. This was done to provide flexibility and reduce dead discards. Any quota debt at year-end was deducted from their quota in 2017.

In response to a suggestion from the HMS Advisory Panel, the accountability rules were modified for 2018 to improve flexibility. In 2018, the fishery entered into a quarterly accountability system. Vessels can fish with a low quota for the quarter they are in, but have to lease or purchase

quota prior to the first trip of the next quarter to meet the necessary minimums described above. All catches still have to be reported at the end of a trip, but quota is balanced quarterly.

The plan calls for a formal evaluation after three years, which is 2018, with pre-defined structure and indicators developed for the report. This is standard NMFS practice for all catch share programs. There will also be a 3 percent cost recovery fee levied on all landings.

Appeals of quota share allocations follow a two-step process for administrative review of allocations. The first step involves captains submitting a written request to have their allocation adjusted indicating the reason for the change. All requests have to be submitted within 90 days of publication of the final rule. HMS staff review the request and approve or deny it. The quota holder has 90 days to appeal the decision. Items eligible for appeals include initial eligibility determination, the accuracy of NMFS records regarding harvest records, and correct assignment of those harvests.

Performance

NMFS is beginning to pull together data for the third-year review, but it will be late into 2018 before all the 2017 data are final. As such, there are no formal analyses of performance. From the standpoint of the fishers, they feel the quota program and full retention of BFT are costly. This is as it should be, by design. Fishers receive decent prices for fish and the prices of leases have been reasonable and falling. But with the monitoring requirements, fishers feel the program impacts their profitability. Initial concerns about EM and leasing costs being too high have dissipated. Some fishers worried that they would catch so many BFT they would go broke. That did not happen to any boats. The industry has even started discussing risk pools and pooling information on BFT location in an effort to move toward real-time spatial management.

NMFS made no attempt to reduce transaction costs in their design, but quota injections definitely helped reduce transaction costs and have encouraged the market to develop. NMFS will also be investigating ways to further reduce transaction costs due to the accountability period being set at the trip level. They will look at monthly, quarterly, and annual quota balancing/accountability windows to see if this reduces transaction cost. NMFS also does not think that transaction costs are that high. There is not a formal market place where quota is advertised, but NMFS has started maintaining a list of those tendering quota and those seeking quota. NMFS did not think it was appropriate to design a marketplace. They do have a system to track all trades, and all trades have to be reported. This system was based on the U.S. snapper/grouper ITQ tracking system.

The system has been set up without any conflict resolution rules in place or a conflict resolution body. So far, there has been no need to have one. There have been some issues with quota transactions and transfer risk due to the way trades are recorded. NMFS is now suggesting that the lessee hold 50 percent of the payment of the quota until after the quota has been deposited in their quota account, and then the remainder is paid.

Dead discards are down 75 percent using the same methods they used to calculate discards before the quota system came into practice; observer data on catch is extrapolated based on logbook effort data. All of that decrease in discards cannot be due to just the IBQ, as there are two new closed areas and effort has been declining overall. One of the new closed areas off Cape Hatteras is only closed to boats with high bycatch. If a fisher's interactions with BFT are low, they can enter that closed area. The number of boats disallowed in that area continues to shrink.

Across other metrics that NMFS tracks, gear restricted areas seem to be working better under IBQs. Additionally, reporting compliance is increasing. There is a new requirement to report BFT catch after every set using VMS, and reporting keeps improving. Overall, even with a very complex administrative program, everything seems to be working. Implementation and compliance are a success, and everyone seems to be playing by the new EM/VMS rules. NMFS have not been able to examine the financial success of the program yet, but will during the three-year review in 2018.

The market for quota also seems to be working well. The amount of quota traded each year has increased every year. Also, the price per pound of IBQ keeps dropping, as one would expect if the incentives are moving boats to avoid BFT. NMFS still does not allow permanent trades to avoid fleet consolidation, but that will be evaluated during the three-year review. The pattern of leasing changed from the first to the second year but this was because NMFS allowed end-of-the-year balancing in the first year of the program. In the second year, under trip level balancing, the trading spread out throughout the year.

In conversations, some NMFS officials advise that more time would have been better. They implemented a very complex change along with numerous other complicated regulations in a very short period of time.

One of the biggest LL communities is Vietnamese. NMFS officials experienced language barriers. They would have loved to do an "implementation road show," traveling around to train dealers and fishers on the new reporting requirements and system, and the new EM. NMFS had a rough start with the IBQ tracking software. They really rushed development and based it on a system already in place in the GoM for grouper/snapper. Having that platform made implementation possible in the short timeframe; however, NMFS is now stuck with architecture fundamentally designed

for another fishery. A better approach would have been to take more time to design a system specific to that fishery. NMFS are still adapting and adding features to that software

NMFS produced a preliminary progress report on the three-year review process at their September 2017 Advisory Panel meeting (NMFS 2017). While the data was not yet final for 2017, data showed significant program success in reducing harvest and dead discard of BFT. Previous to the institution of the program, harvests plus dead discards were 200-400 percent of the allotted quota. The first year of the program, harvests plus dead discards fell to 46 percent of the quota and rose to 61 percent in 2016, a marked reduction. Lease prices for quota have been dropping as trades have increased. Average lease price in 2015 was \$3.46 per pound, falling to \$2.52 per pound in 2016, and for the first three quarters of 2017, averaged \$1.77 per pound.

In closing, NMFS listed all of the enabling conditions that were absolutely crucial to the project's success. First, NMFS paid for the equipment's installation, maintenance, and repair, and monitoring/auditing of the EM program. The industry would never have agreed to spend this much money up front. Second, this fleet was already heavily regulated. Observer, VMS, and logbook requirements were already in place. The fleet was familiar with complex regulations regarding gear and time and area closures, and this program somewhat eased the regulatory burden, although there are still time/area closures.

However, the complexity of the program was daunting, both for fishers and administrators/managers. There were new dealer reporting requirements, new VMS reporting requirements, new EM requirements, new closed areas, and a need to now manage quota. The fleet is very heterogeneous, with a huge geographic scope. Some boats in the fleet are very active, some nearly inactive. Some vessels have very little

BFT interaction, and therefore interact with the monitoring system infrequently, with the result that disseminating information to everyone effectively was very difficult.

Market/Financial-Based Tools

In discussions with NMFS about the IBQ program, another incentive-compatible management intervention emerged. The program is called "Repose," and it offers the Vietnamese LL fleet in LA the opportunity to get paid not to set LL gear. Fishers can accept the payment and still fish greenstick gear for YFT, but they are not required to fish at all. The first year of the program, 2017, seven vessels took the offer. Several converted to greenstick fishing. This program was a compromise to a full buyout of the Vietnamese fleet.

Not long after the Deepwater Horizon oil spill, Pew began a campaign to buy out this fleet using recovered oil fund money for wildlife. Nearly the entire fleet, representing the majority of the LL capacity in the GoM, wanted out of the fishery due to overregulation. The fleet was banned from harvesting BFT, had large spawning area closures, had been required to switch to dead bait, and were forced to use weak hooks to avoid BFT bycatch. Combined with aging vessels and inadequate refrigeration technology, their profitability was suffering. However, buybacks without entry caps or capacity control do nothing and NMFS would not take action to limit capacity, as they felt the United States needed to defend its harvest quotas at ICCAT by maintaining YFT landings. This may be a good compromise that moves boats out of the LL gear and into trolling gear; however, right now it appears to be a social welfare program.

Table 1 (next page) contains the two MSC certified fisheries in the Atlantic. The North Atlantic ALB fishery is prosecuted in the Bay of Biscay and adjacent North Atlantic waters. This fishery was certified in June of 2016. The client is two Spanish

Table 1. MSC Certified Tuna Fisheries in the Atlantic

FISHERY	SPECIES	GEAR TYPES	LOCATIONS	MSC STATUS	MT
North Atlantic albacore artisanal fishery	ALB	Hooks and Lines – Handlines and pole-lines	Northeast Atlantic (FAO Area 27)	Certified	4,300
US North Atlantic swordfish	ALB, YFT, SWO	Hooks and Lines Hooks and Lines – Longlines	Western Central Atlantic (FAO Area 31)	Certified with component(s) in assessment	2,356

producer organizations, OPEGUI and OIPESCAYA, and Cofradía de Pescadores San Martín de Laredo. These organizations represent 42 pole and line vessels and 87 trolling vessels. These two gear types harvest high quality fish with very little bycatch. Most of the fish are canned, and total harvest is about 4,300 MT.

The North Atlantic SWO fishery was certified in 2013 and now includes Southeast U.S. North Atlantic SWO. The main fishery target is SWO with LL and buoy gear; however, the LL fishery also catches YFT and ALB. Most of the SWO fishery goes into the United States' fresh SWO market. The certification of the Southeast U.S. portion of this fishery produced controversy among some environmental groups and recreational fishing groups because it opened up the LL closure area off of Florida to buoy gear. This fishery is prosecuted by a single buyer/processor: Day Boat Seafoods.

Caribbean Pilot Projects

This section switches focus from the United States BFT bycatch quota to the pilot projects in the ICCAT area of competence. The pilot projects in this region focus on reducing billfish harvest in the Caribbean Basin, which is within the ICCAT area of competence. These pilot projects fall under the OPP with FAO as the executing agency. Billfish species, including blue and white marlin, sailfish, and spearfish, make significant contributions to the Caribbean economies, livelihoods, and food security through two very

distinct fisheries: commercial and recreational. Billfish are also important incidental by-catch species from large-scale tuna longline fisheries operating both within and beyond national jurisdictions. Declining trends due to overfishing have been recognized in most billfish species across the Atlantic. This represents a threat to the fisheries sector and to the overall sustainability of respective contributions to regional economies.

The precautionary and ecosystem approach to fisheries principles should certainly be mandated for stocks with such long histories of overfishing and poor data provision. Billfishes are actively, and increasingly, targeted by developing Caribbean fleets which typically do not consider these species as bycatch. ICCAT has not yet instituted aligned reductions in harvests elsewhere in the Atlantic to secure the overall sustainability for these stocks, which have been fished below levels that can support MSY. Caribbean nations' harvest aspirations and high food security reliance upon developing fleets should technically improve their recognition in quota allocation discussions. ICCAT's rebuilding plans for marlins were also noted as failures in the Commission's 2016 independent performance review, within which some Caribbean nations were specifically cited for poor responsiveness or data provision.

The Caribbean Billfish Project aims to develop business plans for one or more long-term pilot projects aimed at sustainable management and conservation of billfish within the Western Central

Atlantic Ocean. The divergence in value between the commercial and recreational subsectors represents a significant “entry point” and opportunity for conservation and value creation, which this project aims to exploit. The completed business plans will incorporate the economic, technical, and financial rationale and feasibility to attract investment involving private and public capital.

The three-year Caribbean Billfish Project consists of the following four components:

1. Generating value and conservation outcomes through tenure-based management or incentive-compatible interventions
2. Strengthening regional billfish management and conservation planning
3. Creating a functional and responsive Consortium on Billfish Management and Conservation
4. Developing business plans for pilot investments in sustainable management and conservation of billfish

Status

The project is structured in such a way that in a three to four-year period, it can achieve the following results:

- Result 1.1. Enhanced knowledge and understanding of the socio-economic and ecological value of billfish resources in the Western Central Atlantic, and a clear value proposition for reform of current billfish governance structures
- Result 1.2. Billfish management options and opportunities explored to enable potential pilot site selection, including reviews of regulatory and institutional arrangements in potential pilot locations
- Result 1.3. Pilot trials established in at least two Caribbean states (countries or overseas

territories) to test and validate innovative management and supporting arrangements. Lessons learned will inform regional approaches in developing and adopting the billfish management and conservation plan for the Western Central Atlantic

- Result 2.1. A regionally-agreed billfish management and conservation plan for the Western Central Atlantic, spanning areas within and beyond national jurisdiction of the Western Central Atlantic
- Result 2.2. Increased capacity within participating Caribbean states to engage in determining improved-shared, high-migratory fish stocks management focused on billfish in the Western Central Atlantic, including contributions toward a more coherent “Caribbean engagement” on these stocks at international fora including ICCAT
- Result 3.1. A Consortium on Billfish Management and Conservation (CBMC) in the Western Central Atlantic, comprising relevant organizations (RFB/RFMOs, INGOs, CSOs, and private sector representatives), with an agreed work plan and budget that responds to project needs.
- Result 3.2. A regional billfish management information system established by the CBMC and hosted at the WECAFC Secretariat
- Result 4.1. Business plans for pilot investment projects on sustainable management and conservation of billfish in up to two locations in the Caribbean

Twelve desk studies, which were initiated under above components (1) and (2) of the project, have been published, with wide distribution in the Caribbean region in hard copy, and soft copies made available online via FAO media messages, the Common Oceans Website, and International Game Fish Association (IGFA) bulletins and website, as well as listserves from the Gulf and

Caribbean Fisheries Institute (GCFI) and the FAO Carib-Agri-list, thus reaching thousands of stakeholders and the general public.

- *Caribbean Fisheries Legal and Institutional Study*, FAO Fisheries and Aquaculture Circular No. 1124. Author: Cristina Leria. Bridgetown, Barbados. PDF URLs: <http://www.fao.org/3/a-i6175e.pdf>.
- *The Value of Billfish Resources to Commercial and Recreational Sectors in the Caribbean*, FAO Fisheries and Aquaculture Circular No. 1125. Author: Brad Gentner. Bridgetown, Barbados. PDF URLs: <http://www.fao.org/3/a-i6178e.pdf>.
- *The Use and Design of Rights and Tenure Based Management Systems for Transboundary Stocks in the Caribbean*, FAO Fisheries and Aquaculture Circular No. 1126. Author: Brad Gentner. Bridgetown, Barbados. PDF URLs: <http://www.fao.org/3/a-i6071e.pdf>.
- *Status of Billfish Resources and Billfish Fisheries in the Western Central Atlantic*, FAO Fisheries and Aquaculture Circular No. 1127. Authors: Nelson Ehrhardt and Mark Fitchett. Bridgetown, Barbados. PDF URLs: <http://www.fao.org/3/a-i6204e.pdf>.
- *A Recreational Fisheries Economic Assessment Manual and its Application in Two Study Cases in the Caribbean*, FAO Fisheries and Aquaculture Circular No. 1128. Authors: Rob Southwick, Brad Gentner, D'shan Maycock, and Myriam Bouaziz. Bridgetown, Barbados. PDF URLs: <http://www.fao.org/3/a-i6148e.pdf>.
- *Western Central Atlantic Fishery Commission Report of the FIRMS-WECAFC Regional Workshop on Recreational Fisheries Statistics in the Caribbean*. The Commonwealth of the Bahamas, 20-22 June 2017, FAO Fisheries and Aquaculture Circular No. R1194. PDF URLs: <http://www.fao.org/3/i8241en/i8241EN.pdf>.
- *Western Central Atlantic Fishery Commission: Third Regional Workshop on Caribbean Billfish Management and Conservation of the WECAFC/OSPESCA/CRFM/CFMC Working Group on Recreational Fisheries*, Bridgetown, Barbados, 4-6 April 2017, FAO Fisheries and Aquaculture Circular No. 1191. PDF URLs: <http://www.fao.org/3/a-bs244b.pdf>.
- *Expenditure and Willingness-To-Pay Survey of Caribbean Billfish Anglers: Summary Report*, FAO Fisheries and Aquaculture Circular No. 1168. Authors: Brad Gentner and John Whitehead. PDF URLs: <http://www.fao.org/3/i9667EN/i9667en.pdf>.
- *Fishery performance indicator studies for the commercial and recreational pelagic fleets of the Dominican Republic and Grenada*, FAO Fisheries and Aquaculture Circular No.1162. Authors: Brad Gentner, Freddy Arocha, Chris Anderson, Keith Flett, Pablo Obregon, and Raymon van Anrooy. PDF URLs: <http://www.fao.org/3/i8833en/i8833EN.pdf>.
- *Caribbean Billfish Project 2018 Brochure*. PDF URLs: http://www.fao.org/fileadmin/user_upload/common_oceans/docs/CaribbeanBillfishProjectBrochure2018.pdf.
- *Economic Impact Analysis of Commercial and Recreational Billfish Fisheries in Grenada and the Dominican Republic*. Author: Brad Gentner. PDF URLs: <http://www.fao.org/in-action/commonoceans/news/detail-events/en/c/1151622/>.
- *Cash Flow Models for Fishery Project Development: A Case Study of the Pelagic Fisheries in Grenada and the Dominican Republic*, FAO Fisheries and Aquaculture Circular. Authors: Brad Gentner, Roy Bealey, Keith Flett, and Raymon van Anrooy. In press.

Supporting documents developed through project activities include:

- Minimum requirements for logbooks and other data collection platforms to support improved data collection, comparability, sharing, and use.
- Endorsed WECAFC Recommendation on Billfish Management and Conservation
- Endorsed WECAFC Recommendation on Recreational Fisheries Management
- Updated WECAFC Recommendation on FAD Fisheries Management
- WECAFC Recommendation and report on sustainably maximizing the ecological and financial efficiency of longline fisheries in the Caribbean region
- Report comprehensively defining FAD effects upon fisheries, and suggesting regional management needs to promote sustainability in FAD associated fisheries
- Minimum requirements for logbooks and other data collection platforms to support improved data collection, comparability, sharing, and use
- Posters and brochures on vessel markings and registrations to support the combatting of IUU fishing for shared fish stocks (Port State Measures and IUU workshop report)
- Inputs from the project to technical workshops on:
 - Shark fisheries management and conservation, supporting crossover of shared stock management needs and best practices for linked fisheries
 - IUU Fishing, contributing to the establishment of an authorized vessel register and IUU vessel lists in the region

- Regional Fisheries governance, building capacity among fisheries-sector stakeholders for the management of transboundary resources

Upcoming reports not yet published include:

- Billfish mercury assessment results, with over 140 samples taken from both marlin species and sailfish in the Caribbean
- Report updating white marlin growth parameters to improve stock assessments
- Techno-economic assessments of the fisheries landing and processing infrastructure in Grenada
- Report on the issues FAD fishing presents in the Caribbean
- Final draft of the Caribbean Billfish Management and Conservation Plan

The Governments of Grenada and the Dominican Republic formally accepted to be pilot countries for testing rights-based and innovative approaches for billfish management and investments, and appointed national focal points to collaborate with the project in implementing the pilot activities. The work plans for the pilots were prepared with the relevant stakeholders, and implementation started in early 2017. Finalization is expected by mid-2018.

The project supported a highly successful capacity-building session on fisheries and oceans governance at the 16th session of WECAFC, held on 20-24 June 2016 in Guadeloupe, France. The capacity-building session was attended by over 80 persons from 28 member states of WECAFC. The capacity-building event included trainers from the Secretariat of the Convention on Biological Diversity (CBD), Caribbean Regional Fisheries Mechanism (CRFM), Caribbean and North Brazil shelf Large Marine Ecosystem Project (CLME+), Convention on International

Trade in Endangered Species of Wild Fauna and Flora (CITES), International Convention for the Conservation of Atlantic Tunas (ICCAT), North East Atlantic Fisheries Commission (NEAFC), the Central American Organization for Fisheries and Aquaculture (OSPESCA), and FAO. Specific attention was given to international and regional fisheries policy and legal frameworks, fisheries and oceans governance in the WECAFC area, and lessons from elsewhere were presented. The Commission agreed to launch a process to establish a Regional Fisheries Management Organization (RFMO) in the WECAFC area of competence, that is, the Western Central Atlantic (area 31) and the Northern part of the South West Atlantic (area 41), and to collaborate in fisheries management and conservation in the Areas Beyond National Jurisdiction (ABNJ) of straddling

stocks, deep sea fish stocks, and highly migratory species that are not under the mandate of ICCAT. The report of the session is accessible at <http://www.fao.org/3/a-i6031t.pdf>.

Capacity-building efforts by the project also included contributing to the organization of the first meeting of the Regional Working Group on Illegal, Unreported and Unregulated (IUU) Fishing, held in Barbados, 1- 2 March 2017, which was attended by 52 persons from 21 member states of WECAFC. This meeting increased awareness and understanding of the IUU fishing problem in the Caribbean region, increased capacity for dealing with IUU Fisheries (VMS/MCS/PSMA, etc.), and developed elements for a Regional Plan of Action to prevent, deter, and eliminate IUU Fishing (RPOA-IUU).



The effective participation of Caribbean SIDS in global oceans and fisheries management processes was supported by the project, which enabled SIDS representatives to join in the following international meetings:

- 32nd Session of the Committee on Fisheries (COFI), Rome, 11-15 July 2016, and associated celebration of entry into force of the FAO 2009 Port State Measures Agreement. (Bahamas, Guyana, and Saint Kits and Nevis participated.)
- The Sustainable Ocean Initiative Global Dialogue with Regional Seas Organizations and Regional Fisheries Bodies on Accelerating Progress towards the Aichi Biodiversity Targets, Seoul, Republic of Korea, 26-29 September 2016. (Barbados participated.)

The Caribbean Billfish Management and Conservation Plan was drafted in April 2016 and was circulated twice for comments and suggestions to members of the CBMC and the WECAFC/OSPESCA/CRFM/CFMC Working Group on Recreational Fisheries. The third draft was submitted to the Regional Workshop on Caribbean Billfish Management and Conservation, held on 4-6 April 2017 in Barbados and attended by 35 experts from 13 countries, as well as regional stakeholder institutions and NGOs. The plan is currently receiving final comments before it will be passed to the Scientific Advisory Group (SAG) of WECAFC for review. The CRFM and OSPESCA have agreed that the draft plan will undergo the review and adoption process of the Interim Coordination Mechanism for Sustainable Fisheries—which is a partnership of the secretariats of CRFM, OSPESCA, and WECAFC—and would imply sub-regional adoption in 2017 and regional review and adoption in the first semester of 2018 by WECAFC.

An additional workshop on Recreational Fisheries and Statistics was attended by 38 representatives from 13 Caribbean nations in

the Bahamas during June 2017. Opportunities to collect and feed recreational fisheries data and statistics into a developing regional database were discussed, while a template for collecting and transferring this data through a template of FAO's SmartForms digital application was finalized through stakeholder and specialist discussions. An updated version of this digital data collection template is currently being reviewed with at-sea implementation among recreational charter fishery fleets expected in early 2018.

FPI rapid assessments have been conducted in both pilot countries. In Grenada, there were three FPIs covering the LL sector, the FAD sector, and the recreational billfish sector. In the Dominican Republic, there were two FPIs conducted, one for the commercial FAD fishery and one for the recreational fishery.

The collaboration with other OPP partners improved significantly in 2016. The Caribbean Billfish Project participated actively in a regional workshop organized by WWF Ecuador, building capacity for implementation of the Fishery Performance Indicators (FPIs) in the Caribbean region. Moreover, CI and FAO/WECAFC jointly developed various terms of reference for studies on recreational fisheries governance, tagging, mercury contamination of billfish, and FPIs, which started implementation in early 2017.

FPI rapid assessments have been conducted in both pilot countries. In Grenada, there were three FPIs covering the LL sector, the FAD sector, and the recreational billfish sector. In the Dominican Republic, there were two FPIs conducted, one for the commercial FAD fishery and one for the recreational fishery.

Other areas of attention by the Caribbean Billfish Project in 2017 included:

1. The development of a billfish fisheries management information system, regional database, expert agreement on the SmartForms system for catch reporting, and e-logbook developments for recreational fisheries to improve national and regional data and information availability on billfish stocks and fisheries
2. A contribution to the second meeting of the Regional Working Group on Illegal, Unreported and Unregulated (IUU) Fishing, held in Barbados, 19-21 September 2017 and attended by 35 participants from 16 WECAFC member states. This meeting made major progress towards regional fisheries governance through capacity-building for implementation of the Global Record of Fishing Vessels, on Vessel Marking and Identification, and MCS needs. The experts meeting discussed and agreed on WECAFC recommendations establishing harmonized vessel marking and identification standards throughout the region, a regional authorized vessel record, and IUU vessel lists—measures that are key to reducing IUU fishing in the region
3. The assessment of fisheries management, policy, and legal frameworks for fisheries in Grenada and the Dominican Republic, development of FADs fisheries regulations, implementation of stakeholder assessments, and promoting the adherence of Grenada to ICCAT.
4. A soon-to-commence mission by a FAO statistical specialist to assist Grenada's implementation of FAO-developed logbooks on LL vessels, while also increasing this nation's capacity to fulfill data reporting requirements linked to its status as a recent signatory to ICCAT.
5. The recently, officially launched Grenada Game Fishing Association, which is expected to further assist recreational fisheries' data collections and other interactions with this sector on national and regional scales
6. A meeting of the WECAFC Working Group on Sharks and Rays in Barbados, attended by the projects LTO and Coordinator, in which lessons learned from regional billfish management improvement experiences were transferred to the group's efforts to address similar ABNJ and open access issues for endangered shark species in the Caribbean
7. A review of the CRFM Sub-Regional Management Plan for FAD Fisheries, currently underway; edit suggestions, a summary report, and a linked WECAFC Recommendation expected for discussion and endorsement by the SAG in November
8. Specialist advice supporting circle hook gear trials within Grenada's LL fleet, expected to produce summary reports and recommendations to the WECAFC SAG in November. Recommendations to pursue the improved sustainability of billfish harvests in alignment with recommendations of ICCAT and the Caribbean Billfish Management and Conservation Plan, while also transferring LL fishery best practices from elsewhere into Caribbean fleets
9. Installation of electronic traceability hardware and software in all tuna landing facilities in Grenada
10. Legislation updates in both Grenada and the Dominican Republic to support co-management of FADs and better overall management with recognition of billfish bycatch concerns

11. Grenada has joined ICCAT and is considering signing the United Nations Fish Stocks Agreement as well. The project has provided technical data support to help Grenada's ICCAT reporting, has developed logbooks for them to implement among the longline fleet, and will be updating their vessel registry to support addressing IUU and implementation of the PSMA, and to ensure vessel insurance needs are also met.
12. A cell phone app for recreational data collection, completed for Grenada recreational fishery using the FAO SmartForms template; trial expected to begin in 2018 or early 2019
13. The Global Review of Recreational Fisheries Governance, completed, with a summary document to be published in a peer-reviewed journal soon.

Business Cases

GRENADA

Grenada has a well-developed LL fishery that targets sashimi-quality YFT for export. It has fairly high catches of BUM, WHM, and SAI, which they refer to as bycatch although it is all retained and sold for local consumption. The business case concept is to explore gear changes that improve catches of YFT while minimizing the catch of billfish. The program will conduct trial fishing to test the efficacy of circle hooks for catching YFT while increasing the capacity to release billfishes live to remain within quota allocations. While billfish bring less of a price than YFT (sometimes just barely less), fishers will keep them if their holds are not full of YFT already. The key is trying to incentivize the live release of billfish. This incentive may develop from the current higher price for YFT, direct compensation for release, and/or supply chain changes that increase the probability that price premiums for high quality YFT are passed back to the harvester. The plan includes installing electronic data terminals at each landing site to improve landings data for

fishery managers, and to improve order routing and inventory control. It is hoped, as has been shown in other fisheries, that this technology will improve access to markets by tracking quality better and maintaining quality through quicker order routing (Gentner et al. 2018a, Gentner et al. 2018b).

Other interventions are also being considered including mandatory recreational release of all billfish and minimum distance-from-shore regulations for LL sets, which would protect sailfish from LL effort. Besides the inshore LL boats, FAD fishers target and take a significant amount of SAI and BUM. While Grenada has FAD fishers, they are still relatively few in number and they exercise de facto community property rights to those FADs. FAD fishers band together for maintenance and placement, and maintain a fund through landings levies to provide for their maintenance and replacement. The FAD fishers that have been talked to seem amenable to both limited entry for FADs and limited entry for FAD fishers. It may be possible to codify these rights to improve their livelihoods while reducing billfish harvests. The primary issue with FAD fishing is the high catch of billfish when deploying drop lines, or buoy gear, around the FADs with live bait. Their other technique is trolling small rubber squids for YFT, neritic tunas, and mackerels. Currently, the FAD fishery sells only domestically, except for an occasional YFT of sashimi grade. FAD fishers typically use little or no ice and do not have access to export channels. Opportunities for value-chain improvements clearly exist and are to be evaluated and tested by the project.

DOMINICAN REPUBLIC

Progress on the ground has been relatively slow, and the devastation caused by hurricane Irma to parts of the country will not help in that regard. The biggest problem in the country—but also in some other countries and overseas territories in the region such as Martinique, Guadeloupe, and Haiti—is extreme over-capacity in the commercial

FAD fleet and the over-use of FADs. There is no limitation for entry in the commercial fisheries, and the commercial fisheries are treated as the employer of last resort. There is a wide range of incentive structures within fishing, from economic satisficers to well organized and vertically integrated fleets of small open boats. Nearly all production is for domestic consumption, except for a small amount of dolphin fish. The supply chains are very short and product is treated very poorly. There is very little ice use on the boats and very little freezing capacity shore-side. There is limited processing and no value-added processing (Gentner et al. 2018a, Gentner et al. 2018b).

The general idea for this pilot country is to develop a privately administered conservation trust fund that is funded by user fees from the recreational sector. The recreational fleet likes the FADs and believes the FADs are the reason for the excellent billfish fishing that has only gotten better in recent years. With both commercial fishermen and recreational anglers fishing over the same FADs, sometimes violent conflict has arisen between the two fleets. To address this conflict, the recreational marinas and clubs have set up compensation funds to pay FAD fishers to maintain FADs and/or to pay for access to existing FADs. Unfortunately, these payments, their care, and distribution have lacked transparency, and in many cases have increased conflict. It is hoped that by creating a formal, transparent structure, such as that used to fund MPA enforcement and maintenance in other Caribbean islands, the project can take advantage of this burgeoning rights structure.

The Dominican Republic is now known as a top billfish fishing destination in the entire world and it is a short flight from the United States. Tourism in the region is booming and is forecasted to continue to grow. There are two classes of fishing tourists in the region: the avid, experienced billfish angler and the beach vacation tourist who may never have been offshore fishing. The boats that serve those two segments are very different with

very different prices. The budget-minded boats are virtually unregulated, kill most of their catch for sale and are generally safety hazards. It might be possible to use some of the conservation funds to professionalize that fleet through licensing and safety inspections. It would also be good to get that fleet to halt its harvest of billfish.

Recently, a proposal for an MPA to protect a blue marlin spawning area was circulated by recreational fishing groups. While one ministry approved of the closure, the fisheries ministry disagreed with the closure saying the recreational groups did not follow the correct channels in trying to get that MPA approved. Regardless, this demonstrates some momentum for protecting spawning areas. It may be possible, therefore, to propose an April-May spawning area closure, if not a year-round billfish closed area. If this initial effort is successful, it may be possible to halt billfish harvesting during peak spawning months for much of the south coast.

The advantage of the conservation fund is that it is the fulfillment of the business case requirements. It is a self-funding entity that can be used for recreational and commercial FIPs long into the future. It could be possible to eventually include a landings tax to improve commercial fisheries infrastructure, as well. There are many opportunities in the short, domestic value chains for improvements. From fish handling extension to developing export markets for sashimi tuna, there are many interventions to improve livelihoods. It may be possible to incentivize fishers to move away from billfish harvest with the carrot of improved fisheries value. Additionally, a complete vessel registry leading to eventual limited entry would be an improvement.

Two other business case possibilities involve improving regional governance, recognizing that sub-RFMOs have had tremendous success nudging their parent RFMOs towards fishery reform. This plan would involve the further transformation of the Western Central Atlantic



Fishery Commission (WECAFC) into an RFMO. The region has endorsed launching a process towards an RFMO, and several nations have already offered funding for its development and operations. The first goal of this sub-RFMO would be to carry forth the Caribbean Billfish Management and Conservation Plan developed under this project. Allocation of billfish harvest limits and control rules would be a priority for this newly formed RFMO.

The further development of the already established and formalized Consortium on Billfish Management and Conservation (CBMC) into a global billfish management advisory group (GloTT equivalent) to increase its reach and potential impact on billfishes (e.g., influence RFMOs, place billfish on agenda, scientifically based policy advice) is another potential business case. The CBMC would provide specialist/expert advice for billfish management decision-making, ensure billfish expert linkages to ICCAT to counter

political interests, support implementation of the Caribbean Billfish Management and Conservation Plan and effectively spread project innovations and research findings throughout the region and elsewhere. The current idea is to develop the CBMC as a U.S.-based non-profit (501(c)(3) organization situated within the IGFA.

Missing enabling conditions

Commercial fisheries data collection is actually quite good in both pilot countries. Grenada lacks an estimate of how much fish is sold informally (without being tracked), and it would be a good idea to estimate that undercount. Grenada is continuing to improve its data reporting timeliness to meet ICCAT standards, and will install electronic data entry terminals in 2018. The Dominican Republic runs into budget shortfalls periodically, and currently has a multi-year backlog for data entry. The country also has high turnover in its fishery data collection staff, and

consistency suffers. The Dominican Republic would benefit from a programmatic review of processes, with an eye toward standardizing methods and data elements, and providing for a training curriculum that could be conducted for new enumerators.

There is zero recreational data being collected in either pilot country. Collecting catch, effort, and participation data is absolutely essential for proper management. It is hoped that some sort of license or registration can be developed to track participants. Current commercial port samplers could be enlisted to collect effort and catch, likely using the developing SmartForms template as applicable for CPUE data collection across both fisheries. In the Dominican Republic, all the marinas collect daily effort and catch statistics for their own use, and a drive is currently underway through the project to collect both historical and new recreational fisheries data for submission to a developing regional database. FAO has been working on developing SmartForms templates for this purpose, and seeks to benefit from ongoing fisheries data improvement actions in the region that are already underway through the WECAFC.

The Dominican Republic has a very low quality supply chain infrastructure. Fish are handled poorly on the boat and back in port, and value suffers. The vast majority of the fish sold to high-end restaurants and into the tourism sector is imported for this reason. With some minor investments in fish handling, hygienic processing, and cold storage, there may be opportunities to supplant local product for this imported high-end product.

CCSBT

Bluefin Quota System in Australia

The Southern bluefin tuna (*Thunnus maccoyii*) is a highly migratory stock found throughout the southern hemisphere. It is located primarily

between latitudes 30-50 degrees south (CCSBT 2002). Southern bluefin tuna (SBFT) is considered to be a single stock, shared by Australia, Japan, Korea, Chinese Taipei (Taiwan), New Zealand, Indonesia, South Africa, Philippines and the European Union. In 1994, an RFMO, the CCSBT, was formed to manage the stock. Currently, the CCSBT incorporates virtually all fishing activity for SBFT (CCSBT 2008d). The CCSBT convention area is large covering the entire area the SBFT migrates.

SBFT has only one known spawning area in the Indian Ocean, southeast of Java Indonesia (CCSBT 2002). Breeding takes place from September to April. The juveniles migrate to the south, towards the west coast of Australia. From December to April every year, very large concentrations of the stock are located in Australia's southern coast. As SBFT grow older (they can live as long as 40 years), they tend to leave the near-shore waters of Australia and travel far offshore in international waters. There they are vulnerable to exploitation by a number of countries, mainly by the Japanese vessels. The fraction of the stock that migrates in the high seas is not known. The Australian fishery targets almost exclusively (at 99 percent of catches) the juveniles (two to three years old), which are found in the surface waters. The Japanese vessels harvest all ages, from juveniles to adults (above 12 years old).

Currently in Australia, the fishery is dominated by purse seiners. However, in the past, pole and line was the main method, and purse seiners would operate cooperatively with pole and line boats (Geen and Nayar 1989). Purse seiners do not land tunas, but tow them towards the mainland and fatten them in cages and farms off Port Lincoln. Farming in Australia began in 1990. The capture of SBFT takes place from December to March, and fattening continues for several months before selling the tunas to the Japanese market. Exports of farmed products peak in July-September each year.

Longline is the main method for catching SBFT among the other fleets that are members of the CCSBT. Longliners target larger adult fish, which tend to swim in deeper waters. Their landings are frozen (at very low temperatures of -60 degrees Celsius), and then shipped directly to Japan. Bluefin tuna are generally considered the most highly priced tunas when compared to the other principal tuna species, including ALB, SKJ, YFT, and BET tunas. SBFT fetch high prices in the Japanese sushi market, and are used for sashimi. The current total value of the SBFT is estimated around \$1 billion Australian dollars (AUD). The net benefit from the Australian farm sector was calculated to be over \$10 million AUD in 1994 (Campbell et al. 2000).

Problem

The CCSBT was formed as an RFMO in 1994 after almost nine years of attempted joint management without the structure of an official RFMO. In the late 1970s and early 1980s, Australia realized that the SBFT stock was fully exploited and decided to restrict the operation of Japanese vessels within its EEZ. At that time, only 10 percent of Japan's harvest came from Australian waters, with the remainder coming from an area south of latitude 30S between South Africa and New Zealand (Kennedy and Watkins 1985).

Australia began requiring licensing of Japanese fishing vessels wanting to fish in its EEZ in 1979. Australia, in the face of declining stocks, decided to reduce TACs in 1984, and asked Japan to do the same. Japan refused, and Australia revoked their Australian fishing licenses (Campbell et al. 2000). In 1985, the stock decline sharpened, which forced Japan and New Zealand to cooperate with Australia in setting a rebuilding schedule. Up to that point, Japan had not limited bluefin catches. Once Japan agreed to limit its catches, Australia let them back into their EEZ. For the 1986-87 season, the TAC was 35,650 MT, and by 1990 the TAC had been reduced to 11,750 MT, down from its peak of 81,750 MT in 1961.

In 1994, Japan, Australia, and New Zealand formed the CCSBT. Since 1994, Korea, Taiwan, and Indonesia have become full members, with the Philippines, South Africa, and the European Union admitted as cooperating non-party members. The CCSBT does not have a well defined convention area, but covers parts of the Indian, Pacific, and even Atlantic Oceans, and overlaps in jurisdiction with the Indian Ocean Tuna Commission, the Western and Central Pacific Fisheries Commission, and the Commission for the Conservation of Antarctic Marine Living Resources.

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Australia decided to address its own capacity and harvest issues in 1984 with the creation of an ITQ program, but there are still problems with the stock and a general inability by the CCSBT to reign in total harvest. By the CCSBT's own admission and external peer reviews, TACs are set based on national self-interest rather than stock status. A decade-old external review criticized the CCSBT for lacking a clear separation between science and management, and pointed out that CCSBT's scientists should be more neutral, trying to find what the available data are actually saying, rather than acting like advocates of their countries' point of view. The most recent report of the Scientific Committee (CCSBT 2006a) acknowledged that catch data might have been substantially under-reported in the previous 20 years (1985-2005). Today, much of the previous assessment work is now considered invalid (Wilson et al. 2009).

As a result, the CCSBT has failed to recover the stock and the stock continues its downward trajectory. Currently the spawning stock is believed to be below 10 percent of pre-exploitation levels, and well below the 1950-1980 exploitation levels. Currently, the stock is viewed as over-exploited with no signs of rebuilding. Additionally, there is evidence that the fleets are exploiting younger and younger fish, and if global catches exceed 14,925 MT, the stock will be in serious jeopardy. Beyond setting country TACs, the CCSBT leaves the management of the TAC to the individual member nations.

Implementation

Australia has had an ITQ program for SBFT since 1984, which is considered to be successful. Prior to the implementation of the system, the Australian SBFT was biologically over-exploited and heavily capitalized. Commercial exploitation in Australia began in the mid 1950s. In 1979, the parental stock was estimated to be less than 30 percent of its pre-exploitation period (Geen and Nayar 1989). Catches reached 11,000 MT in 1980 and peaked at 21,000 MT in 1982. A study from industry representatives had estimated that if all fishing were to cease at that point, the stock could be expected to recover in 18-25 years (Haagan and Henry 1987).

In the early 1980s, the Australian fleet was composed of three State fisheries: the New South Wales, the South Australian, and the Western Australian. The South Australian was the most specialized of the three, comprised of larger vessels targeting SBFT all year round. The other two consisted of small- and medium-sized vessels, some of which were used in multi-species fisheries. Fishing activities for SBFT were regulated by various input restrictions such as size limits, area restrictions, and entry restrictions on pole and line gear.

Prior to RBM, the economic position of many operators had been declining. The Western Australian fishers still maintained positive rates of

returns to capital, while the other two segments had increasingly negative returns. For instance, pole and line boats had a rate of return of -7 percent in 1981-82, and a return of -25 percent in 1983-84 (Geen and Nayar 1989). These conditions forced the Australian government to consider implementing a RBM system. The SBFT fishery was a good candidate for ITQs because it was a single-species fishery, there was not much potential for developing black markets since the main outlet is the Japanese sashimi market, and it was not subject to large-scale annual variations in fish abundance (Geen and Nayar 1988). One year before the introduction of the RBM, an interim management program was implemented for the fishing period 1983-84. The interim plan abolished the previous input restrictions and only set an aggregate quota (19,600 MT). This program was, in effect, a regulated open access regime.

The quota program had three main objectives: reduce overall harvest, reduce harvest of sub two-year-old fish, reduce capacity substantially, and minimize social dislocation and hardship (Meany 2001). In response to stock trends, a Tuna Task Force (TTF) was formed in 1982 to develop innovative solutions. Following a series of stakeholder meetings, the TTF issued a management plan in July of 1983. This plan contained catch quotas, minimum size limits, limited entry, and other limits on PS activity. The target start date was to be the 1983-84 season, but that did not come to fruition due to the need for further discussion. In the end, the TTF decided to eliminate minimum size limits, institute an ITQ, and allow trade across the zones and gear types (Meany 2001). It also recommended cost recovery.

Design

In 1984, the first Australian RBM program was introduced in the SBFT fishery. The TAC was originally set at 14,500 MT, a reduction compared to the TAC of the interim program, and was shared by the three Australian states, with the most specialized state receiving the highest proportion (68 percent) of the TAC.

Fishers were eligible to receive a quota based on their catch history (75 percent) and their capital investments (25 percent). Regarding catch history, the harvester was allowed to use the highest harvest year from the period of 1 October 1980 to 30 September 1983. Capital investments were defined as the current market value of their fishing vessel as determined by an independent marine surveyor, and included fishing gear and navigational equipment (Meany 2001). The individual quotas were defined as proportions of the TAC. In 1986-87, the TAC was reduced to 11,500 MT; in 1988-89, further to 6,250 MT; and thereafter has been stable at 5,265 MT.

To be eligible to receive quota, the harvester had to be currently licensed and had to land at least 15 MT of SBFT in any one season from 1980-1983. If person had sold their boat during this period, but could prove they were in the process of acquiring another boat before 7 September 1984, they could be eligible for quota.

The ITQ policy eliminated the size limit in exchange for a two-month closure in March and April and a ban on fishing north of the 34-degree South parallel off the Australian west coast (Meany 2001). Both the elimination of the minimum size limit and the western zone quota were a concession to the Western Australian government in order to get them to agree to the ITQ. There were reports of excessive dumping of small fish in 1983, so to balance removing the minimum size limit, Australia instituted a closure during the time that the small fish were present, and closed an area that typically held small fish (Meany 2001).

The regulatory body that is responsible for the Australian RBM program and the management of the wild-catch component of the SBFT fishery is the Australian Fisheries Management Authority. The objective of this authority, as set forth in the 1995 Southern Bluefin Tuna Fishery Management Plan, is to maximize the net economic returns, not revenues, from production of SBFT.

Today, the Australian TAC for SBFT is set through what is called by the industry a triple-jeopardy arrangement (FERM 2008). First, the Australian Government negotiates at the CCSBT meetings. Then, the Australian Fisheries Management Authority has the right to set the national TAC to a lower level than that agreed by the Australian Government at the CCSBT meetings. Finally, the TAC, as set by the Australian Fisheries Authority, is subject to a third round of government review by the Department of Environment and Water Resources. The minister has the power to close down the fishery if it is assessed as unsustainable.

From a public perspective, the total management cost under the RBM system was initially estimated around \$400,000 AUD, but by 1986-87, it had risen to \$600,000 AUD. Fishers were required to pay 44 percent of this cost (less than \$0.3 million AUD), and the remainder was cost to the taxpayers (Geen and Nayar 1989). Prior to RBM, the taxpayers shouldered the entire burden of fisheries management.

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The cost of licensing and quota monitoring services in the Australian SBFT fishery has

increased over the period 2001-08. In 2007-08, these costs accounted for 10 percent of the total \$1.3 million AUD SBFT industry management cost (FERM 2008). Monitoring was a fairly simple task as it was a single-species fishery with very distinct market pathways. Catches were accounted for through logbooks with verification from cannery purchases and export data (Meany 2001). As for compliance costs, these have also gone up. In 2007-08, compliance costs were estimated at \$940,000 AUD, shared equally by the government and the industry (FERM 2008). The observer coverage for the RBM program in Australia across the purse seiners was 11.8 percent in 2008, and 5.6 percent in 2007 (Wilson et al. 2009). The program employs international observers, in compliance with the Commission's standards.

Performance

Overall, the economic performance of the fishery improved substantially after the implementation of this program, and some pressure on the stock was reduced. However, RBM was not able to reverse the declining status of the stock because the bulk of the SBFT harvest occurs outside Australian jurisdiction. Problems with the overall status of the stock should not be attributed to any weakness with the Australian domestic RBM regime (FERM 2008). Instead, the continued decline in SBFT stocks is attributable to over-harvest by other members, IUU fishing, and underreported catches.

Geen and Nayar (1988, 1989) discuss in detail the short-term impacts of the RBM system on the fleet and its profitability, comparing these impacts to simulated outcomes had the fishery continued under regulated open access. Geen and Nayar compare the ITQs to the regulated open access management (of 1983-84) because changes in the structure of the fleet would have occurred without the ITQ system. Geen and Nayar (1989) estimated that the average catch rates for those that stayed in the Western Australian fishery were 90 percent higher than what they would have been under a different management system.

Campbell et al. (2000) summarize the short and the long-term effects of the RBM management program. Regarding the short-term effects, there was a rapid adjustment in the capital with two-thirds of fishers leaving the fishery within the first two years (Campbell et al. 2000). The 82 vessels that left were non-specialized tuna fishers, who could easily operate in other fisheries without significant modifications in their gear. Nearly all of the New South Wales fishers (23 out of 26), and about 70 percent of the Western Australian fishers (49 out of 70) had withdrawn from the fishery by the end of 1986. Haagan and Henry's (1987) opposite prediction that the Australian SBFT fishery could have the greatest returns if the entire catch was taken off New South Wales was not substantiated. This prediction was based on the idea that catching small fish early in their migratory path would reduce the potential size and the value of the overall Australian catch. Therefore, all quotas, Haagan and Henry argued, should be placed under the control of the purse seiners working off New South Wales. In the end, this prediction did not come true. By the beginning of the 1986-87 season most of the adjustments had already taken place and only marginal changes occurred in the following years (Geen and Nayar 1989).

The 82 leavers held about one-third of the catch quota, and their market value was estimated around \$17.4 million AUD. Campbell et al. (2000) argue that some of those that left would have exited the fishery even without the introduction of the RBM program. In other words, RBM expedited the removal of the latent effort. Other leavers, for instance the Western Australia fleet, made about 50 percent more profits by exiting, compared to what they would have made had they stayed in the fishery. Geen and Nayar (1988, 1989) estimated that about 30 percent of the short-term reduction in the capital could be positively attributed to RBM and the remaining 70 percent would have left anyhow. This capital reduction attributed only to RBM was estimated to have a value around \$10-12 million AUD less

than the value of the capital that would have been employed under a non-RBM system. The total capital employment in 1986-87 was estimated to be around \$31 million AUD.

The majority of those who exited sold their quota shares to the South Australian specialized fishery. The latter increased its quota share from 66 percent in 1984, to 84 percent in 1986. This redistribution of quotas from the New South Wales and Western Australia to South Australia took place because of the different opportunity costs in each of these states (in South Australia there were limited options for alternative employment). A portion of those who exited from the non-specialized fisheries was employed elsewhere in the economy, generating additional wealth. However, there was some redeployment of labor in other fisheries already fully exploited, reducing their profitability.

RBM reduced over-capacity and had a positive effect on the profitability of the remaining vessels. The main reason why profitability in the SBFT fishery increased was the change in the behavior of those who remained in the fishery. The operators no longer had to compete with each other. RBM allowed them to fish whenever they wanted with a view to maximizing the value of their quota. Instead of fishing on grounds just a few hours from their ports, operators could steam two days or more, on the edge of the continental shelf. Eventually, after the exit of the less profitable operators, the variable costs of fishing were reduced by 23-28 percent. In South Australia specifically, the average fishing effort decreased by 20 percent compared to the effort that would have been employed under an aggregate quota regime while still catching the same tonnage of fish (Geen and Nayar 1988, 1989).

This change in fisher behavior had positive effects on the stock's condition. Harvesters, knowing that the entire season was available to catch their individual quotas, started concentrating on larger fish. There was an increase in average size by 11 percent between 1983 and 1986. This implied that more fish could be expected to live up to the spawning age. However, even after the introduction of the RBM, there was evidence that recruitment was declining (Geen and Nayar 1988, 1989).

The practice of targeting larger fish also produced positive economic benefits in addition to the conservation benefits. In general, large tunas, over 15 kg, are more valuable in the Japanese sashimi market. Prior to 1984, only 13 percent of the Australian catch was comprised of fish greater than 15 kg, but this proportion had increased to 35 percent by 1986-87 (Geen and Nayar 1988). Exports to the sashimi market increased from around 2,600 MT in 1983-84, to over 4,500 MT in 1986-87.

Geen and Nayar (1989) estimated the resource rent resulting from the RBM system at around \$6.5 million per year.⁸ This number was probably an underestimate of the actual resource rents of the fleet in 1986-87. They also found that under an alternative management regime, the resource rent would have been less than 25 percent of that achieved under the RBM. The authors also mentioned that trading prices for the quota, in late 1984, were in the range \$800-1,200 per MT, while in 1986-87 prices had risen to \$3,200-3,500 AUD per MT. This was also an indication that the profitability of the fishery increased.

8 Resource rent is the profit generated due to the management. In this case, the increase was due to the reduction in effort because of the ITQ system, not the total economic rents in the fishery. Economic rents are profits in excess of normal return on capital employed. Geen and Nayar (1989) defined "normal" as a 10 percent rate of return on capital. Economic rents comprise resource rents and highliner rents (profits that skilled fishers make under any management regime). The authors estimated that highliner rents were about 36 percent of the total economic rents, therefore resource rents (due to ITQs) were the remaining 64 percent (i.e., 0.64×10 m), around \$6.5 million AUD. Resource rents would be dissipated if open access to the fishery were restored. In their simulations for the alternative regimes, resource rents were 0 under the aggregate quota management, and only \$1.6 million AUD under an aggregate quota with limited entry regime.

Regarding the long-term impacts of RBM, the value of the Australian SBFT fishery increased from \$14.3 million AUD in 1982-83, to \$86.3 million AUD in 1994-95 (Campbell et al. 2000). This was despite the fact that the Australian TAC was reduced by 75 percent (from 21,000 MT in 1983, to 5,265 MT in 1995) due to the decline in the abundance of the stock. Campbell et al. (2000) mention two reasons for this increase in the value of the fishery. The first was the restructuring of the fleet with the remaining, more efficient vessels being able to earn a higher profit per each ton caught. The second was the 1986-89 cooperation between Australia and Japan, and their joint venture during 1989-1996.

During the period 1986-89, the Australians offered to forego 3,000 MT of their quota for each of those seasons in return for \$7.57 million AUD from the Japanese. This payment was greater than the profits the Australians would have earned if they had caught the 3,000 MT. Japan paid the Australians to forego some of their catches because they hoped to encounter a thicker stock and thereby reduce fishing costs. Essentially, the Australians leased some of their quota to the Japanese. The fact that property rights were more clearly defined (in the form of RBM) facilitated this type of agreement (Geen and Nayar 1989).

Also, a joint venture started in 1989-90, under which the Japanese would train the Australian longliners and provide payment for research purposes (\$500,000 AUD over three years). This facilitated the transfer of farming technology to Australian companies. Once again, the RBM had created an institutional structure for having the joint venture agreement. In 1995, the joint venture catch was diminished, which caused the value of the Australian fishery to fall by nearly 50 percent (from \$86.3 million AUD in 1994-95 to \$47.5 million AUD in 1995-6) (Campbell et al. 2000). By the end of 1996, the joint venture was terminated. These are two examples, perhaps the first examples, of the transfer of quota for payment between two parties of an RFMO using the market.

Prior to the RBM program, Australian biologists had warned that the stock was fully exploited. After the introduction of the program, though there were some conservation benefits due to the Australian vessels shifting to larger age classes and reducing their overall TAC, the condition of the stock continued to deteriorate. The positive effects of RBM in the condition of the stock were not yet seen in the late 1980s. The Australians' restraint alone was not enough to improve the overall condition of the stock. To recover the stock, the Japanese should also have reduced their catches. Just a few years after the introduction of the RBM, the Japanese vessels were unable to catch their quota in 1986-87, though they had increased their fishing effort. In 1988-89, Australia, Japan, and New Zealand were forced to reduce their catch limits further. Geen and Nayar (1989) argue that the continuing decline in the stock was the result of the large catches taken in the early 1980s.

Compliance with regulations is generally considered to be high, with isolated events of non-compliance (FERM 2008). Co-management or increased cooperation between government and resource users has been suggested as a step to improve the domestic compliance program (FERM 2008). The Australian industry, however, may be more willing to expose non-compliance of Japanese vessels, rather than to expose domestic non-compliance.

The Australian quota has been filled every year since 1999-2000, with almost no latent effort. The Australian Bureau of Agricultural and Resource Economics does not survey the SBFT fishery; therefore, any estimates of the net economic returns are based on estimates of latent effort and quota value (Wilson et al. 2009). The value of shares in 2006-07 was about \$11.5 AUD per kg (Hohnen et al. 2008) while in 2007-08 the estimates ranged from \$7.50-\$15.00 AUD per kg (Wilson et al. 2009). Overall, these two indicators imply that the SBFT is a high-profit fishery as the market price of quota reflects expected profits,



even if the stock is well below its 1980 biomass level. However, the bad condition of the stock suggests that these positive returns may not be sustainable (Wilson et al. 2009).

Though estimates for the net economic return from the Australian SBFT fishery are not available, there are some estimates for the gross value of production. In 2000/01-2002/03 the total value of production, inclusive of aquaculture, was around \$260 million AUD per year while in 2004-05, it decreased considerably to \$140 million AUD, and in 2005-06 to \$156 million AUD (FERM 2008). In 2006-2007, the value was around \$138 million AUD (Hohnen et al. (2008). If the multiplier effects in other sectors of the economy are included, the economic impact of the fishery was estimated to exceed \$500 million AUD in 2002-03 with more than 800 full-time positions generated in Port Lincoln and almost 1000 additional jobs in other sectors (FERM 2008). The main

reasons why the value after 2002-03 dropped by half were the appreciation of the Australian dollar, and competition from farmed BFT in the Mediterranean dropping the market value in Japan. Australian exports declined by 54 percent between 2002-3 and 2006-7.

Market/Financial-Based Tools

Table 2 (next page) contains all of the MSC certified fisheries in the region. The Walker Seafood certification covers four vessels that use LL gear on the East Coast of Australia to fish for DOX, SWO, ALB, and YFT. They set with frozen squid at 30 m depths and produce high quality product. They were certified after spending \$350,000 AUD and after four years to meet the certification requirements. The process involved setting HCRs for all stocks and instituting 100 percent release for great white sharks, longfin mako, BUM, and BLM. This fishery was certified in 2015.

Table 2. MSC Certified Tuna Fisheries in the Southwest Pacific

FISHERY	SPECIES	GEAR TYPES	LOCATIONS	MSC STATUS	MT
Walker Seafood Australian albacore, yellowfin tuna, and swordfish longline	DOX, SWO, ALB, YFT	Hooks And Lines – Longlines Hooks And Lines – Set ...	Southwest Pacific (FAO Area 81)	Certified with component(s) in assessment	930
New Zealand albacore tuna troll	ALB	Hooks And Lines – Trolling lines	Southwest Pacific (FAO Area 81)	Certified	2,225
Talley's New Zealand Skipjack Tuna Purse Seine	SKJ	Surrounding Nets – With purse lines (purse seines)	Southwest Pacific (FAO Area 81)	Certified	

The New Zealand ALB troll tuna certification was granted in 2011. This is troll fishery on the western coasts of both the North and the South Islands. Vessels troll 12-18 lines and catch very little bycatch. The fleet is made up of 175 vessels. They harvest 3,000 MT annually and the fish are mostly landed whole. The fish go to a variety of markets for canning, including Thailand and Pago Pago. Recently they have started shipping fish to Spain for canning.

Talley's New Zealand SKJ purse seine certification covers SKJ caught in New Zealand EEZ that are part of a single Western and Central Pacific Ocean stock. Most of the effort in this fishery is centered off the northern west and east coasts of the North Island. Three companies land 95-98 percent of the total catch using five vessels. This is a seasonal fishery peaking from January to March. Catch of NZ SKJ compromise only 0.5 percent of the WCPO harvest of SKJ. Average harvest is 11,326 MT with less than 1 percent bycatch. This fishery does not set on FADs. The majority of the harvest is canned.

Eastern Pacific Ocean

Tuna stocks in the EPO are managed by the IATTC. The IATTC convention area covers the eastern portion of the Pacific Ocean from Canada south to the tip of South America. The tropical tuna fishery in the EPO is directed at SKJ, BET,

and YFT, and catches range from 500,000 MT to 900,000 MT, making up between 10-20 percent of global tuna harvests. Industrial scale vessels using PS and LL gear types predominate, with the PS fleet primarily targeting SKJ and yellowfin for the cannery market, and the LL fleet mainly targeting adult BET for the fresh/frozen market. There is a single EPO stock of SKJ, and SKJ represents about 50 percent of all tuna harvests (Allen 2010).

Currently, the EPO contributes 13 percent of global tuna production (WWF 2017). In 2015, tropical tuna catches amounted to 693.6 MT, representing a 14.7 percent increase over 2014. Averaged over the last six years, SKJ makes up 44 percent of the harvest, YFT 40 percent, and BET 16 percent (WWF 2017). The PS harvests 91.4 percent of that volume and the LL fishery harvests 8 percent. The PS sets are split between dolphin sets, catching mostly YFT, non-associated sets, and floating object sets. Most floating object sets are on FADs which catch most of the SKJ and almost all of the small BET and YFT.

Regarding current management for tropical tunas, PS vessel classes 4-6 (more than 182 MT carrying capacity) must shut down for 72 days, and have a choice of closure period of either July 29 to October 8 or November 9 to January 19. There is a closed area, called El Corralito, that is closed from October 9 to November 8. Class 1-3 vessels are exempt from these closures, as are LL vessels under 24 m, pole and line vessels, trolling vessels and recreational boats. In previous years

this closed season was 62 days and the recent ten-day increase in that closed season was a response to the growth in operative capacity in the purse seine sector. Additionally, there is a cap on purse seine capacity in the EP that can only be increased through IATTC approval and a regional register of vessels authorized to fish in the IATTC convention area.

The industrial LL vessels are managed through country limits for bigeye tuna. Current limits are China 2,507 MT, Japan 32,372 MT, Korea 11,947 MT, Chinese Taipei 7,555 MT, and United States 750 MT. In 2017, the IATTC officially allowed temporary transferability in a given year across these six countries. IATTC resolution C-17-02 contains additional details on transferability restrictions.

Capacity Trading System

Problem

To summarize from WWF (2017), the problem is over-capacity in the PS fleet that has led to excessive effort. While IATTC resolution C02-03 was enacted to cap capacity in 2003, over-capacity in the PS fleet has been growing, as some flags are converting unused capacity that is on the books into new boats and the IATTC has granted requests for additional capacity. In 2015, 25,000 cubic meters of capacity became operational in the EPO, and catches rose 10 percent. Total current hold capacity on the regional vessel register in 2017 was 230,000 cubic meters and the optimum was set at 158,000 cubic meters by the IATTC in 2002.

The use of FADs in the PS fishery has increased in recent years. This explosion has brought conflicts with the LL fishery and the PS fishery that primarily fishes over dolphins. The PS FAD fishery harvests small YFT and BET and as much as 25 percent of that bycatch is too small to be marketed (Gjertsen et al. 2010). When marketable, the small BET and YFT are landed but bring as much as four times less at the dock

than if those same fish were allowed to grow and be harvested by the LL fleet (Sun 2010). In addition, harvesting these small fish is causing growth overfishing that is hampering the overall productivity of these stocks.

There is a single EPO stock of BET with little mixing. In the past, the LL fishery harvested the bulk of the BET. Since FADs came into wide usage, PS gear takes an increasing portion of the harvest. Unfortunately, FAD sets harvest smaller BET with implications for stock sustainability. Additionally, recent harvests are 17 percent greater than MSY (IATTC 2010). This stock has been overfished for the last five years (Allen 2010). Before the introduction of FADs, MSY was higher and mortality was less than the mortality level that would produce MSY. The last full assessment indicated a recovery trend from 2005-2009. However, in 2018, the scientific staff indicated concerns about bigeye resulting from the annual stock assessment, independent indicators of stock health, and a continued increase in purse seine fishing effort over FADs.

The health of both bigeye tuna and yellowfin tuna is of concern as the stock status has fluctuated below or slightly above sustainability targets. The long-term recovery goal for BET is MSY harvest of 215,000 MT. The long-term recovery goal for YFT is to increase SSB by 5 percent, which will hopefully bring YFT back to MSY. Additionally, average length of fish at harvest is declining. Combining the drop in average length with a leveling off in landed catch and CPUE possibly indicates that exploitation is approaching or is above MSY. Currently, the SKJ stock is assumed to be at healthy levels.

In 2002, recognizing the BET overfishing, the IATTC called for a 16 percent reduction in mortality but it was never fully realized (Allen 2010). In 2005, the IATTC ordered that catch be reduced by 50 percent, and introduced several management measures including a six-week PS closure and limits on LL catches.

These restrictions were not enough to reduce BET mortality by 50 percent. PS catches are still increasing while LL catches are falling, so much so that no country has been able to meet their LL catch limits. In 2008, the IATTC ordered that mortality be reduced an additional 20 percent, which members fought. While fighting these cuts, the members stuck to the six-week closure instituted in 2005. In 2009 the IATTC estimated that a six-week closure was not enough and sought a 12-week closure. Again, members balked, and the IATTC settled for a 59-day closure in 2009, a 62-day closure in 2010 and a 72-day closure in 2017. They also included an area closure for 30 days that was about 60 percent of the recommended closure size and imposed LL catch limits for the main countries. In 2018, the scientific staff at the IATTC recommended a cap on sets over FADs in response to concerns about the bigeye stocks and continual increases in operative capacity.

Fisheries in the EPO are exhibiting the typical open access problems. Stocks are being fished above or just at sustainable levels and there is too much capacity in the fleet. By some estimates, capacity is 70 percent too high. Rents have been dissipated and the IATTC is locked in a downward regulatory spiral of ever-increasing closed seasons and has yet to control harvest, particularly of juvenile YFT and BET.

Between 1966 and 1979, PS capacity increased five times while catch only doubled (Joseph et al. 2010). Too much fishing effort is being expended relative to YFT and BET production. As the PS fleet continues to grow, more and more juvenile BET and YFT are being harvested. Aggregate PS well volume has been increasing since 1991, and after 1998, the fleet became large enough to require restrictive management. Caps have been placed on total well volume, but vessels have invested in other inputs to retain the same harvesting capacity. The target was set at 158,000 cubic meters, and in 2005, the actual aggregate well volume in the operational fleet was 209,000

cubic meters or 32 percent too high. By 2007, the actual aggregate operational well volume had increased to 230,000 cubic meters or 46 percent greater than the target. Total capacity of the current fleet is close to 300,000 cubic meters, clearly indicating severe over-capacity in the fleet. Between 2003 and 2017, this closure ranged from 60 to 74 days, which will only increase as latent capacity becomes activated or additional capacity is granted by the IATTC. It is no wonder that time/area closures and capacity limits are still not enough to control overexploitation.

Implementation

Aranda et al. (2012) give a detailed timeline of the capacity issue in the EPO. In 1990 the IATTC began to recognize that there was an over-capacity issue. In 1998, they formed a working group on capacity management that developed recommendations at the end of 1998 target capacity levels. They decided the measure of capacity to be used would be cubic meters of hold capacity. The target put forth in 1998 was 135,000 MT, or 158,000 cubic meters, of hold capacity. While the IATTC sought to cap the current level of capacity in 2002, language in C02-03 allowed additional claims to be recognized. At this time, the IATTC is at the forefront of managing capacity across all tuna RFMOs.

Recognizing that the fishery was still over the target, the IATTC developed the regional vessel register (RVR) in 2000. In 2003 IATTC passed the Resolution on the Capacity of the Tuna Fleet Operating in the EPO. Resolution C2-03 allocated capacity rights to states based on the RVR according to their current well volume (Squires 2014). States can allocate the rights to transfer to vessel owners. This resolution banned all vessels not flagged by CPCs. Also, any new fleet additions needed to be balanced by removals of capacity. The resolution did allow some capacity additions for coastal state aspirations and provided more rules on transfers, including the provision that if one country transferred capacity to another

country, that capacity was not available to the country that transferred it. Some felt this was the opening of a real capacity transfer market, but by 2010, there had been very few transfers (Aranda et al. 2012). Also, disputes arose from temporary transfers across countries, and that has contributed to an increase in overall capacity to settle disputes. IATTC has clarified procedures and reporting on permanent and temporary transfers that will hopefully avoid future increases in fleet capacity.

In 2005, the IATTC confirmed the target capacity level of 158,000 cubic meters of hold volume. It also recommended capacity constraints for the LL fleet and reiterated the importance of IUU vessel lists. The Permanent Working Group on Capacity warned that PS capacity was too high and recommended reductions by 2011.

By 2010, it was found there was actually 214,000 cubic meters of active capacity in the PS fishery and only 210,000 cubic meters actually being utilized. In addition, there were 73,000 cubic meters of capacity on the books that was not active. This inactive capacity was tied up in sunken vessels, capacity increments not yet used, and other forms of unused capacity. Adding all these sources of capacity on the RVR together brings the RVR total capacity to 287,000 cubic meters of well volume. So, despite the cap, trading, and RVR, the actual capacity was at least 80 percent higher than the target (Aranda et al. 2012). Trading of capacity will not reduce fleet capacity, just as transferable effort programs will not reduce effort unless the effort issued is a percentage of the optimum total effort.

In 2011 the ISSF and WWF hosted the Guayaquil RBM workshop with the focus of nudging the IATTC towards reducing capacity in the EPO with RBM. This first in a series of regional workshops was an outgrowth of the Bellagio process. The focus was on the economic and conservation benefits that could be had by reducing capacity. The goal was to develop either a capacity-based

or catch-based right, and the implementation of that right might involve capacity buybacks (ISSF 2011). ISSF suggested buying out latent capacity, then purchasing excess authorized capacity. Either might involve purchasing the capacity right and/or the vessel. It was also suggested that moving to a tradable individual right would reduce capacity through the marketplace.

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ISSF suggested that examining why trading does not currently occur be a top priority. There is no current legal reason why trade is not occurring. The only current impediment is that apparently transferring capacity across flags is not palatable to many members, although it may be possible to encourage trade sub-regionally. Additionally, trading capacity may not lead to reduced capacity, as trading permits in U.S. fisheries led to increases in capacity as permits were traded to more efficient vessels. Also, without a proportional allocation of total capacity, capacity creep will still be an issue.

MCS will need to be strengthened in the region to increase security and exclusivity of rights. In the IATTC, there is no central authority, beyond the keeper of the RVR, to enforce capacity limits currently. Additionally, there needs to be local fishery management capacity building. ISSF suggested that the market also has a role, and that labels and chain of custody could make it possible for consumers to choose sustainable product (ISSF 2011).

The Ecuador workshop was followed by a similar workshop hosted in Mexico in 2012 in cooperation with the Mexico PS industry (ISSF 2012). The assembled group was presented the basics of rights-based management with a vision for tradable capacity or catch rights. The industry had a number of concerns. Their first concern centers on their place in what is a large global market for canned tuna. They contend that it is more expensive to operate in the EPO due to monitoring and stringent overall controls. They also pointed out that it might take significant funds to reduce capacity, making the cost of fishing even higher for them. They were worried that a regionally-funded buyback would make them less competitive.

The group had other concerns about free-riders on their sacrifices and a need to account for aspirations of developing coastal states. There are also some fleets in the region that are subsidized through vessel construction subsidies, tax exemptions, and other infrastructure subsidies. This places an unfair burden on the unsubsidized and makes any buyback inherently unfair to the unsubsidized. Subsidies also distort markets raising concerns about market-based reforms.

The Mexican PS industry is concerned about aggregating market power in the country if any capacity is reduced. Industry members felt that any fleet shrinkage would concentrate rights in too few hands and result in monopoly power for those left. They said they are very heterogeneous regarding how vessels set their gear and the buyback should take that into account. The Mexican PS industry, as a fleet, set on dolphins targeting YFT, and therefore they are not part of the FAD sets that catch undersized BET and YFT.

Encouragingly, the Mexican industry understands that well volume caps will never be sufficient to control harvest. They are also very concerned about the increase in FAD sets, particularly in the southern range of the IATTC, and they

recognize that FAD sets have been a type of input substitution that increases capacity without changing hold volume. They are very keen to control the growth in FAD sets (ISSF 2012).

Design

With Resolution C-02-03, the IATTC placed national limits on PS hold capacity based on the 1985-1998 reference period. These limits were set based on catches by nations in the entire EPO, catches by nation within the EEZ, landings by nation, and other factors. However, because the capacity limits are determined by the regional vessel register, it creates an implied capacity allocation scheme. The system is eight years old, and limits capacity not catch.

Two side payments were given to gain acceptance of the capacity cap. The first was an initial over-allocation of capacity based on grandfathering, as total fleet capacity exceeded the target. The second was a granting of capacity to coastal States that did not have fleets based on their EEZs. With this second side payment, some States felt they did not receive enough of the initial allocation (Squires 2014), and continually present and negotiate claims at IATTC meetings. Essentially, the IATTC backed into an allocation and an attenuated rights program (Squires 2014).

In 2005, they adopted a comprehensive plan to manage capacity in the EPO to ensure the long-term sustainability of the stocks. However, the capacity cap ended up higher than desired to reach consensus (paper capacity problem). It allowed vessels to be added pursuant to paragraph 10. It allowed listed sunk vessels to be replaced. It allowed listed inactive vessels to be reactivated. It allowed adding vessels to account for oversights made by delegations at the meeting where C-02-03 was adopted. Finally, the original cap used estimated capacity, and once capacity was actually measured, some States had higher capacity than estimated, and these overages were accepted.



For new vessels, the flag State must advise the Secretariat in writing, and the State must have sufficient capacity available on their register (capacity is measured in well volume). If it is a replacement, vessels being replaced must be identified. Newly flagged vessels must show proof of new registration and proof of deletion by previous flag State. To change flags and remain on a list, both flag States must agree. It has become increasingly difficult to change flags as the old flag is reluctant to give up capacity. To remove a vessel, the flag State must request removal in writing to be able to retain capacity. If a smaller vessel is later added, the flag State retains the difference. If removed from the regional register, the IATTC Secretariat needs to know if the flag is also removing it from its national register.

Vessels can move from active to inactive and back again. The inactive list must be submitted to the Secretariat every 1 January, and those vessels must remain inactive all year. Active vessels may replace inactive vessels provided the total active capacity of the State does not exceed the active capacity of its entire vessel registration on June 28, 2002. The Secretariat recognizes that there are some problems with the wording of these rules, and that the language could be improved. In practice, however, vessels rarely change status during the course of a year.

The capacity limits were initially allocated to flag States, and some flag States have ceded their authority to vessel owners. States then allow their own flagged vessels to use the State capacity right as a use right. Some States have allowed

vessel re-flagging, and within this re-flagging some States retained that portion of capacity—and therefore the use right—while other States have relinquished the rights of the vessel leaving their flag. Technically, re-flagged vessels without a capacity right must obtain capacity from the new State.

Transfers, or loans, of capacity have been addressed and rules exist. Vessels may be added to the regional vessel register using a specified amount of capacity currently available to the lender. The vessel must fly the flag of the lendee and the lendee flag is responsible for the operation of the vessel according to IATTC and AIDCP rules. The two flags shall agree that the vessel may be removed from the regional vessel

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registry at any time at the request of either party in writing to the Director. Capacity shall revert to the lender upon the termination of the loan.

Performance

There have been no formal analyses of performance, beyond what has been mentioned above. Stocks are still in trouble and the program has had no impact on harvest or wealth. There has been very little trading, and no market has developed for capacity. Current capacity is at least 80 percent higher than the set target. It can be speculated that this program slowed the growth

of fleet capacity in the EPO, as current claims for new capacity and disputes amounted to 54,573 in 2016.

Dolphin Mortality Limits

Currently, the IATTC uses dolphin mortality limits (DMLs), established under the Agreement on the International Dolphin Conservation Program (AIDCP), to address dolphin bycatch. This is a type of property rights management, albeit imperfect (Allen et al. 2008). It is a blend of international common property and individual use rights (Squires et al. 2013). Since 1992, each vessel is allocated a DML, and that allocation has a one-year duration. Limited transfers are allowed, but there is not a full market. Vessels can renounce or forfeit an assigned limit, and that allocation can be assigned to other vessels. Ad hoc transfers also have been allowed. Security of ownership is also weak and not fully exclusive. Security of the right is subject to the ability of other governments to manage their rights. There has been some evidence of vessels changing flags to avoid DMLs (Allen et al. 2008).

Squires et al. (2013) agrees that it is an attenuated right that is not fully exclusive and is only valid for 12 months. However, security and transferability are subject to government decisions. The mortality limits are not individual but assigned to the country. Security is subject to the ability of various governments renouncing their DMLs or to the reallocation of the unused limits among their own fleet. Changing flags retains DMLs, and the new flag State enforces the DML. The AIDCP allows for some limited transferability. Vessels can forfeit or renounce their limit, and then the forfeited limit can be re-distributed among the other vessels.

Market/Financial-Based Tools

Table 3 contains the MSC certifications in the EPO. The Northeastern Tropical Pacific PS YFT and SKJ fishery was certified very recently, September of

Table 3. MSC Certified Tuna Fisheries in Eastern Pacific Ocean

FISHERY	SPECIES	GEAR TYPES	LOCATIONS	MSC STATUS	MT
Northeastern Tropical Pacific Purse Seine yellowfin and skipjack tuna fishery	SKJ, YFT	Surrounding Nets – With purse lines (purse seines)	Eastern Central Pacific (FAO Area 77)	Certified	
AAFA and WFOA North Pacific albacore tuna	ALB	Hooks And Lines – Trolling lines	Eastern Central Pacific (FAO Area 77)	Certified	11,436
AAFA and WFOA South Pacific albacore tuna	ALB	Hooks And Lines – Trolling lines	Eastern Central Pacific (FAO Area 77)	Certified	390

2017. It was certified after a detailed assessment that took two years, shepherded by an umbrella organization called the Pacific Alliance for Sustainable Tuna (PAST), which is comprised of four Mexican tuna industry groups: Grupomar, Herdez del Fuerte, Pesca Azteca, and Procesa. The goal of the fishermen in this group is to attempt 100 percent live release of all non-target species. They do this by working together using a fine mesh safety panel, called a Medina panel, and by employing trained divers to assist remaining dolphins out of the net. Medina panels are fine mesh panels that keep dolphin from becoming entangled in the net as the net is pursued.⁹ The fleet operates in compliance with all IATTC requirements including the AIDCP. All of the tuna in this fishery is destined for the canneries.

The last two fisheries on the list were merged into one certification program in 2014 after initially being separately certified one month apart in

2007. This is a hook-and-line and troll fishery for ALB in both the Northern and Southern East Central Pacific. This certification covers 650-870 boats that fish in the American Albacore Fishing Association (AAFA) and the American Western Fish Boat Owners Association (WFOA). There is little to no bycatch in this fishery. Most of the 11,826 MT harvest is canned, but some is sold fresh or frozen.

Table 4 contains the FIP projects in the Eastern Pacific Ocean. Both FIPs were initiated one month apart in late 2016. The OPAGAC projects encompass all global tropical tuna stocks of BET, SKJ, and YFT for a total of 13 units of certification. This FIP is working toward the following objectives by fall of 2021:

1. Achieve MSC certification for the OPAGAC industrial purse seine tuna fleet in three oceans and four RFMOs within the next 5 years

Table 4. FIPs for Tuna Fisheries in the Eastern Pacific Ocean

FIP NAME	SPECIES	MT	START DATE	PARTICIPANT(S) - ORGANIZATION(S)	CURRENT STAGE
Eastern Pacific Ocean tropical tuna – purse seine (OPAGAC)	BET, SKJ, YFT	80,000	Oct-16	OPAGAC	Stage 4: Improvements in Fishing Practices or Fishery Management
Eastern Pacific Ocean tropical tuna – purse seine (TUNACONS)	BET, SKJ, YFT	113,568	Sep-16	TUNACONS - Tuna Conservation Group	Stage 4: Improvements in Fishing Practices or Fishery Management

9 <http://www.fao.org/fishery/equipment/medinapanel/en>.

2. Unify the industrial purse seine fishery into one MSC unit of certification, instead of the misleading current division of free and associated schools
3. Bring together leading industry and environmental partners to work collaboratively towards sustainability of the fishery, and ensure fair market access
4. Have RFMOs adopt Harvest Control Rules (HCR) for stocks of tropical tuna species, including support to the process of Management Strategy Evaluation based on the best science available
5. Adoption of robust ad hoc rebuilding strategies, in line with MSC standards, for stocks not subject to HCR (where required)
6. Influence the various RFMOs to adopt an ecosystem approach to fisheries management
7. Assist RFMOs in the adoption of best practices concerning the use of drift fish aggregating devices (dFADs), through provision of information in support of informed scientific advice
8. Drive real changes in the fleet to minimize the impact of the fishery on non-target species and improve survivorship of sensitive species such as turtles, sharks, and any other sensitive bycatch

The second project, TUNACONS, seeks similar goals to the above for PS YFT, SKJ, and BET. TUNACONS is an organization created by Ecuadorian PS fishing firms. By 2018, this FIP aims to:

1. Develop sustainable fish stocks guidelines during the certification process
2. Achieve effective management for the fishery
3. Minimize environmental impacts from its vessels
4. Achieve MSC certification

The fleet fishes in the IATTC convention area, EEZs of the Marshall Islands, and Kiribati. The vessels are flagged by Ecuador, Panama, the United States, and Colombia. From an actions standpoint, the project is 85 percent on track and 15 percent complete. From a red indicator progress standpoint, the FIP is 100 percent on track.

Pilot Projects

The pilot projects in this region have built off the previous pre-implementation work discussed above. FPIs have been conducted to inform the process and stakeholder meetings conducted to explore options in the region. Several potential business cases have emerged prior to the 2016 GloTT meeting, including creating a functioning market for hold capacity coupled with an industry funded buyback; a VDS program modeled after the PNA with limits on FADs; FAD set limits; a TAC and quota program across the entire EPO; or a TAC quota program for BET and YFT, implemented initially in one or two main countries to control the catches of small tunas in the FAD purse seine sector. These options were presented to stakeholders with early stakeholder meetings indicating that limits on FADs were not desired and that they preferred BET and YFT quotas. It was noted that a transferable quota on small BET and YFT would be unlikely to rationalize the entire PS fleet and a transferable quota program for adult YFT could impact Mexican capacity (Maharaj 2016). Once these options were developed further, the operational costs of a catch quota system seemed to deter some vessel owners who then indicated a preference for vessel days.

From outreach efforts, it was found that stock status will not likely be a driver, but that lost wealth might be a good driver. WWF also found that rights assignment would be a contentious issue.

1. Developing coastal States not participating in the fishery, including States with claims for capacity, are unlikely to agree to an EPO-

wide final allocation, unless such allocations are time limited, States are compensated, or quotas (days or catch) are set aside for their future use. ISSF conducted a workshop in 2014 on transfers of capacity, summarized in Appendix 2, that offers additional solutions. The ISSF workshop report also covered the risks of capacity transfers and provided the following relevant to the EPO: "Transfers must take into account the shore based processing capital and taking care not to strand that capital. Also, government revenues could be impacted by these transfers. It is important to analyze the social and political implications of trades to avoid downsides."

2. Nations with fleets that do not have lengthy catch histories have objected to allocation formulae presented in recent proposals submitted to the IATTC by Colombia and Ecuador.
3. Reaching sustainability may require trade-offs between the PS and LL gear types. There does seem to be enough dissipated rent to compensate the PS fleet as a side payment or under some sort of Coasian solution. This is complicated by nations that have vested interests in particular gear types driven by large investments in shore-side processing capacity. For example, Ecuador has little LL revenue but a lot of PS revenue and processing revenue.

Given the above, stakeholders are exploring a gradual pathway to reform that breaks up the problem into manageable parts that will yield meaningful gains. One starting point considered was BET, as a relatively small number of boats harvest BET and one country, Ecuador, captures most of the small BET in the purse seine sector. Also, country limits for adult BET have been established for the industrial longline sector. As stated before, the stakeholder meetings generally found that quota systems were preferred over day-based rights because of experience with

DMLs. Days at sea would not work for BET because they are not uniformly distributed in PS sets over FADs. Days might work for YFT if they were coupled with FAD set limits and effort creep measures are implemented.

A sub-regional agreement might work as only five countries catch 80 percent of tuna catches. The PS sector vehemently opposed a BET tax, but fines or penalties for exceeding individual or country quotas were not opposed. Another option discussed was to form a BET corporation that would own and manage PS BET and could trade quota with the LL fleet. It was very clear that the majority of key actors wanted to avoid an increase in the 25-day PS closure, and Ecuador and Colombia submitted formal proposals to the IATTC in 2016 to consider country-level and individual-level quotas as alternatives.

Using the outputs from the initial data collections plus the stakeholder input, the WWF commissioned a cost/benefit analysis of the use of country quotas for BET and YFT compared to longer closures for the purse seine fleet. IATTC biologists developed equivalent scenarios to meet the TAC reductions necessary for stock recovery. This utilized the quotas set by the IATTC in February 2017 for Class 4, 5 and 6 boats that fish on FADs. Ecuador and Columbia, at the February meeting, proposed IVQs for Class 6 boats that fish for BET using FADs and Columbia extended their proposal to also include YFT fishing on FADs. Both countries put these proposals out pro-actively because they do not want longer closures. These two proposals prompted the IATTC to set the global quota for all PS sets for BET and YFT. Unfortunately, this global quota system resulted in a race to fish in the FAD purse seine sector. The IATTC then increased the seasonal closure by 10 of the 25 additional days in 2017. In 2018 the scientific staff recommended additional measures to protect bigeye that were not adopted.

Bucaram (2017) conducted a cost and earnings survey of the fleet and was able to estimate



cash flow profiles for five vessel size classes. The study also estimated the costs of increased MCS including electronic monitoring (EM), annual observer coverage for vessels not covered by the current 100 percent person-observer requirement, and improvements to observer safety. The report examined accomplishing the MCS goals strictly with EM or a combination of EM and observers, and estimated that the net present cost of compliance costs per vessel to be \$13,467 for boats that have observers already and \$24,054 for vessels that don't currently carry observers.

As mentioned above, IATTC biologists estimated the intervention equivalencies for this analysis. An increase in the PS closure to 25 additional days is equivalent to an IVQ for BET 10 percent less than the historic catch level or an IVQ for both

BET and YFT 10 percent below historic catches for both species. An increased in the closure of 10 days would be equivalent to an IVQ for BET set 4 percent below the historic catch rates or an IVQ for YFT set at 8 percent less than historic catches. He also analyzed a simultaneous 4 percent and 8 percent catch drop for BET and YFT respectively.

While it is hoped that an IVQ would be tradable eventually, Bucaram (2017) modeled no trading and no rent gains due to trading and other features of tradable catch rights. Instead, the interventions were simply modeled as reductions in individual TACs. Any reduction in cost over a closure would be the flexibility to reduce bycatch of BET and YFT and increase revenues by targeting SKJ with less bycatch.

From the analysis and with the costs of MCS included, most scenarios analyzed resulted

in improved benefits under an IVQ program compared to the closed season. Larger vessels were better off than smaller vessels under the IVQ scenarios. Closures reduce flexibility, and reduced flexibility is costly. Ten more days of closure would cost the fleet between \$10.1-\$26.3 million per year in lost revenue. Looking at the IVQ equivalent scenarios, the BET-only scenario would cost between \$705,000 and \$2.4 million annually, the YFT-only scenario between \$3.2 and \$22.6 million annually, and both species together would cost between \$4.8 and \$26.6 million per year. Twenty-five more days of closure would cost between \$25.2 and \$61.6 million per year. Looking at the IVQ equivalent scenarios, the BET-only scenario would cost between \$1.7 and \$28.4 million annually and both species together would cost between \$12.6 and \$59.7 million per year. The lower-end figures in the estimates allow the boats to catch more SKJ to make up for the lost revenue in BET and YFT fisheries. None of these figures include the costs of additional MCS. Including MCS costs, accepting closures instead of an IVQ will cost \$2-4 million more, or \$9,000 – \$16,000 more per vessel than the IVQ. It is important to point out that adding a market and allowing resource rents to return to the vessels would change that calculus dramatically in favor of the IVQ.

WWF also provided technical support to the IATTC's developing plan of action for fleet capacity management by supporting analyses of capacity alternatives under OPP. Capacity management alternatives analyzed were based on options discussed at an IATTC Cartagena Workshop held in 2014 that was jointly supported by NGOs; options presented by Commission members separately and as part of the IATTC Capacity Committee's recommendations; and additional options recommended by an advisory committee for this study (Northern, Economics, 2018). A total of eight capacity reduction programs and initiatives are assessed in this report. Three are

assessed in a qualitative manner and five are assessed quantitatively.

The three qualitatively assessed capacity reduction programs are as follows:

1. Adoption of elements of Japan's proposal to the IATTC in 2013¹⁰ that whenever there is a request to reassign capacity to a different vessel, some percentage of the capacity must be removed from the Regional Vessel Register. Based on the parameters in Japan's proposal, this alternative will result in a very slow reduction of fleet capacity;
2. Implementation of a "small steps" initiative. Collectively these small steps could set the stage for additional actions that could significantly reduce capacity; and
3. A program that would freeze current latent capacity on the vessel register until fleet capacity is reduced to the optimum.

The five quantitatively assessed capacity reduction programs are as follows:

1. An industry-funded vessel/capacity buyback program. Generally, buybacks resulted in a fleet that was profitable after accounting for repayment of the buyback loan. To be effective in the medium- and long-term, buybacks need to be combined with other programs such as RBM to eliminate the incentive for "effort creep";
2. IATTC member states reduce operative capacity by 10 percent per year and freeze that capacity until total capacity reaches optimum level;
3. Voluntary capacity reduction pilot programs;
4. A Transferable Individual Vessel Quota Program;
5. Annual Small Tuna Vessel Limits for BET and YFT.

10 The full text of the proposal is available at http://www.iattc.org/Meetings/Meetings2013/Jun/_English/IATTC-85-PROP-H-2-JPN-Management-of-fishing-capacity.pdf.

Northern Economics (2018) concluded that excess capacity in the Eastern Pacific negatively impacts the profitability of the industry, conservatively estimated at \$47 million annually. The over-capacity problem will become even more serious as current operational vessels can increase effective effort, which could result in a closure period ranging from 84 to 103 days. Future replacement of existing vessels with more efficient ones will also intensify this “race to fish.”

The over-capacity problem will become even more serious as current operational vessels can increase effective effort, which could result in a closure period ranging from 84 to 103 days. Future replacement of existing vessels with more efficient ones will also intensify this “race to fish.”

Consistent with the findings in many fisheries around the globe, the Northern Economics study shows that transferable quota approaches result in a reduced fleet size that is close to the optimum. A similar alternative is a uniform limit on small bigeye and yellowfin tunas for all vessels in combination with improved monitoring on the vessels and at the processing plants. The uniform limit approach will constrain the least number of purse seine vessels. While the study examines proposals separately, it is clear that there are different pathways to reform that can utilize a combination of these scenarios appropriately sequenced. For example, industry-funded vessel buybacks could be combined with quota programs to jump-start capacity reduction initiatives and/or used to settle disputes.

Recognizing that some adaptations will be required to change behavior, the study also analyzed pilot programs on individual vessel quotas (transferable) and voluntary capacity

reduction. The latter includes incentives such as reduction in the length of the closed season for member countries taking steps to reduce fleet capacity, with compensation paid to those who choose not to fish by vessel owners benefiting from the shorter closed season. Pathways to reform could incorporate such pilot programs, which once implemented would be modified and expanded using a stepped approach to full adoption. The IATTC can make progress by adopting one or more of these proposals or build off the analyses conducted and adopt modified versions in its plan of action on fleet capacity management in the Eastern Pacific. Apart from use by the IATTC, these assessments can be useful to other tuna producing regions grappling with problems of over-capacity.

Results of the Northern Economics and Bucaram’s analyses described above will feed into two business cases currently under development. Obtaining an early assessment from pitching business case concepts to prospective investors was helpful in designing the subsequent analyses for the business cases. Both are currently under development and a brief description follows.

The first business case focuses on raising enough money to cover some or all of the cost of transitioning towards an IVQ that includes the costs of increased monitoring. IVQ adoption would require improvements in reporting at the fish processing plants and increases in observer coverage and observer security. This investment in EM and analysis of data gathered by EM would also be needed (WWF 2017). The analysis considers first starting with a subset of the fleet that is large enough to repay an investment, followed by one member state of the IATTC, and finally the IATTC region. The traditional financing path would seek \$7 million dollars at traditional 8-12 percent rates amortized over five years for the entire IATTC region and proportionally smaller investments for the cases applied to a subset of the fleet. If agreement cannot be reached at the IATTC to allocate catches in the near term,

a sub-regional agreement could be considered. Another intermediate step is a pilot “research” program for a subset of vessels to assess the cost savings from an IVQ versus the closed season and effectiveness in reporting.

The second business case will address over-capacity in the EPO that builds off technical support that WWF provided to the IATTC’s developing plan of action on fleet capacity management. A combination of vessel/capacity buybacks and ITQs are modeled for Ecuador and the entire IATTC region. Options for capacity removal through buybacks are viewed as a potential first step in settling allocation disputes and jump-starting the capacity reduction process in the Eastern Pacific. This business case requires investments that could range from \$15-\$40 million that can be repaid over a five to seven-year period.

The difficulty of the traditional path for both business cases is the lack of an asset to securitize the loan. Hence, both cases model blended investments that are backed with multi-sector credits and allow for initial grants to make the overall loan repayments attractive to industry. Also, some sort of borrowing entity would have to be developed. The loan could be paid back with either a landings tax or a landings commission.

Another financing option proposed is a tuna trust for a program based on ITQs or IVQs with leasing allowed. The trust would acquire a 0.3 percent share of the newly issued IVQ using loans with the IVQ as security. This option would seek \$9 million for 10 years in non-traditional financing that might require higher returns (12-15 percent). However, since the quota would act as security, the terms might be more favorable. In this option, \$7 million would be used to purchase quota and \$2 million would be used to develop a quota leasing body. The trust would use the funds from leasing quota to cover the initial start-up costs and act as a proof-of-concept for the development of a market across all IVQ holders

that could eventually control capacity and earn those vessels resource rents. The investment options paper is clear to point out that there are risks including biologic uncertainty, market price and demand volatility, regulatory uncertainty, credit risk, and execution risk.

Other Solutions for the FAD Bycatch Problem

This section discusses RBM approaches to addressing BET bycatch around FADs, neither of which is currently being actively considered in the region at this time. These concepts were presented at a special session of the International Institute of Fisheries Economics and Trade (IIFET), organized by WWF and sponsored by OPP in Aberdeen Scotland in 2016. The goal of this session was to present incentive-compatible intervention strategies to address the issues facing the pilot projects. Both of these short papers focused on solutions to the BET bycatch problem around FAD PS sets.

Ovando et al. (2016) developed the concept of a benefiter pays, or Coasian solution, to the issue of BET bycatch on FAD sets in the PNA area of competence. The general construct of the problem, covered above, is that BET is worth more harvested as a larger fish for the sashimi market than as a PS-harvested fish for the cannery market. In addition, by catching BET as juveniles, the FAD fishers reduce recruitment and intercept those fish before they grow large enough to spawn, which also reduces the amount of sashimi-sized fish available to the LL fleet. Their approach seeks to determine whether the LL fishers would be willing to pay (WTP) the PS fishers to avoid FAD sets.

Ovando et al. (2016) utilize a surplus production model to determine if there is enough WTP from the LL sector to make the PS fleet as well off avoiding FAD sets as they would be fishing over FADs. The payment would be structured as a subsidy to PS boats in the market for vessel days

in the VDS, but those vessel days could only be used for non-associated sets. The model seeks to calculate the revenue gains expected by the LL fleets from a given bycatch reduction while also calculating the cost to the PS fleet of foregoing FAD sets. If the LL sector's gains are greater than the cost, there is room for a Coasian bargain that leaves both sectors at least as well off as they were before the intervention.

When considering the sort of market that would result in a Coasian solution, structuring how the trade happens makes all the difference with regards to transaction costs.

The authors find that a Coasian bargain is possible. The LL fleet can pay the other party to avoid bycatch, and their payment is sufficient to keep the PS fleet as least as well off as before. They find that the LL fleet would be WTP \$540 per FAD set per year up to a total of 97,000 FAD vessel days to increase their harvests of mature BET. Under this strategy, B/B_{msy} would go up from 0.6 under status quo to 0.7. The authors go further to offer some advice on making this bargain operational (Ovando et al. 2016). The success of the bargaining in the market place depends on the level of transaction costs. Under a free market with little to no friction, the above result would occur naturally; however, if trade is costly and rights are not secure enough, the bargain may fall apart. To have success, the right institutions need to be in place. Currently in the PNA area of competence, the VDS is used to manage PS fishing under weak limited entry with a cap on the total number of vessel days available. In this fishery, vessel days sell for as

much as \$10 k per day. It would seem, then, that the basic institutions are in place for a Coasian solution to work.

When considering the sort of market that would result in a Coasian solution, structuring how the trade happens makes all the difference with regards to transaction costs. For example, if every LL vessel had to bargain with individual PS vessels to secure a reduction in bycatch, transaction costs might prevent a Coasian solution from arising. However, because rights are assigned to PNA countries first and then those countries lease those rights to other flag states and individual vessels, it would reduce transactions costs greatly if LL vessels could negotiate these payments directly with the PNA countries that hold the vessel days. It would further reduce transaction costs if the LL fleet could establish a single entity that handled negotiations on their behalf. Ovando et al. (2016) offer an example of how this might work. As posited above, suppose vessel days sell for \$10 k/day and can be used to fish any way the PS vessel chooses to fish. The BET interests (the LL fleet) would pay the PNA country \$500 per day to restrict the use of that day to fish only on non-associated schools of tuna. The PNA country would then sell that day, restricted to no FAD sets, to a PS boat for \$9,500/day, representing a \$500 discount to the PS vessel.

Squires (2016) developed another incentive-compatible way to address bycatch in a very similar fishery in the Eastern Pacific Ocean. There again, some of the PS sets are on FADs and those FAD sets have high bycatch of juvenile BET and YFT. This generates a reduction in value as the juvenile fish are entering a lower-value supply chain and are harvested before they have a chance to respond, further reducing the availability of larger fish that could be sold into a higher-value supply chain. Squires (2016) proposes to address this bycatch with a cap-and-trade program for bycatch. Squires proposes something very similar to the recently

implemented Amendment 7 cap-and-trade system for BFT in the Atlantic. Both are based on assigning quota to boats by rewarding those that avoid bycatch. While the language used to describe the allocation methods differ, both follow essentially the same allocation rule under what Squires calls an “absolute performance standard.”

The Squires proposal is fundamentally an ITQ that can be based on a tradable absolute or a relative performance standard. Vessels then would use the market to trade these bycatch shares. The market rewards those with low marginal abatement costs and ensures that those with high marginal abatement costs are incentivized to reduce their abatement costs. It also allows these high abatement costs to keep fishing while still conserving the bycatch species. Within this system, credits—or what is typically called quota units—would be generated when a vessel fishes under their bycatch quota in a certifiable way. The U.S. BFT system differs in that the initial allocation of bycatch quota is made based on the historic avoidance of BFT and assigned for a long term. Squires’ proposed system seems to imply an annual re-distribution of catch based on the previous year’s bycatch performance.

Once the credits are assigned, users can sell their credits to another vessel with a higher abatement cost. Or if the quota is assigned to flag States or a corporation that has multiple boats, those credits can be pooled and traded within the vessels in the country or the corporate fleet. If a vessel does not have enough credits to cover bycatch, it has to cease fishing. Per the U.S. Atlantic BFT example above, a vessel cannot leave the dock if it does not have enough quota weight to cover the average size BFT. A significant difference between a proportional allocation of a total bycatch cap and a bycatch credit is that a credit does not, according to Squires, constitute a property right and therefore may be more politically acceptable.

Squires (2016) goes on to describe two separate ways the credits can be assigned. The first, the most similar to the U.S. system for BFT, is an absolute system. The credits would be in pounds of bycatch and the credits must sum to the bycatch TAC. The second is a relative credit based on the ratio between bycatch and target harvest. The managers would define a maximum ratio that could not be exceeded. The ratio could be defined by bycatch per day, bycatch per FAD set, or bycatch per ton of SKJ harvest. It is possible that a ratio target would be more politically acceptable than an absolute credit, however a ratio target is a weaker incentive to reduce bycatch and might need to be combined with other rewards or penalties to enhance incentives.

Both relative and absolute credits require the same technology standards such as strong monitoring, 100 percent observer coverage, and mandatory FAD designs that include electronic monitoring devices. Electronic monitoring in real time at the FAD level can incentivize real-time spatial management within the fleet. If the fleet can agree to share this data in real time, FADs with high bycatch rates can be avoided and FADs with little bycatch can be frequented. Similarly, countries, corporations, or cooperatives could pool their quota across vessels to form risk pools that would act like an insurance policy against high bycatch levels.

Indian Ocean

The Indian Ocean supports valuable tuna fisheries for YFT, SKJ, BET, and ALB, along with a host of neritic tunas and tuna-like species. The Indian Ocean produces 20.7 percent of global tuna production worth \$2.7 billion (Macfadyen et al. 2016). By weight harvested, YFT is the most important stock with over 400,000 MT landed in 2015, followed closely by SKJ with 393,954 MT, BET with 92,736 MT and ALB with 35,068

MT (IOTC 2016a). Forty nations fish in the IOTC region of competence including coastal States and DWFNs (Maharaj 2016). The IOTC region of competence covers the entire Indian Ocean. The fleet includes industrial fleets and small-scale boats from coastal States locally dependent on their catch.

Problem

YFT, the most important fishery in the region, is overfished and overfishing is occurring. As of 2015, there was a 94 percent probability the stock was in the red zone in the Kobe plot (IOTC 2016a). For 2016, that probability was lowered somewhat due to utilizing better LL harvest data, but the stock is still strongly in the red. The stocks of ALB, SKJ, and SWO (not in the southwestern Indian Ocean) are not quite fully exploited and may be able to stand additional exploitation. BET and SWO in the southwestern Indian Ocean are fully exploited (IOTC 2016a). As with other regions, recruitment overfishing in YFT and BET are hampering the long-term sustainability of those two stocks.

Thus far, conservation measures have been unable to prevent the YFT stock from being overfished, and now the stock is below BMSY (IOTC 2016a). Those conservation measures include a vessel register and capacity controls that were largely set too high (Aranda et al. 2012). The IOTC, recognizing trouble with YFT stocks, decided to explore limiting the capacity of large-scale fishing vessels (LSFV) fishing in the region. This decision grew into the first measures to limit capacity in 2002. The measure attempted to limit access through the creation of a vessel register for boats over 24 m. The number of vessels over 24 m LOA in operation in 2003 became the vessel cap. The cap was placed in terms of number of boats and overall tonnage, and included entry/exit rules (Aranda et al. 2012). These flag State-capacity caps were not transferable, with no provisions for reflagging vessels. However

the entry/exit rules allowed countries to plan for replacing vessels (Aranda et al. 2012). They also included provisions for the development aspirations of coastal States, provided they filed fishery development plans (FDPs) with the IOTC. This limitation was expanded to vessels below 24 m LOA that fish the high seas in 2005. However, these limits were set high enough not to be binding because of the ability to add capacity below 24 m LOA, and based on developing state FDP requirements (Aranda et al. 2012).

Capacity continued to increase despite these measures, and the IOTC froze capacity for LL and PS boats larger than 24 m to 2006-2007 levels in 2009. Aranda et al. (2012) views this as an implicit allocation of capacity to member countries. However, FDPs can still be filed requesting additional capacity. It is clear that the stocks cannot be maintained with the current level of allowed capacity (Aranda et al. 2012). This led to the establishment of closed areas in 2010, as well as effort controls. The failure of the capacity controls to limit exploitation of tropical tunas led to the further reforms, discussed below.

Implementation

As with other regions in this larger discussion, implementation has involved a long, deliberative process that includes IOTC meetings and workshops hosted by NGOs. In 2014, the ABNJ tuna project sponsored a workshop run by WWF focusing on management strategy evaluation, developing a precautionary approach, and rights-based management for tuna fisheries (FAO 2014). The RBM portion of the workshop is pertinent to this exercise and the entire premise of the RBM day of the workshop was to discuss tradable catch quotas highlighting that allocation and effective market mechanisms, the most critical design concepts to increase value and decrease capacity (FAO 2014).

The following goals were discussed for a transition to RBM (FAO 2014):

1. Fulfilling the right to benefit from tropical tuna fisheries (recognizing development aspirations);
2. Increasing economic growth and local employment;
3. Building human capacity;
4. Meeting rights obligations;
5. Exercising sovereign rights; and
6. Ensuring food security.

The workshop introduced the concept of “graduality,” suggesting that it may be best to begin with a weak, attenuated right and move toward strong individual rights in the future. In this region, a large proportion of the catch is from the artisanal and non-industrial sector. Therefore, meeting social and economic objectives for these sectors will be important. Perhaps “soft” limits for these sectors will protect their aspirations and socio-political goals, which is a right attenuation (FAO 2014). Most discussions at the IOTC, to this point, have only been about fleet capacity limitations.

It was learned in this workshop that there is a lot of stakeholder concern about development aspirations and socio-political issues. Some of the socio-political issues include the potential for rising prices for fish for local consumption. Artisanal and small-scale fishermen largely fish for local consumption, and if RBM increases the value in those fish, stakeholders are afraid they will be priced out of the market. Also, property rights, by definition, mean exclusivity, and that generates concern among coastal States that treat fishing as the employer of last resort (FAO 2014). For these reasons, it was decided that any intervention should be built from the bottom up.

There was a lot of discussion about looking at “capacity” holistically. Stakeholders in this workshop want capacity to include the

entire supply chain, and want to examine the implications of interventions using a community-wide livelihoods approach (FAO 2014). They also expressed a desire to have the process move from a focus on harvest capacity and allocation of strong rights. This was reinforced during the small group discussions, in which participants focused on the difference between small-scale fishers and industrialized fishers. They recommended that management interventions should proceed slower for artisanal fishermen than for the industrial sector (FAO 2014). Much of the stakeholder focus turned to a desire not for RBM but for shore-side infrastructure investment and addressing aspirations by building more processing capacity locally. Any discussion around reducing harvest centered on input controls and primarily effort controls. Equity and fairness were a common theme in the group discussions. There was also a sentiment that any intervention should be a package—a holistic group of interventions and not bits and pieces (FAO 2014). It was mentioned that side payments could be helpful and that job training and relocating employment to other sectors could be a good side payment. Overall the workshop concluded with a positive outlook, but a realization that it would take much iteration to train participants in markets and RBM, in addition to designing any possible intervention. However, there was a high degree of willingness to engage and an interest in maintaining momentum (FAO 2014).

WWF has been involved in considerable pre-implementation work for RBM in the southwest Indian Ocean (SWIO) under the aegis of the Coastal East Africa Global Initiative (CEAI). The CEAI was initiated in 2010 with the goal of building political coalitions around justifying tuna management reforms; raising awareness of triple bottom-line benefits of improved engagement in tuna governance; lobbying SWIO governments, the African Union, SWIO Fisheries Commission, and regional economic communities; and facilitating a process for SWIO states to agree

on a collective approach to engaging in tuna management reforms (IOTC 2015). The original focus was on the countries of Kenya, Tanzania, and Mozambique, but that scope was expanded to include Seychelles, Comoros, Madagascar, and Mauritius. Suggestions to encourage the development of RBM included developing pilots to show livelihood improvements, build capacity to capture EEZ rents, support better fishery access agreements, and set allocations that recognize aspirations.

These efforts have begun to pay off in the region, as Mozambique and the Maldives joined the IOTC. Maldives joined in 2011. Additionally, SWIO countries have been involved in making management proposals. Seychelles and Mozambique have adopted FAO port State measures as part of national efforts to end IUU. Kenya, Tanzania, and Mozambique have adopted the Maputo Declaration on Regional Minimum Terms and Conditions. Finally, Kenya, Tanzania, Mozambique, and Madagascar have adopted and begun to implement National Tuna Management and Development Strategies (IOTC 2015). WWFs work also has led to a focus on the precautionary approach, using reference points and moving forward with allocation as part of an RBM process.

Through this engagement in pre-implementation work, WWF has learned a lot. Adequate socio-economic advocacy is important to secure regional engagement. Pre-implementation discussions need to include the incentives and benefits that will come from improved management. It is important to engage with the relevant institutions. Regional processes require a long-term commitment. That commitment can include building internal, coastal state capacity. If the region is heterogeneous, it is important to build the platform on common goals and to build trust. Sub-regional RFMOs can influence the process upwards. It means engaging and synergizing with regional economic communities in the region. Empowering civil

society organizations and the private sector is a necessary but not sufficient condition to ensure civil society engagements in offshore fishery reforms. Building a comprehensive approach to fisheries reform requires addressing the entire range of tunas and must include all the different sub-sectors and supply chain groups, while recognizing that the artisanal sector presents complex issues for RBM institution (IOTC 2015).

Finally, the IOTC (2015) made a number of recommendations going forward: Promote the implementation of the ideas and concepts developed through the SWIO pre-implementation work; Promote harmonization across the regional groups and stakeholders; Improve coordination so all regional IOTC groups are working towards the same goal while also harmonizing funding approaches; Promote a locally-based tuna industry to keep more value-added local, and to strengthen and improve the livelihoods of artisanal fishermen.

Design

The pre-implementation processes discussed above have led to IOTC Proposal D (IOTC 2016). This proposal is focused on establishing a quota allocation system for the main target species in the IOTC area of competence. IOTC Resolution 10/01 in 2012 required the CPCs to adopt a quota allocation system for BET, YFT, and SWO. This proposal is a revision of Proposal B submitted in 2011 at the Nairobi meeting of the IOTC. This proposal lays out a complete allocation plan that recognizes the legitimate sovereign rights and aspirations of coastal States, SIDS in particular, and DWFNs that have historically fished in the IOTC area of competence. The allocations are based on more than just history to address the aspirations of coastal States (IOTC 2016).

The allocation scheme is a hybrid scheme. Fifty percent or more of the historical catches are from DWFNs fishing on the high seas. Coastal States in the region often lack historical catch data,

not from lack of participation in the fishery, but due to the lack of catch reporting. The scheme will use catch history by area fished across EEZs and the high seas, creating a zonal attachment basis for quota allocations. Coastal States with no reporting history are defined as “disadvantaged States” and will be handled differently in the allocation process. This system was designed to maintain status quo in the near term but allow for aspirations in the longer term. More catch reporting and MCS is obviously needed in the longer term.

Formally, a disadvantaged CPC is a coastal State with a baseline nominal catch proportion of less than 3 percent, averaged across all IOTC species with a TAC, but excluding CPCs that have historically operated flagged vessels over 24 m on the high seas in the IOTC area of competence, and also excluding CPCs categorized as developed by UN criteria (IOTC 2016). The allocation procedure itself is quite complicated.

It starts with the scientific committee setting a precautionary “effective TAC.” The effective TAC is reduced by the supplementary TAC and becomes the adjusted TAC. The supplementary TAC is calculated as the proportion of the total area of IOTC competence held by the combined areas of all the disadvantaged nations. Disadvantaged CPCs will develop a scheme to allocate the supplementary TAC based on socioeconomic criteria to calculate the individual supplements.

The adjusted TAC is allocated as the baseline nominal catch proportion to eligible CPCs as defined in 2012, before any deductions. This is set using a hybrid scheme based on the catch per area in the EEZs of coastal States and on historic catch levels of eligible flag State fishing fleets on the high seas. The total catch taken by all CPCs in the EEZs of each coastal State, including CPC artisanal catches, will be calculated for the reference period, and the proportion of the total catch taken in each EEZ will be calculated.



This approach similarly applies for total high seas catch by a flag State. The baseline nominal proportion is the sum of the proportion of EEZ harvests plus the proportion of high seas harvest for each CPC.

The baseline supplementary TAC is the allocation proportion allocated to the disadvantaged CPCs, as defined in 2012 before any deductions. The baseline allocations become the adjusted nominal catch proportion after adjustments to

Artisanal catches are currently only estimated and will only be adjusted in the reference period if found to be significantly different. This may create a fishing-for-allocation problem for CPS with high artisanal effort.

the baseline to accommodate factors such as new entrants or permanent quota trades. A CPC nominal catch allocation is its allocation at the start of any specific allocation period before any adjustments for membership or compliance. Preliminary catch allocation is the nominal catch allocation to the disadvantaged CPCs before any addition of supplementary allocation. The effective allocated catch limit is the catch allocated to a CPC net of all deductions or additions. Baselines are only set once at the start of the entire program. The effective allocated catch limit is calculated at the start of every allocation period, and is not necessarily proportional to the baseline due to the application of a number of control rules.

Nominal catch allocation is the baseline catch proportion multiplied by the adjusted TAC for non-disadvantaged CPCs. The preliminary catch allocation is the exact same formula

for disadvantaged nations. Similarly, for the disadvantaged, the supplementary allocation is the baseline supplementary allocation multiplied by the supplementary TAC. For the disadvantaged CPCs, their total allocation is the preliminary allocation plus the supplementary allocation.

Finally, both of those allocations can be lowered due to membership status or compliance issues. Only full-member CPCs can receive 100 percent of their quota allocation. Cooperating non-contracting parties get 80 percent of their quota before other adjustments. Non-members get a 0 percent effective allocated catch limit. There is a table of compliance penalties as well, and any deductions from that table would be applied here. Members can reclaim their penalty deductions if they fix the offense. For non-members, that forfeited quota is held for redistribution as a bonus to eligible CPCs. The final effective quota allocation is the summation of their regular quota plus bonuses.

Because artisanal catch has been poorly reported, it may be necessary to make adjustments as MCS and reporting are increased; adjustments will be made after five years. Artisanal catches are currently only estimated and will only be adjusted in the reference period if found to be significantly different. This may create a fishing-for-allocation problem for CPS with high artisanal effort. Over time, it is possible for disadvantaged nations to transition out of disadvantaged status.

All future allocations will be in reference to these baselines. The catch history eligibility period is 1981 through December 2010. An artisanal vessel is any vessel less than 24 m, and therefore not on the IOTC list of authorized vessels. New entrants can only enter by buying or leasing quota.

The TAC, effective TAC, and effective allocated catch will be set for a three-year quota allocation period for economic stability and fleet planning. The TAC, and subsequently the quota, can be adjusted if the stock conditions change

significantly during that three-year window because it is a proportional quota. The allocation period is also subject to review in three years. The science committee will establish the assessment frequency.

Quota can be freely fished anywhere in the IOTC area of competence, and the spatial distribution of harvest will be monitored by the science committee. Any CPC can transfer all or part of their quota to one or more CPCs. CPC is in charge of allocation of the quota within their fleet and of monitoring catch and compliance. Excluding the artisanal fleet, only vessels on the IOTC record of authorized vessels can hold quota. CPCs will be obligated to indicate the number, size, and fishing gears for each vessel in their artisanal fleets.

Once traded, quota monitoring and compliance fall to the new owner. Quota may be leased to any member or cooperating non-contracting party. For the first 15 years, or first three allocation periods—whichever is longer—sale will not be permitted, and ability to sell will be reviewed at the end of this period. Quota cannot be carried over, and fines will be levied for going over quota.

CPCs are obligated to adhere to and apply all other relevant IOTC conservation and management measures. The compliance committee arbitrates any disputes. A CPC will submit a utilization plan at least 30 days before a commission meeting detailing fleet allocations, anticipated transfers, and any voluntary set asides.

Coastal States can only lease out their quota for the first 15 years. Access agreements and license stay in effect. Leases are to be tracked, and it is the sole responsibility of States to negotiate trades. The compliance committee will arbitrate any disputes that may arise. There will be a set-aside for new entrants but only new coastal States with a status of cooperating non-contracting member or member will be eligible.

Those potential entrants will request the amount of quota they would like, and the compliance committee will rule on the amount. A new DWFN can only enter by purchase or by lease. Either can rent quota at any time.

Compliance will be reviewed annually and the compliance table will be updated. Any penalties apply for a minimum of one year. The compliance table will include details on payment of IOTC contributions, and failure to pay will result in a sliding scale of penalties with a 20 percent reduction in quota the first year, 40 percent the second year, and disqualification of the CPC if the CPC is three or more years past due.

Performance

This intervention has not yet been implemented.

Market/Financial-Based Tools

Table 5 contains the currently MSC-certified fisheries in the IO. Currently, only Maldives SKJ is certified. The use of MSC in the region has sparked a bit of controversy. MSC certified both the Maldives SKJ and YFT pole-and-line fishery, even though neither fishery has harvest control rules (HCRs) in place and YFT is overfished and overfishing is occurring. The SKJ fishery was certified first and led to the YFT pole-and-line certification, which then led to the Maldives handline YFT certification and the Seychelles and Mauritius PS tuna certifications (IOTC 2015). WWF was heavily involved in the certification effort as a stakeholder for at least five years, and at the end of it all published a critique of the process (WWF 2016). WWF raised concerns repeatedly through the process regarding the lack of HCRs, and therefore the fishery should not be certified. However, multiple assessors, MSC technical oversight reviewers, and MSC peer reviewers all concluded that both fisheries should be certified. WWF felt this was a clear misapplication of the MSC Fisheries Standard.

Table 5. MSC Certified Tuna Fisheries in the Western Central Pacific Ocean

FISHERY	SPECIES	GEAR TYPES	LOCATIONS	MSC STATUS	MT
Maldives pole & line tuna	SKJ	Hooks And Lines	Western Indian Ocean (FAO Area 51)	Certified	85,782

WWF involvement in the process identified troubling systemic flaws in the MSC assessment process applied to these fisheries. MSC assessments disregarded factual stakeholder input in place of the discretion of conformity assessment bodies (CABs) (WWF 2016). Some in the WWF believe that it sets a bad precedent to certifying fisheries that are sub-standard in the hopes that the certification will nudge those fisheries towards sustainability. WWF feels the opposite is actually true, and insists now that sustainability promises must be fully delivered before certification. They conclude that nudging is probably best accomplished with fishery improvement projects (FIPs).

In February of 2016, the International Pole and Line Foundation hosted a workshop supported by MSC, WWF, ISSF, and several retailers who all came together in support of a sustainability proposal by the Maldives that called for robust HCRs. That was followed by 38 tuna purchasing and processing countries writing a letter to the IOTC urging that HCRs be adopted. By April, MSC pulled its certification for YFT. They said

they pulled the certification because there were no HCRs, YFT was overfished, and overfishing was occurring. Yet they left the certification for SKJ, which does not have HCRs either. Maldives had 90 days to submit corrective action, but even if that action is accepted, the certification will remain suspended until YFT stock status improves. IOTC and IATTC have since instituted HCRs, removing the barriers to YFT re-certification.

Table 6 contains all of the FIP projects in the region. Starting with the first in the list, the Indian Ocean tropical tuna purse seine FIP is a sub-FIP of a larger FIP that covers all global tropical YFT, SKJ, and BET stocks for a total of 13 units of certification. The sub-FIP groupings were made on the basis of RFMO boundaries. This separation was necessary because, even though the species are single stocks, each RFMO scored differently in the process and takes different actions on the various MSC principles. OPAGAC is an organization of frozen tuna producers recognized officially by the Spanish government.

Table 6. FIPs for Tuna Fisheries in the Indian Ocean

FIP NAME	SPECIES	MT	START DATE	PARTICIPANT(S) – ORGANIZATION(S)	CURRENT STAGE
Indian Ocean tropical tuna – purse seine (OPAGAC)	BET, SKJ, YFT	80,000	Oct-16	OPAGAC	Stage 4: Improvements in Fishing Practices or Fishery Management
Indian Ocean tuna – purse seine (SIOTI)	BET, SKJ, YFT	243,000	Apr-17	Seychelles Fishing Authority	Stage 3: FIP Implementation
Eastern Indonesia yellowfin tuna – handline	YFT	2,800	Sep-13	MDPI Foundation	Stage 4: Improvements in Fishing Practices or Fishery Management

The objectives of the FIP are:¹¹

1. Achieve MSC certification for the OPAGAC industrial purse seine tuna fleet in three oceans and four RFMOs within the next 5 years
2. Unify the industrial purse seine fishery into one MSC unit of certification instead of the misleading current division of free and associated schools
3. Bring together leading industry and environmental partners to work collaboratively towards sustainability of the fishery and ensure fair market access
4. Have RFMOs adopt Harvest Control Rules (HCR) for stocks of tropical tuna species, including support to the process of Management Strategy Evaluation, based on the best science available.
5. Adopt robust ad hoc rebuilding strategies in line with MSC standards for stocks not subject to HCR (where required)
6. Influence the various RFMOs to adopt an ecosystem approach to fisheries management
7. Assist RFMOs in the adoption of best practices concerning the use of drift fish aggregating devices (dFADs) through provision of information in support of informed scientific advice
8. Drive real changes in the fleet to minimize the impact of the fishery over non-target species, and improve survivorship of sensitive species, such as turtles, sharks, and any other sensitive bycatch

This FIP was started in October 2016 and projected to run through September of 2021. This FIP is listed as 100 percent on-track regarding overall actions and 100 percent on-track

regarding progress on programs to address red indicators.

The second FIP in Table 6, Indian Ocean tuna purse seine, was jointly established by key governments in the region, major tuna processors, producer organizations, and their fishing vessels. Support for this effort has also been provided by WWF. This FIP focuses on large PS vessels, >60 m, that set on free schools and associated floating objects. The objectives for this FIP are:¹²

1. To form a collaboration between governments, industry, and fleets to bring about improvements in the fishery;
2. To address the shortfalls in the stock health, ecosystem health, and management of the fishery by meeting actions described by the Improvement Performance Goals (IPGs);
3. To improve the fishery to a point at which it can undergo (and pass) full assessment by a credible, science-based, multi-stakeholder certification program like the MSC by the end of 2021.

This FIP was started in April of 2017 and is projected to run through December of 2021. This FIP is listed as 100 percent on track regarding overall actions and 100 percent on track regarding progress on programs to address red indicators.

The third FIP in the list is the Eastern Indonesian YFT handling fishery. This FIP covers a small-scale YFT fishery that is a subset of a national tuna FIP covering five gear types and three species. This FIP was implemented in close cooperation with international YFT buyers, WWF Indonesia, AP2HI and the International Pole and Line Foundation, along with provincial governments and the Ministry of Marine Affairs and Fisheries Indonesia. The objectives of this FIP are:¹³

11 <https://fisheryprogress.org/fip-profile/indian-ocean-tropical-tuna-purse-seine-opagac>.

12 <https://fisheryprogress.org/fip-profile/indian-ocean-tuna-purse-seine-sioti>.

13 <https://fisheryprogress.org/fip-profile/eastern-indonesia-yellowfin-tuna-handline>.

1. Bring together leading Indonesian industry to work collaboratively towards sustainability and to ensure market access;
2. Create real change in the water by implementing various sustainability programs throughout the tuna supply chains;
3. Through collaboration, participation, and learning, create well informed, well educated, and highly active stakeholders to engage in Indonesia tuna supply chain. These stakeholders include industries, fishermen, government, NGOs, and academia;
4. Achieve MSC certification for small-scale tuna fisheries.

This FIP was started in September 2013 and was projected to run through December of 2017. This FIP is listed as percent on track regarding overall actions and 100 percent on track regarding progress on programs to address red indicators.

Pilot Projects

The pilot projects in the region focus on the Bay of Bengal (BOB), especially in India (Maharaj 2016). The region has all the challenges that all of the other regions face. There are conflicts in goals between the coastal States and the DWFNs. While not everyone is a member of the IOTC, there is some cooperation between States in the region. Reporting and MCS is weak. However, there is a strong value proposition with a potential increase of \$2.1 billion annually across all tunas, including neritic tunas. The capitalized asset value of the fish stocks capable of generating this annual income at 8 percent is \$26 billion (Neiland 2016). The region is not producing anywhere near this potential (Townsend 2016). The GDPs of the BOB countries are as follows: India \$2.1 trillion (Indian states of Tamil Nadu \$167 billion and Kerala \$77 billion), Sri Lanka \$67 billion, and the Maldives \$2.3 billion.¹⁴

The pilot project will be implemented by the Bay of Bengal Programme Inter-Governmental Organisation (BOBP-IGO), a regional fisheries body established in 2003 with membership from Bangladesh, India, Maldives, and Sri Lanka.¹⁵ The BOBP-IGO evolved from an erstwhile Bay of Bengal Programme of FAO, which started in 1979. The Organization involved the whole range of stakeholders, from fishers to the key government functionaries from the region in the form of a Project Coordination Committee for overseeing the planning and implementation of the Pilot Project. The Pilot Project also reached out to IOTC at the early stage of design to reflect its concerns.

The institutional arrangements under which the pilot projects operate have been evolving for 40 years now under the BOBP-IGO. The BOBP-IGO is made up of a Governing Council, a Technical Advisory Committee, and Project Coordination Committee. The Governing Council is composed of top fishery ministers from each country in the BOB region. The Technical Advisory Committee is made up of a fishery manager and scientist, and is hierarchically just below the Governing Council. The Technical Advisory Committee provides the scientific guidance regarding policy interventions being considered in the BOBP-IGO. The Project Coordination Committee is composed of seafood exporters, harvesters, community members, and other scientists, and is broader-based than the Governing Council. The chair of the Project Coordinating Committee is India's key officer in the Ministry of Agriculture, who is in charge of India's fisheries. These complex institutional arrangements have strengthened progress. The institutional arrangements organize participation and input from the fisheries ministers, scientists, and other fishery stakeholders (Townsend 2016).

While these many-layered institutional arrangements may appear daunting on paper, they have been invaluable, providing the base for

14 <https://data.worldbank.org/indicator/NY.GDP.MKTP.CD>.

15 www.oppbob.org.

networking, coordination, and policy intervention ideas. With a more recent inclusion of industry and fishers, these arrangements have helped build trust with stakeholders, and have been very helpful in the development of the pilot projects. Overall, the pilot project organizers feel this radical inclusion has been very helpful and has built trust. This trust and rapport have led to many partnerships with other NGOs, as they are seen as an honest broker for change in the region.

The pilot project has identified three paths to increasing value: one, improve management at the harvest level; two, increase catches up to MSY; three, focus on value chain improvements. The business cases will focus on supporting existing fisheries management through establishing effective MCS and improving catch quality. They also will focus on progressive nudging through developing a management system for neritic tunas and longtail tuna in particular. Their final focus will be to capitalize on improvements to alternative management approaches through policy development and capacity building.

One sub-focus is increasing benefits to small-scale fishers (SSFs) through improvements in trade. In the BOB, most fishers are SSFs. Recent FAO recommendations to address this issue include product diversification, added value, improvements in product quality, and opening access to new markets. Current constraints in these efforts include high shrinkage due to poor infrastructure and lack of storage facilities and transport networks. Also, fishers lack knowledge regarding proper fish handling, with local products generally very substandard and unsanitary.

The to-do list for increasing SSF benefits includes better handling of fish at sea, including the increased use of ice. The government needs to establish hygienic fish landing sites, increase cold storage, increase ice supply, and improve road infrastructure. To address these issues, technical

support and extension need to be increased. The government needs to develop training programs for quality improvement, proper fish handling and storage, product diversification, adding value, and hygienic packaging. There also needs to be extension and technical assistance for identifying fish and products suitable for export. There is a

There is a potential for efficiencies and higher value from the supply chain by shortening the chain and increasing fisher bargaining and lobbying power. It is possible that this goal could be accomplished through establishing cooperatives.

potential for efficiencies and higher value from the supply chain by shortening the chain and increasing fisher bargaining and lobbying power. It is possible that this goal could be accomplished through establishing cooperatives. There is a perception that some middlemen operate as monopsonies. Finally, the project could work to raise awareness of micro financiers regarding the needs of SSFs.

As of October 2018, four project sites were selected, and their selection is almost finalized. There are two sites each on the East and West Coasts of India. The two East Coast projects involve improving fisher livelihoods by improving value in the value chain. The two West Coast projects focus on management interventions to improve enabling conditions, sustainability, and access to markets.

One of the West Coast project sites is Thoothoor. It is a small community historically engaged in multi-day shark fishing trips with tuna bycatch. The project goal was to move these fishers away from targeting sharks, and move them into higher

value tuna production by improving their market access. The community was not closely associated and did not work as a group or have strong ties to one another. They landed their catch all over India. In working with them, it has become apparent that they are totally unmanageable and show no interest in cooperating or working with the project. The other West Coast projects are still very much in the preliminary stages. The BOBP is still setting up structures, but it is too early to name them.

The East Coast projects have grown out of a longer process of fisheries reform in the region. The “back story” on these two projects is important to highlight, because this sort of incremental nudging seems to work well for RBM.

The East Coast projects have grown out of a longer process of fisheries reform in the region. The “back story” on these two projects is important to highlight, because this sort of incremental nudging seems to work well for RBM. Under a separate project, BOBP was conducting extensive consultations with India’s tuna fisheries. There was little quantitative data and no qualitative data about these fisheries, and the mission was to characterize them. BOBP issued nine consultations and utilized primary and secondary data collections. Through this process, one of the key outcomes of the work was the finding that the quality of the tuna being landed was and is extremely poor. Also, there seemed to be a lot of conflict and mistrust between the harvester and the first dealer/processor. At every site examined, there emerged a “chicken-and-egg” sort of dilemma about landed prices. Buyers would say they would not pay higher prices unless

quality improved, and fishers would not invest in ice boxes and better handling at sea because they did not trust the buyers to pass a quality premium down to them.

This separate fishery characterization project led BOBP to identify two groups on the East Coast where they could focus on improving value chains. The first is in a small village 60 km from the city of Visakhapatnam. This fishery takes day trips and fishes hook-and-line gear for tuna. The goal of the project would be to provide them with ice chests, handling training, and market support. The second East Coast town is Puducherry. Through the characterization process, BOBP discovered a small processor that works with eight fishers to sell tuna to a local Japanese buyer who ships the fish to Japanese and Korean consumers in India. BOBP plans to use his operation as a model for improving value chains by improving his processing facility. They also plan to bring more fishers into his group to improve consistency of volume. Currently, he only sells 100 kg a week into the local sashimi markets. The project has communicated with the processor’s buyer, who was already impressed with the processor’s quality, although it was not up to export grade. The buyer also stated that if he could get more volume, he could sell it, as there is a big market for Japanese and Koreans who live in India.

At this Puducherry site, BOBP intends to improve sanitation and increase the value added in processing. Right now, the fish is minimally processed, basically only gilled and gutted. BOBP wants to promote vacuum-packed cuts for a higher price. The plan is to increase volume by adding eight to ten additional harvesters, train them in better product handling and provide them with ice boxes. Next, BOBP would search out other Japanese and Korean markets. Currently, all product goes to Delhi, but Chennai, another large city, is closer. Originally, before this characterization, it was thought that the only way to higher prices at the first dealer was through

the export market to Japan. However, now there is the knowledge that there is a huge market for sashimi-grade fish in India currently being met with imported fish.

This project has already attracted the interest of Tata Groups Corporate Social Responsibility group. They see the potential for livelihood improvements through supplanting expensive imports with domestic production. They are already interested in seeing both of these East Coast examples replicated throughout India. This is another point to highlight: bringing industry and financiers in early can make for smooth transitions and uptake.

The BOBP has institutionalized outreach and engagement. They have a committee dedicated to it and it is obvious from how the East Coast projects were selected, through the proactive application of a characterization study, that it works. On a more formal basis for these projects, BOBP has created a lot of media materials. They produce posters, animations, and other “general marketing” types of products. They have a BOBP web site and Facebook (FB) page. Their FB page has over 1300 followers and is very popular in the region. They regularly post content and link that content back to their web site. For instance, for World Tuna Day BOBP produced a three-minute documentary, hosted it on their web site, and promoted it on their FB page. There are 14 national languages in India and 18-20 languages across all partner countries. As a result, they generally only publish in the key languages, which is a constraint. Their outreach and engagement have generally been helped by a realization by harvesters and industry that the stocks are over-harvested. There also seems to be a general understanding that product is being wasted through poor handling. Even though product quality is already higher in Sri Lanka, the industry are very interested in boosting quality further. The Maldives is very interested in sustainability as evidenced by their MSC certifications and

application of pressure at the IOTC level to generate HCRs for all tunas.

From an enabling conditions standpoint, India has stock assessments for their EEZ, but this information is generally missing in the rest of the BOB. Meanwhile Bangladesh is emerging as a tuna fishing country and needs to participate in data collection and assessment activities. Overall, there is a need for stock assessments that cover the entire region. The other critical enabling conditions that are missing are value chain conditions. Fish quality is terrible regionwide. Every country needs a process to bring good quality fish to market. Quality seems to be the biggest impediment to value growth. Additionally, harvesters and processors work as a team in Sri Lanka, and it would be nice to foster the same relationship in India.

These pilot projects have grown into four business cases currently under development. The first business case builds on the ongoing work of the OPP-BOB project, and is focused on catch quality, labeling, and certification schemes. An in-depth exploration of the value chain for a number of key tuna products, as well as different fishery locations, business scales, and markets, will identify possible opportunities for improving catch quality. A primary focus will be on technological and human capacity-building interventions, although other options will also be considered, if appropriate. Finally, to follow on, a standard business case methodology will be used to identify, compare, and evaluate the intervention/ investment options, underpinned by a benefit-cost analysis and investment appraisal approach.

The Puducherry and Tamil Nadu pilot projects have grown into a business case on fishery co-management in the region. Building upon the earlier project work on fisheries governance and fisheries management, the value proposition for investing in an appropriate fisheries co-management system focused on tuna will be outlined.

The third case will focus on improving monitoring, control, and surveillance through the development of an MCS plan. This report will present a business case for developing improved MCS concerning tuna fisheries in south India and the BoB region. Building upon the earlier work of the OPP-BOB project, along with more recent focused studies on fisheries governance and fisheries management, the value proposition concerning investment in improved MCS will be explored, evaluated, and presented using the standard business case framework already adopted by the project.

The final business case will be for the creation of a Centre of Excellence. This final business case will draw upon the results and outputs of the earlier reports and business cases to propose the establishment of a new Centre of Excellence for fisheries management and development in the BoB region. The business case will be underpinned by at least three key elements: the opportunity to build upon the extensive and high-quality work of the OPP-BOB project, the strong and wide-ranging links forged by the project at all levels (local-national-regional-international) concerning a new policy approach for regional tuna fisheries management, and the solid and well-respected reputation and institutional base provided by the BOBP-IGO.

Northern Pacific

The Pacific halibut (*Hippoglossus stenolepis*) is a large deep-water species with a depth range of up to 920 m found in the eastern and the western Pacific. The eastern stock is shared by the United States (U.S.) and Canada; the western stock, by Russia, Japan, and Korea. This section examines the management of the eastern stock. The U.S. and Canada started commercially exploiting the stock in the late 1880s (Clark 2003). In 1923, pressure from the halibut industry to reduce fishing effort forced

the two countries to jointly manage the stock through the International Fisheries Commission (IFC). This was the first international commission created for a marine resource. In order to meet the changing conditions of the fishery, the initial 1923 convention was revised in 1930, 1937, 1953, and again in 1979. Today, with numerous other RFMOs, the IFC has been renamed the International Pacific Halibut Commission (IPHC).

Bottom longlines are the only halibut fishing gear used by the two countries. Longliners use baited hooks at depths of 30-300 m that are attached to skates that keep the hooks on the bottom. The skates are hauled on board after 6-10 hour soak times. There is a wide variety of vessel sizes in operation across the two countries. Additionally, halibut is a bycatch in the salmon and sablefish fisheries.

The world's largest consumer of Pacific halibut is the continental U.S. taking the majority of the Alaskan and the British Columbia (B.C.) landings. There is virtually no export of B.C. halibut to nations other than the U.S. (Herrmann and Criddle 2006). From 1975-1995, Alaska supplied about 85 percent of the U.S.'s Pacific halibut market, while B.C.'s share in the U.S. market has not exceeded 14 percent (Herrmann 1996).

Today, given that the commercial Pacific halibut fishery lasts for 245 days in most of the IPHC's areas, this fishery provides a significant and constant employment opportunity, particularly in Alaska, where outside employment options are limited. In 2003, the coast-wide ex-vessel value of the commercial halibut fishery was over \$200 million. Its retail value was conservatively extrapolated using industry margins to over \$400 million. The value of the sport fishery was estimated to be over \$50 million and second in participation only to the salmon sport fishery. In 2007, the average coast-wide ex-vessel price was over \$4.00 per pound, with some prices going up to \$5.50 late in the 2007 season (IPHC 2008).

Problem

In 1974, commercial catches by U.S. and Canada were around 21.31 million pounds, but by 1988 had increased to 74.34 million pounds. In the early 1990s, catches started falling, and in 1996 catches had decreased to 47.34 million pounds. Prior to the introduction of either RBM program, the Pacific halibut fishery was a classic derby fishery. The fishery was a regulated open-access fishery exhibiting over-capacity and very short season lengths. For instance, in Alaska's management area 3A, the fishing season had fallen from 175 days (in 1975) to 25 in 1985, and to fewer than three in 1994. As for B.C., the season in 1976 was 123 days, in 1980 65 days, and in 1990 only 10 days (Herrmann, 2000). In 1990, the amount of halibut caught in B.C. was almost 50 percent more than in 1980, and the number of vessels had increased within a decade from 333 to 435 (Grafton et al. 2000). Before institution of RBM in Alaska, the TACs were regularly exceeded, even when seasons were as short as 24 hours.

These short seasons in Alaska and B.C. encouraged fishers to harvest in unfavorable weather conditions, reducing fisherman safety. Short seasons also created product wastage in several forms. First, skates (the gear type used in this fishery) from different vessels were hauled back simultaneously, frequently resulting in damaged or lost gear. Abandoned gear continued to harvest fish, wasting the resource. Second, competition between boats reduced product quality, and low product quality limited fishers' bargaining power with halibut processors. The majority of halibut marketed during this period was frozen because the annual TAC was landed in a very short period of time, making it impossible to have a year-round fresh market. Finally, because most of the harvest was landed in such a short period of time, processors could not adequately care for such a large volume of fish quickly. For example, in 1991, over 50 percent of the harvest was never iced and approximately

one-third was not gutted during one 24-hour opening in May (Wilén and Homans 2000). In 1990, total catches started declining everywhere.

Implementation

THE CANADIAN IVQ PROGRAM

Canada imposed limited entry on their halibut fleet in 1979 at 435 vessels (Sporer 2001). However, this did not stop the depletion of halibut, as the technical efficiency of the limited fleet continued to grow rapidly. Limited entry fishing under a TAC and closure upon reaching the TAC did not sufficiently control fishing effort (Sporer 2001).

In 1989, a small group of licensed halibut fishermen proposed an individual quota program to Fisheries and Oceans Canada (FOC) (Sporer 2001). The IVQ program grew out of this proposal and was developed by FOC. The IVQ program was instituted in 1991 for a two-year trial period. During the trial, the IVQ proved itself in protecting the stock and improving the economic viability of the participants. It was converted to a permanent program when the trial expired.

THE ALASKAN IFQ PROGRAM

Pautzke and Oliver (1997) and Hartley and Fina (2001) describe the history in the North Pacific Fishery Management Council's efforts to establish a limited entry program in the Alaskan Pacific halibut fishery. In the beginning, this was a very controversial issue, but finally, after 14 years of deliberations the Alaskan IFQ program was implemented in 1995.

Because of stock concerns, the North Pacific Fishery Management Council (NPFMC) began considering limited entry in the halibut fishery. However, a moratorium on entry was not recommended until 1983 when the stock problem became severe. The moratorium was rejected by the Secretary of Commerce who wanted a stricter limited entry program (Hartley and Fina 2001). This rejection had the

opposite effect, taking the momentum out of the movement for reform, and nothing happened.

Simultaneously, similar stock concerns and gear conflicts began to arise in the sablefish fishery, a fishery with high levels of halibut bycatch at times (Hartley and Fina 2001). Because of the loss of momentum on halibut, the NPFMC began to focus on rationalizing the sablefish fishery. In 1987, the NPMFC committed to analyzing license limitation and tradable quotas. In 1988, the NPFMC began a series of workshops with industry as a form of stakeholder engagement. A plan detailing many management options, including an ITQ, was released for public comment in May of 1991 (Hartley and Fina 2001).

The sablefish ITQ program was then used as a template to design the halibut ITQ program because the two fisheries had significant stakeholder overlap. There was a belief that simultaneous development of two ITQ programs would increase the probability of ITQ success in the halibut fishery (Hartley and Fina 2001). As a result, a halibut ITQ plan was published for public comment later that same year (1991), leading to a revision and then final recommendation from NPFMC in late 1992. The Secretary of Commerce approved the plan in 1993 and applications for initial allocations were collected and processed in 1994. Fishing under the ITQ began at the opening of the 1995 season (Hartley and Fina 2001).

Design

In 1990, Canada decided to switch from a derby-style fishery to an RBM system. That year, 70 percent of the B.C. fishers voted for an IVQ system. This system was implemented in 1991 in Area 2B for a trial two-year period. In December 1992, 90 percent of the Canadian quota holders voted to continue with IVQs (Grafton et al. 2000), which are still in place. In 1995, the U.S. followed Canada's practice with a similar system in the

remaining IPHC convention areas (all except Area 2A). The Alaskan system was called an IFQ system.¹⁶

The IPHC is responsible for managing the portion of the stock found only in the eastern Pacific. As of 1978, Canada and the U.S. have agreed that harvesting of halibut should not be reciprocal. That is to say, neither U.S. nor Canadian vessels are allowed to operate in the Exclusive Economic Zone (EEZ) of the other country (NOAA 2009).

While some halibut regulations are set by the IPHC, the federal fishery management bodies of the U.S. (National Marine Fisheries Service) and Canada (Department of Fisheries and Oceans) also set their own regulations within federal waters. In addition, state water regulations (inside three nautical miles), are imposed by the individual U.S. states (Alaska, Washington, and Oregon) mainly for recreational fishing.

The IPHC, like many other RFMOs, apart from setting the overall species TAC and the national quotas, also takes action towards regulating the activities of the countries. In summary, management measures include season restrictions, depth restrictions, observer coverage, vessel monitoring systems, bag limits for sport fisheries, and a minimum landing size limit. Moreover, the IPHC regularly revises these measures by taking in-season actions, such as extra gear restrictions, closed areas, and closed seasons, and can terminate fishing activities in specific areas earlier than initially determined during the annual IPHC's meetings.

Both the Canadian and the U.S. governments provide funding to the IPHC. Moreover, each government appoints three representatives (commissioners). The role of the commissioners is to decide on the TAC level for halibut, the allocation of quotas among the regulatory areas, and the update of fishery regulations

¹⁶ In B.C., quotas were attached to vessels, thus the system was called IVQs; while in Alaska, property rights were attached to quota holders, thus called IFQs.

annually. Apart from the six commissioners, the IPHC consists of a Director and 27 research and support employees (marine biologists and administrative personnel). The role of the employees is to provide scientific advice and administrative support to the commissioners.

Before making their final decisions, the commissioners also receive advice from three panels. One is the Conference Board, created in 1931, which represents the interests of commercial and recreational halibut fishers from both countries. The second is the Processor Advisory Group, created in 1996, which represents the interests of halibut processors. The third panel, namely the Research Advisory Board, formed in 1999, represents both fishers and processors who advise the IPHC for future research programs. All of these three groups make only recommendations to the delegates of the countries. In other words, the final decisions for the quotas can be higher or lower than these panels' recommendations based solely on commissioner discretion.

The IPHC, similar to other RFMOs, adopts the following two practices when setting TACs. First, it does not set quotas for the various user groups in each regulatory area. Instead, it leaves this task to the governments of the U.S. and Canada. This practice allows each member nation to allocate quotas based on the country's superior information for the fleets' efficiency and structure in every region. Second, the IPHC's TACs are abundance-based. Abundance-based TACs are catch limits, which change over the years according to the variation in the halibut biomass estimates.

THE CANADIAN IVQ PROGRAM

When Canada introduced its IVQ program, a total of 435 vessels participated. Quotas were allocated according to the length of each vessel and their best catches over the previous four years (30 percent of the initial allocation was based on

the length and 70 percent on the catches). A prohibition on quota trading was placed for the two-year trial period of the program, and quotas could be sold only with the corresponding vessel. The purpose of this prohibition was to discourage large processing companies and vessels from getting control of a big portion of the market.

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Canada's 1991 program was first revised in 1993 allowing temporary transfers, and again in 1999 allowing permanent transfers. However, transfers have been limited to vessels not more than 10 feet longer when compared to the vessel of the initial quota holder. Moreover, stacking of licenses is prohibited; that is, only one license per halibut vessel is permitted. Today, Canada's program provides 100 percent monitoring of fishers, through dockside and at-sea video camera coverage.

THE ALASKAN IFQ PROGRAM

The shares were allocated as a proportion of the TAC by management zone to avoid localized depletion. The shares were valid in perpetuity, but do not convey a full property right, in that if the program were ever discontinued, there is no value in the right and the government is under no obligation to compensate shareowners for their shares (Hartley and Fina 2001). The allocation scheme had a series of goals as developed by stakeholder meetings, public comment, and multiple plan revisions (Hartley and Fina 2001).

These goals were (Hartley and Fina 2001):

1. To preserve the character of the fleet;
2. To limit and discourage corporate ownership of the fisheries;
3. To reward active participants in the fisheries;
4. To reward long-time participants over relative newcomers to the fisheries;
5. To reward those who invested in the fisheries by purchasing vessels, over those who simply worked in the fisheries as crew;
6. To limit windfalls to fishers receiving quota shares, regardless of federal policies precluding any charge for quota shares distributed in the initial allocation; and
7. To discourage speculative entry into the fishery.

The initial allocation was based solely on catch history. Any vessel owner or fisherman leasing a vessel who had landed halibut in any year during the years of 1988-1990 was eligible for an allocation. Crew members were not included in the share distribution. Those eligible could submit an application for allocation including their five best catch years of the previous seven years, going back as far as 1984. This allocation method was chosen for a number of reasons. Primarily, it spread more shares around more vessels than would have been the case had the eligibility period been shorter, as there seemed to be a fair amount of latent effort in the fishery. This was done expressly to avoid larger windfalls to the highliners in the fishery and to give all participants a chance to exit the marketplace. The longer catch record window was allowed to protect any fishermen that had met with hardship, such as sickness, or had curtailed their fishing as a result of the Exxon Valdez oil spill (Hartley and Fina 2001).

Upper limits on individual shares were imposed such that no quota holder could hold more than

0.5 percent of the total tonnage available, but that was later relaxed to 1.5 percent. Additionally, there were restrictions on which vessel size classes could trade with each other. Generally, quota could not move from small vessels to large vessels, but quota from large vessels could move down to smaller vessels. The purpose for limiting the transferability of quotas was to maintain diversity in the fleet, and protect the smaller vessels in the Alaskan coastal communities. For more details on these restrictions see Pautzke and Oliver (1997). Singh et al. (2006) found that these restrictions on the Alaskan quota trading resulted in a greater number of active vessels in the halibut fishery. Without these restrictions, the fleet would have been smaller and more efficient, and the Alaskan fishery's value could have been 13-19 percent higher.

Performance

These two quota programs are some of the most studied programs in the world. As a result there is a wealth of tradable quota performance analysis in the published literature. Since RBM implementation in Alaska, harvests have been less than the TACs (Leal 2002). In recent years, TACs have been falling because the exploitable biomass has been falling. Both commercial catch per unit effort (CPUE) and survey CPUE have been falling. The biologists attribute these declines to several factors. Some factors are related to changes in the larger marine ecosystem. However, removals have surpassed surplus production, preventing stock rebuilding (Hare and Clarke 2007). Hare (2009) believes that harvest rates in Area 2 have been higher than sustainable levels for over a decade.

The concept of leakages, or the inability to exclude non-owners, has driven much of the over-harvest in certain areas. In this case, recreational charter boat operators, private recreational fishermen, and subsistence fishers harvest a significant amount of halibut in both countries, particularly in the charter sector. In Alaska, the projected

recreational harvest, called the guideline harvest limit (GHL), is taken off the top of the TAC set by the IPHC. If the GHL is set too low, charter harvest of what should be commercial quota erodes the commercial TAC and therefore erodes the commercial quota value and stock sustainability. Conversely, the recreational sector faces increasingly stringent regulations that reduce charter profits and consumer welfare. Since the creation of the halibut IFQ, the number of charter operators, total effort, and catch in the for-hire sector has gone up in Alaska. The GHL has regularly been exceeded in recent years. Unfortunately, the charter sector was not granted initial quota shares, and only recently has it been given the ability to purchase and fish commercial quota in 2017. That compensated reallocation plan has been approved, but the charter sector is still developing an entity that will act as the quota agent and a vehicle for raising money to purchase or lease quota. As a result, this leakage to the recreational and subsistence sector will continue to erode commercial quota value and hamper conservation efforts.

In summary, after the implementation of these two systems, safety improved by shifting away from the derby fisheries, fishing seasons expanded greatly, wastage all but disappeared and the two commercial fisheries increased their value. Since 1995, Alaska and B.C. have agreed upon a season length of 245 days.¹⁷ The elongated fishing season translated into larger quantities of fresh product supplied in the markets. The high total demand for fresh product increased prices for halibut as consumers were willing to pay more for better quality, and increased the profitability of the fishing industry.

THE CANADIAN IVQ PROGRAM

Under the Canadian IVQ program, the number of vessels was reduced by almost 30 percent in

1991-93, and by a further 11 percent in 1993-94. Crew employment also dropped by 20 percent within the first year of the program (Grafton et al. 2000). In 1999, the number of participating vessels was 257, and in 2006 there were only 182 vessels (IPHC 2008). Apart from reducing effort and competition, the program extended the fishing season dramatically, from 435 vessels fishing in a six-day season in 1990 to 281 vessels fishing in a 245-day season in 1996 (Grafton et al. 2000). In 1990, the season was just six days; in 1991, 214 days; and since 1993 it has been 245 days (Grafton et al. 2000).

Apart from reducing effort and competition, the program extended the fishing season dramatically, from 435 vessels fishing in a six-day season in 1990 to 281 vessels fishing in a 245-day season in 1996 (Grafton et al. 2000).

Over the first six years of the Canadian IVQ program, capacity, as measured in number of vessels, had fallen 35.4 percent (Leal 2002). Using data from two years before implementation and three years after implementation, Grafton et al. (2000) estimated the change in Canadian halibut fleet input technical efficiency (another capacity measure). Their analysis showed that producer surplus (profit) per pound went up, and short-run cost efficiency rose. Grafton et al. (2000) found that long-run cost efficiency would have been five times greater had the Canadian government not placed aggregation and vertical integration restrictions on quota trades. Because Canada limited the trade of quota for two years after implementation and because the post-

17 In 2009, fishing commenced in all regulatory areas (except in Area 2A) on March 21, and will last until mid November. In Alaska, the busiest month is May, while in B.C. it is March. No fishing is allowed in the winter period, when spawning takes place. As for Area 2A, this is open only for seven 10-hour fishing periods during the summer.



implementation data is from the year after trade was allowed, any estimate of capacity would be of limited usefulness as very little capacity could have left the fishery. Squires et al. (1999) found that per-day capacity utilization increased significantly for large vessels in this fishery post implementation.

Regarding the effects of the IVQ system on product prices, Herrmann (1996) distinguishes three periods. The first, prior to 1991, was the period when both B.C. and Alaska fisheries were regulated as open access fisheries; the second, from 1991 to 1994, was the period when the Canadian fishery operated under IVQs, but the Alaska fishery remained an open access; and the third, after 1995, was when both fisheries had introduced RBM programs. Herrmann's simulations find that the ex-vessel halibut price

in B.C. increased in 1991 due to the Canadian IVQ program by C\$1.22 per kg over what the price would have been without the IVQs and by C\$1.70 per kg in 1994. The high market prices increased the industry's revenues by C\$3.98 million in 1991 and by C\$6.55 million in 1994. The total increase in revenues due to IVQs in 1991-94 was estimated at around C\$23.2 million to the B.C. Pacific halibut fishery. Herrmann and Criddle (2006) also estimated the revenues in B.C. due to the IVQ system at approximately C\$39.5 million for the period 1991-98.

There are two reasons prices increased in the Canadian fishery during 1991-94. First, by having a fresh product for most of the year, Canadian fishers were able to sell a higher quality product at higher prices. In the pre-IVQ period, about 40 percent of the B.C. halibut was marketed fresh,

while in the post-IVQ period this percentage had increased to 94 percent. In the pre-IVQ period, exports of the B.C.-landed halibut to the U.S. were ranging from 50 percent to 80 percent of harvest; but after the IVQ period, 90 percent of the B.C.-landed halibut was exported to the U.S. With a longer fishing period, fishers were no longer price takers as they were during extremely short seasons pre-IVQ. Instead, they had a larger selection of buyers. Moreover, both fishers and processors had the ability to pay more attention to the proper handling of fish, and they could obtain higher prices for their higher quality, fresh product. The second reason for the high prices in B.C. had to do with the comparative advantage of the Canadian fishery over the Alaskan fishery. Previous to 1995 in Alaska, fresh product was available for only two days. This second advantage disappeared in 1995 with the introduction of the Alaskan IFQ system.

Herrmann (2000) discusses the effects of the Alaskan IFQ program on the Canadian fishery. Alaska's program reduced the ex-vessel prices for halibut in B.C., on average by about \$0.27 per pound. In the period before 1991, prices in Canada and Alaska were about the same, with a spread in 1990 of C\$0.93 per kg. Though the two products were virtually identical, prices in B.C. have been higher than the Alaskan prices due to higher Alaskan shipping costs and the perception that the B.C. product was better in quality than the Alaskan product (Herrmann 1996). However, during 1991-94, the spread in prices increased and reached a peak of C\$3.34 per kg in 1994. The average spread in this post-BC IVQ and pre-Alaska IFQ period was C\$1.64/kg. The spread began decreasing after Alaska implemented its own IFQ system. During the first years when both systems coexisted, BC still maintained a positive price spread. The average spread for the period 1995-98 was C\$1.62 per kg. This was due to B.C. fresh production exceeding Alaskan fresh production. B.C. production was higher in the early period because Alaska had limited capacity to handle

fresh halibut and had higher transportation costs. Since 1997, ex-vessel prices in Alaska and B.C. have been virtually undifferentiated.

A more recent study calculated the Canadian price reduction at \$0.34 per pound for the period after the Alaskan ITQ was introduced (Herrmann and Criddle 2006). The authors found that approximately one-half of the price advantage of the B.C. IVQ system was lost within three years (1995-98) after the Alaskan IFQ was implemented. However, even with the decline in the B.C. price after the introduction of the Alaskan program, the B.C. RBM program still produced more revenues than the fishery would have without RBM. Herrmann and Criddle (2006) calculated that the revenues in B.C. due to its IVQ system were about C\$39.5 million for the period 1991-1998, C\$23.2 million for the period 1991-94, and C\$16.1 million for the period 1995-98.

Grafton et al. (2000) also measured the benefits of RBM in the B.C. halibut fishery. Their conclusions are in line with those of the previous studies. They found that the majority of the gains from privatization have not been the result of improved cost efficiency (gains resulting from vessels adjusting the scale of their operation, and thus reducing the cost of landing a given catch). Instead, the majority of the gains are attributable to increased prices for higher quality product. Fox et al (2003) found similar results showing that changes to profits post implementation were the result of increases in output prices. The two RBM programs allowed halibut fishers to spread effort evenly over time and deliver a high quality fresh product, which eventually increased their marketing power relative to processors. During 1991-94, the observed producer surplus per pound increased (due to the IVQs) by 25 percent, and the total revenues for the B.C. halibut fishers increased by C\$23 million, while the extra cost of implementing the IVQ program during the period 1991-94 was less than C\$3 million. The price of a halibut quota increased from C\$3.04 per pound in 1991 to C\$3.72 per pound in 1994.

THE ALASKAN IFQ PROGRAM

The effects of introducing an IFQ program in Alaska were similar to those in B.C. Prior to the introduction of the Alaskan IFQ program, more than 5,000 boats were harvesting around 50 million pounds of halibut in three or four one- to two-day openings each year (Matulich and Clark 2003). When the program was implemented in 1995, a total of 4,830 vessels participated and 25 percent of the IFQ landings were monitored (Pautzke and Oliver 1997). By January 2007, the number of participating vessels had dropped to 3,099 (IPHC 2008), and monitoring was considered successful. For example, in 2007, catches from the IFQ program were 2 percent under the IPHC's catch limit.

Vessel counts are a qualitative indicator of capacity reduction. Over the first five years of RBM in Alaska, 53.3 percent of the fleet had been reduced, indicating a significant reduction in capacity (Leal 2002). No quantitative estimates of capacity have been produced for this fishery, before or after implementation. Felthoven, Hiatt and Terry (2002) used 2001 data to estimate capacity showing that there is still 16.2 percent to 47.3 percent excess capacity in the fishery. They also estimate fishery utilization using the number of weeks a vessel fished. Fishery utilization is at 71.4 percent for catcher-processor vessels and 42.1 percent for all catcher vessels. It is possible that these results showing excess capacity and less than full utilization could be attributable to the restrictions placed on quota trades.

In a report to the U.S. Congress, NOAA (2008) produced estimates of excess capacity and over-capacity in the halibut fishery using 2004 data. Given data limitations, the researchers were unable to estimate lower bound 2004 estimates, but the upper bound estimates were 50 percent excess capacity and 48 percent over-capacity for the fleet. These estimates ranked with some of the highest estimates in the publication, but, since halibut is not currently overfished, these

levels of capacity are not necessarily indicative of a problem, and may be an artifact of the measurement technique used. Additionally, the technique used is not well suited for fisheries under an RBM system, as some vessels may fill their quota with few high harvest trips and others may fill their quota with many low harvest trips. As a result, trip level estimates will be driven by the harvest of the high harvest trips; but if the majority of the TAC is taken by many low harvest trips the method will produce high excess capacity estimates. Because of limited data, it was impossible to refine these estimates.

The reduction in competition among vessels and the elimination of the derby fishery decreased wastage and improved safety conditions. For example, in two telephone surveys following the implementation of the IFQs, more than half of the interviewed Alaskan fishers replied that the new property rights regime had reduced their gear losses compared to the earlier open-access system. Moreover, they felt that this was a better strategy for the conservation of the halibut resource (Knapp 1999a). Additionally, wastage mortality in this fishery due to abandoned gear has dropped 77 percent, increasing stock sustainability (Leal 2002).

The Alaskan ITQ program has also increased safety in the fishery (Leal 2002). Search and rescue missions for halibut boats have fallen by 63 percent since the pre-ITQ period. Knapp (1999b) also asked Alaskan halibut fishermen about fishing safety and 85 percent responded that IFQs had made halibut fishing safer. Additionally, fishermen were given the opportunity to list the most positive effects of the IFQ program, and the most frequent response by far was fishing safety improvements.

IFQs in Alaska elongated the fishing season to 245 days, and shifted the industry from mainly a low-valued frozen product to a high-valued fresh product. Halibut catches increased by 19 percent from 1993 to 2000, purchases of

Alaskan raw halibut increased from about 28.5 million pounds in 1995 to 56.5 million pounds in 2001, and ex-vessel prices almost doubled from \$1.12 per pound in 1993 to \$2.27 per pound in 2000 (Matulich and Clark 2003). Another study calculated the increase in the average ex-vessel prices due to the Alaskan IFQs to be \$0.21 per pound from 1995 to 2002, and the increase in the average wholesale price to be \$0.24 per pound across the same period (Herrmann and Criddle 2006). In summary, as with the B.C. case, the Alaskan halibut fishery realized significant gains due to the reduction in effort, but also got market gains by delivering a higher-valued raw product.

An interesting question is whether harvesters or processors captured these gains. Matulich and Clark (2003) found that the Alaskan program was efficient for the harvesters as harvesters increased their revenues two- to four-fold, from \$48.8 million in 1993 to \$117.3 million in 2000. However IFQs did not increase revenues for most processors. In their survey, the authors estimated that despite the increase in ex-vessel prices and the increase in catches, about 82 percent of the Alaskan halibut processors were left worse off after the IFQ system. Overall, the processing sector lost 56 percent of its prior quasi-rents. Similar to Matulich and Clark (2003), Criddle and Herrmann (2004) also found that the price gains due to the Alaska program accrued mainly to fishermen (90 percent of the wholesale price gains), not to processors.

The reason processors experienced losses was that many of them were forced to abandon their capital-intensive technologies formerly used to keep up with the high volume of landings produced in the derby-fishery. In general, the cost of processing fresh fish is lower than that for preserved fish (frozen, cured, or in cans), and consumers are willing to pay a price premium for fresh product. Therefore, new fresh-fish processors had an incentive to enter the market, while the inefficient incumbent firms were forced to exit (Hackett et al. 2005). The number of the

Alaskan processors in the pre-IFQ period was 104; but only 31 of them remained after IFQs were implemented. The abandoned capital, in the remote Alaskan communities, was non-malleable; firms just closed and landings were redistributed toward ports that could support the fresh market. Moreover, in 1999-2000, 51 new entrant processors gained 34 percent of the post-IFQ halibut market.

Today, Alaskan halibut fishers are concerned about the possibility that farmed halibut may substantially affect the wild-halibut market, as has happened with farmed salmon.

Today, Alaskan halibut fishers are concerned about the possibility that farmed halibut may substantially affect the wild-halibut market, as has happened with farmed salmon. Farmed halibut is currently sold from November to March when the wild halibut fishery is closed, but overall farming has not grown as quickly as expected because its hatching technology has been slow to develop (Herrmann and Criddle 2006). Halibut fishers are afraid that if total halibut production increases, the market for halibut may saturate, driving down prices for wild-caught fish. Herrmann and Criddle (2006) examined how close the halibut market is to saturation. They found that it would not take unthinkable amounts of farmed halibut before Alaskan fishermen experience substantial revenue losses.

As a solution to this potential reduction in profits, both fishermen and processors of wild-caught halibut have proposed that the IPHC should increase the fishing season from 245 days to 321 days, with a view to supplying fresh halibut for as

much of the season as possible (Herrmann and Criddle 2006). If this happens, the Alaskan ex-vessel annual revenues are estimated to increase by over \$4 million (Herrmann and Criddle 2006). If the wild-halibut fishery is elongated to 12 months, the ex-vessel revenues could increase by approximately \$6 million (Criddle and Herrmann 2004).

Western Central Pacific

Western and Central Pacific Ocean (WCPO) lands 2.7 million MT of tuna worth \$6.1 billion averaged across 2011-2015 (Reid et al. 2016). The region is the largest tuna producer in the world and one of the single biggest fisheries for any species globally (Reid et al. 2016; Havige 2010). Eighty percent of those fish are caught in the EEZs of small Pacific island countries (Havige 2010). This region has taken incentive-compatible management principles farther than any other RFMO to date. This includes both RBM and market-driven interventions. RBM interventions in the region include the PNA VDS, the new Tokelau Arrangement, and the southern BFT ITQ in Australia. Market-based tools include MSC certification for non-FAD set SKJ and pole-and-line caught ALB. This section will cover the relevant details of these interventions.

Parties to the Nauru Agreement and the Purse Seine Vessel Day Scheme

The Parties to the Nauru Agreement (PNA) was founded in 1992 as a multilateral treaty and collaborative arrangement to manage tuna stocks in national waters of the parties. In the beginning there were eight parties including Federated States of Micronesia, Kiribati, Marshall Islands, Nauru, Palau, Papua New Guinea, Solomon Islands, and Tuvalu. Forum Fisheries Agency (FFA) members land over half of the WCPO total, 1.6 million MT of tunas worth \$3.1 billion, in their EEZs (Reid et al. 2016) The EEZs of the

eight parties represent the majority of the area of the WCPO, and control 25-30 percent of the entire global tuna supply and about 60 percent of the WCPFC tuna harvest (Squires 2014). Most RFMOs have substantially more high seas area than the WCPFC. Within the PNA, the fleet is fairly homogeneous, with some domestic ownership of purse seiners and many reflagged vessels primarily from Taiwan (Squires 2014). There are some port facilities in the region as well as some processing capacity (Squires 2014).

Access fee revenues are extremely important in the region accounting for between 2 percent and 60 percent of individual coastal state GDPs (Yeeting et al. 2016). Some coastal states also get significant economic benefits from tuna transshipping and canning.

Problem

The PNA were motivated to reform PS management for two primary reasons: enhancing value from access fees and stock conservation. Fishery access fees are a very important part of coastal State economies. Prior to the VDS, the fishing industry was predominantly foreign-owned but locally-flagged joint ventures that simply extracted the tuna value and sent it outside the region paying very low access fees (Yeeting et al. 2016). Access fees had stagnated below 5 percent and as low as 2 percent of landed value (Havige 2010). The PNA felt they needed to increase access fees and retain more of this value in the local communities.

The biggest stock concerns in the region centered on BET. FAD use has been on the rise, and it was thought to have contributed to overfishing of BET due to the catch of juveniles on FAD sets. The main target of the PS fleet however is SKJ, whose stocks appear to be in a sustainable status. Since 1990, YFT and BET biomass has been declining; however, it is not yet overfished (WCPFC 2017). In 2010, it was recommended that YFT harvest be reduced 10 percent and BET harvest reduced 25 percent, with further reductions potentially

warranted (Shanks 2010). By 2016, BET was declared overfished and YFT fully exploited (Yeeting et al. 2016). However, the most recent BET stock assessment has now shown BET to be in a healthy state and is not overfished due to recent updates in the life history of BET. BET harvest is now believed to be below MSY (WCPFC 2017).

Implementation

As discussed above, the implementation of RBM is often the result of a path or progression from completely open access to regulated open access to limited entry and finally to right creation. The PNA and the VDS are no exception. It started with the Nauru Agreement in 1982 to organize the management of fishery resources in signatory EEZs. This agreement established the PNA to for the Cooperation in the Management of Fisheries of Common Interest. The main objective, going back that far, was to give coastal State preference; require/enhance development of domestic fisheries, ports, and infrastructure; and provide for local employment. The Palau Arrangement (PA) came out of concerns that YFT stocks were being over-exploited and measures should be formulated to reduce harvests (Dunn et al 2006). The agreement capped vessel numbers initially at 164, increased those numbers to 205 in 1993, and came into force in 1995. However, simply limiting entry did not improve access fees. The PA did not create the competition to raise fees simply by limiting entry because the cap was set too high and also because the limited entry permits were given to the vessels and not too PNA members (Yeeting et al. 2016). There was a slight increase in fees, but the increase stalled out at between 5-6 percent of landed value.

Before giving the Palau agreement much time to work, the Federated States of Micronesia Arrangement (FSMA) was created in 1995 and discounted access licenses and reciprocal access if the vessel would use local labor, buy local provisions, and offload locally (Havice 2010).

However, the FSMA simply increased the license numbers without removing other licenses, so capacity increased. Unfortunately, the FSMA did not reach its goals of improving local economic conditions because there was a general lack of transparency and few development opportunities (Yeeting et al. 2016).

The limited entry conveyed rights to the flag States, which guaranteed individual fleets a set number of licenses (Havice 2013). This functionally eliminated competition for access between fleets. By preventing boats from entering and competing for access, it set the stage for any benefits to accrue to the flag State that held the licenses instead of the coastal State. As a result, limited entry did not improve access fee revenue.

Additionally, neither agreement had any positive impact on stocks. While the PA limited the number of boats, it did not address capacity, and license holders began to increase their vessel size, creating effort creep (Yeeting et al. 2016). Also, PNA countries were allowed to license new vessels within the cap on vessels, increasing capacity. Capacity under the vessel cap also increased through the use of geo-referenced FADs. Catches continued to increase, albeit more slowly (Havice 2013, Yeeting et al 2016). By 2000, the goals listed above were still not being met (Yeeting et al. 2016).

The Vessel Day Scheme (VDS) grew out of the failure of these previous agreements to reduce pressure on the stock and improve local economic conditions through increased access fees and local infrastructure development. The PNA decided to cap total effort, eliminate limited entry, and create a transferable effort program (Squires et al 2013). It was designed to generate a real limit on fishing days, thereby creating a demand for days and a competition between users for those days (Yeeting et al 2016). It was hoped the scheme would drive up access prices. The VDS eliminated limited entry and allows for new entrants as long as those new entrants

can secure fishing days. The primary reason an effort quota was chosen over a catch quota was to make monitoring easier, as it is easier to monitor location and fishing time than it is to monitor harvests from DWFs that land their fish at ports outside of the region (Havice 2010, Yeet et al. 2016). Initially the PNA had planned to ratchet down effort over time to reduce harvests to sustainable levels. The PNA were not against tradable catch quotas, but knew the MCS infrastructure to monitor catches would be far more challenging (Havice 2013).

It took three years to hammer out the allocation strategy alone (Shanks 2010). The second phase started in 2011 with full implementation. There now were hard limits on Party Allowable Effort (PAE). The year 2012 marks the third phase, which can be characterized by full adoption by all parties.

Another interesting motivating factor developed by Havice (2013) was a desire to maintain control of fisheries management in the face of the newly created WCPFC, which came into force in 2004 (Aranda et al. 2012). Yeeting et al. (2016) also point to a perceived erosion of state sovereignty as a motivating factor for creating VDS. By developing and defining their regional sovereignty over their tuna, it prevented the WCPFC from usurping control (Dunn et al. 2006, Havice 2013). WCPFC recognized the VDS and made it binding at the RFMO level with a legislative instrument that was agreed to by consensus (Shanks 2010).

Implementation followed generally along four phases as identified by Yeeting et al. (2016). The years 2007-2010 marked the first phase. The VDS was ratified in 2007 but many design elements

were still being worked out. It took three years to hammer out the allocation strategy alone (Shanks 2010). The second phase started in 2011 with full implementation. There now were hard limits on Party Allowable Effort (PAE). The year 2012 marks the third phase, which can be characterized by full adoption by all parties. All members had agreed to a benchmark price for days, ensuring that access fees would increase. The fourth and final phase, which is still ongoing, began with a commitment to trade days across members. Members also agreed to increase flexibility, to more efficiently allocate effort, and they agreed to work on staying within the Total Allowable Effort (TAE).

Design

As discussed above, rights can be divided into access rights and use rights. The VDS is an access right only. Access rights on effort can manage the stock as long as catch is proportional to effort, but that link becomes weaker the more species that are caught in the fishery (Shanks 2010, Havice 2016). The VDS defined an attenuated access right and gave it divisibility, transferability, and eventually exclusivity (Shanks 2010). Exclusivity of access only as catch is still unregulated. Currently, transferability is fairly attenuated (Squires 2014, Yeeting et al. 2016). Duration is defined, although relatively short, but is planned to be flexible (Squires 2014). Quality of title and security is similar to an individual catch quota (Squires 2014). As an input control, however, it can be circumvented by increased capacity, whereas a property right (or use right) to a proportion of the harvest would eliminate capacity creep.

PNA settled on a multi-stage allocation procedure whereby the PNA allocates days to individual States, that can then allocate to contracting parties, who can then allocate to individual vessels. Allocation to the States is based both on historic harvests (50 percent) and the proportional amount of biomass found in the EEZs of the participating States (Squires et al

2013, Shanks 2010). Each party is assigned a PAE that is a proportional allocation of the TAE. The VDS was designed to make sure the access right rents flow back to the PNA states. To do this, the PNA states own the rights and DWFs, and others buy the right from the States for a price higher than the minimum benchmark price set by the PNA (Squires 2014). The allocations are good for a three-year time horizon. The three-year window was created to allow for stock shifts across the equator that follow the Southern Oscillation. Once a party uses their entire three-year allocation, they cannot receive more allocation until the next period, although days could be banked into future periods or borrowed from the future, creating transferability across time (Squires et al. 2013).

Borrowing from the future was later rescinded (Havice 2013). Trade is allowed between PNA members. While initially allocated days were 100 percent transferable, now—once a right has been paid for—individual flag State vessels cannot trade directly with each other (Squires 2014, Havice 2013). Some members began to sell allocations during this phase. However, implementation was partial and there still remained high seas pockets where the VDS did not apply, hampering exclusivity. Vessel days are only tradable in blocks of 50 days and are debited from the account based on the size of the vessel, out of recognition of the differential capacity of different vessels. Vessels 50 m or less in length are only deducted 0.5 days for every 24 hour day they fish, vessels 50-80 m are debited 1.0 day for every 24-hour day they fish, and vessels greater than 80m long are debited 1.5 days for every 24-hour fishing day. The initial plan was to adjust these capacity factors as technical efficiency changed (Squires et al. 2013, Yeeting et al. 2016). The goal with this program is not to maximize fishing efficiency nor is it to increase rents for individual fishing vessels. Instead, the express goal is to create competition for days between DWFNs and capture the most rent for the PNA states (Shanks 2010).

Initial total allowable effort was set at 35,758 days and was based on effort levels from the 2004 season (Shanks 2010). That total was derived by summing the 28,469 2004 PNA fishing days, the 3,907 FSMA treaty fishing days, and the 3,362 U.S. Treaty fishing days. The U.S. Treaty was worth \$21 million in access fees in 2007 and 2008. While the PNA limit and the FSMA limits started as hard limits, the U.S. Treaty has no upper limit on days within the initial VDS design. This created a race to be licensed under the U.S. Treaty. The U.S. Treaty, pre-VDS, allowed the U.S. to license up to 40 vessels. In February of 2007, the U.S. only had 12 vessels licensed. By August of 2009, the U.S. had licensed an additional 24 boats (Shanks 2010). U.S. catches have therefore increased substantially. As of 2010, the U.S. Treaty-based allocation of days was based on the seven-year average of the U.S.-licensed fishing fleet's fishing effort. By 2015, the TAE had grown to 44,623 days, in part due to the U.S. Treaty (Yeeting et al. 2016).

Regarding MCS, every vessel is required to carry an observer for every day they are at sea. Additionally, every vessel is required to have VMS and those must report every four hours or face being denied access (Shanks 2010). This has resulted in much better monitoring than before the VDS, and has shown that vessels were over-reporting SKJ harvests and under-reporting juvenile YFT and BET harvest (Havice 2013).

Performance

This is one of the only interventions discussed in this paper that has undergone a complete independent review (PNA 2015). Additionally, because of its novelty on the global stage, the VDS has been a nearly constant topic of discussion in the fishery management journals. Overall, the project has been quite successful and has demonstrated marked success for incentive-compatible management. Access fees have gone from less than 6 percent of landed value to 14 percent of landed value in a relatively short period



of time, raising economic returns dramatically (Yeeting et al. 2016, Havice 2013). This has driven total access fees up by 280 percent, and parties are therefore earning \$3,689 more per day for access from a 2006 baseline (Havice 2013). Benchmark prices for access have increased to nearly \$8,000 per day in 2015 (Yeeting et al. 2016). These increases meet one of the major goals of VDS and have strengthened the resolve of the Parties (Yeeting et al. 2016). Additionally the acceptance of the program by the WCPFC, and the demonstrated success, has increased the PNA's bargaining power with DWFNs (Yeeting et al. 2016). Vessel owner revenues are up as well, by as much as 56 percent, and vessel owners are earning \$11,542 more per day, again from a 2006 baseline—although some in the fishery dispute this claim (Havice 2013).

VDS has shown that it is possible in the management of highly migratory and transboundary stocks to directly strengthen rights and take ownership of the resource. It has demonstrated that exercising these rights allows collective and direct negotiations for access without difficult and slow moving RFMO process or complicated bilateral treaties (Yeeting et al. 2016). Along those same lines, success of the VDS increases the PNA's leverage over vessels in the FSMA and U.S. Treaties, both of which have been loopholes in the VDS plan in and of themselves (Yeeting et al. 2016).

While the VDS is largely viewed as a success, there have been several criticisms. These criticisms center around several design loopholes and a general inability of the program to improve stock conditions (Yeeting et al. 2016). Regarding

the loopholes, there is still great concern about what is locally termed “effort creep” or increasing capacity within the definition of a fishing day (Yeeting et al. 2016, Havice 2013, PNA 2015). While it has been an economic success, effort, capacity, and total vessels have all increased under the VDS (Havice 2013). Between 1990 and 2006, total PS vessels in the region ranged from 180 to 220. By 2013, there were over 300 vessels in the VDS (Havice 2013). Additionally, free riders have been attracted to fishing on the edges of the VDS area (Yeeting et al. 2015). Part of the capacity issue stems from the vessel size class ratios used to debit vessel accounts. The initial allocations did not account for members’ existing fleets, so some States ended up with a vessel day windfall. For instance, a party may sell a full day to a <50 m boat and then re-sell the other half-day that they are debited, leading to effort creep (Havice 2013).

One of the loopholes that has arisen is the inconsistent application of the definition of what is and is not a fishing day (Yeeting et al. 2016, PNA 2015, Havice 2013). There is a feeling that, generally, fishing days are under-reported (Yeeting et al. 2016). In 2014, there were 8,041 non-fishing days. Comparing that to previous years both before VDS and after VDS, that is roughly 65 percent higher than it should be (Yeeting et al. 2016). Initially, a fishing day was any 24-hour period the vessel was not in port. There was some limited granting of days for transit time to Japanese boats because they are required to offload in Japan. The request for transit time had to be submitted in writing. Shortly after this concession was granted to Japanese boats, there was a sharp rise in transit requests (Havice 2013). It is likely that many of these new requests were actually using this “free” time to search for fish. More and more concessions have been granted for bad weather, mechanical issues, port time, and partial-day charges (Havice 2013). Overall, this has led to effort creep. It also reduces the security of the right as the rules are changing frequently (Havice 2013). It also weakens

monitoring and enforcement. This led to reform in 2013 that eliminated partial days, reasserted that a fishing day was any portion of a 2-hour day, and reasserted that a day will be debited for any fishing activity (Havice 2013). To claim a non-fishing day, the boat must not be under power and all gear must be stowed.

Another effort loophole arose when Tokelau became a party. They entered and claimed 1,000 days. If the allocation formula had been applied to Tokelau, as it had been for all other parties, they would have been allocated far fewer than 1,000 days (Havice 2013). This represents further effort creep. This may encourage other nations to join, and may increase effort further.

While tradable effort can work where there is a direct relationship between catch and effort, no direct relationship has been observed here, though this is confounded by effort creep and reporting loopholes (Havice 2013). When multiple species are covered by the effort quota, the problem may be exacerbated, particularly if those species are bycatch that arise from the use of an untaxed input in an input control setting. That is, capacity increases in the form of increases in FAD sets have both increased the effective effort and changed the relationship between catch and effort that the TAE was based upon in the first place. FAD fishing has increased as has the catch of juvenile YFT and BET (Yeeting et al. 2016, PNA 2015, Havice 2013). To address this increase in capacity and juvenile catch, FAD closures and other FAD management measures have been instituted.

Minimal trade has been observed (Squires 2014). Many reasons have been put forth for this lack of trade including newness of the right, unfamiliarity with rights markets, national sovereignty concerns, limited secondary market infrastructure, information and transaction costs, and general uncertainty about the future form of the program (Squires 2014). Preference has been given in trades with DWFNs for political

and social reasons that include landing fish in party countries and investing in shore-side infrastructure (Shanks 2010). This strategy trades maximum access revenue for additional economic benefits shore-side (Shanks 2010). Parties view trade between vessels as taking their power away (Havice 2013).

The primary goal of the VDS was to assert control over coastal State tuna resources and maximize the fee revenues for fisheries access.

In 2015, the PNA commissioned a full review of the VDS, completed by Ragnar Arnason and Michael Harte (PNA 2015). The reader is referred to this document for further details about their conclusions and recommendations, as everything they recommended could not be covered here. They made suggestions regarding governance, design objectives, allocation mechanisms, participation and management of substitutes, trading arrangements, system integrity, compliance, transparency, TAE and legal instruments. Overall, they suggested separating the broader governance of the PA, NA, and FSMA from management of the VDS. Along these same lines, the management of the VDS should be organized much like a corporation, with a strong VDS Administrator governed by a board of directors (PNA 2015).

The VDS Administrator should be given the authority to ensure consistency and uniformity. The board of directors should adopt and implement a clear definition of vessel day that has very few exceptions. The Administrator then

should have the authority for implementing this new definition. The Administrator should also have the authority to develop and operate an efficient market trading mechanism that includes setting benchmark prices, operation of the exchange and the development of a day auction system. The Administrator should develop and keep a vessel registry that is real-time and includes vessel location, trading information, and unused VDS information. Finally, this Administrator would develop and implement sanctions for violation of any of these new rules as well as any existing rules (PNA 2015). Regarding compliance, VDS rules should be examined and rewritten to be clear and complete, and eliminate loopholes. There should be a clear and transparent process for dealing with violations and a clear definition of penalties that should be strong enough to curb violations. Also, a formal adjudication process should be developed (PNA 2015).

The primary goal of the VDS was to assert control over coastal State tuna resources and maximize the fee revenues for fisheries access. To develop the potential contained in the VDS, Arnason and Harte (PNA 2015) created a bioeconomic model to look at the potential rents available in the fishery. They concluded that maximizing fee revenue is a function of the stock size and the days available in the VDS. While there was substantial uncertainty regarding the optimal number of days, they showed that there is room for significant growth in the value captured by fees. Given 2011-2013 operating conditions in the fishery, the maximum daily fee was between \$12,000 and \$17,000 per day, generating annual total maximum revenue of between \$370 million to \$1.15 billion. However, maximizing the rent recovered left harvesters with very low, 6-10 percent, profit margins.

To reach maximum fees, the PNA might need to increase fishing days to as many as 67,000 days; however, the model is not very sensitive to maximum days between 32,000 and 67,000 days

(PNA 2015). It is very likely, however, that if the TAE is raised, more BET and YFT will be caught unless FADs are simultaneously addressed. The PNA should examine using pricing schemes to address FAD effort, move to a harvest-based system, or focus on technical solutions to FAD bycatch. If instead, the TAE was reduced enough to improve the BET stock, fees would drop 40 percent from current levels. Others have recommended catch retention requirements and time/area closures for FADs to address the continued bycatch problem (Shanks 2010). The reviewers fully admit that there is much uncertainty in their estimates, but the magnitude of the rent potential advocates for developing a permanent research group to examine maximizing this value. That research group should focus on technical studies to improve the selectivity of PS gear, enhance trading, and develop a day auction system.

To address these concerns and suggestions, the PNA has instituted both FAD charges and time/area closures for FADs. Currently, the FAD closure is four months long (Kumasi 2016). The FAD charge has two objectives. One, the FAD charge is hoped to reduce BET overfishing by placing a disincentive on FAD use. It is hoped that this would eliminate the need for total FAD day limits or time/area closures. The second objective is to generate funds to pay for BET conservation. Currently, the management of the impact of FADs is falling disproportionately on PNA parties (Kumasi 2016). The FAD charge is levied for each vessel that sets on FADs and is set at \$1000 per day on top of the VDS fee. The trial began in January 2016.

Instead of setting fees through a research committee, the reviewers also suggest encouraging a more robust market for days to develop (PNA 2015). To that end, they suggest that TAE shares be given for a longer duration. Also, transferability should be substantially increased and trades of PAE to other parties should not affect allocations of PAE in future years

as it does now. They also suggest that the PNA should examine a move to catch- rather than effort-based shares, as it would also open the door to reducing harvests of BET and YFT while maintaining rents. Another potential solution to the bycatch problems is to include the LL fleet in the VDS system and set fees, or allow the market to set fees, to minimize artificial distortions between fishing methods.

From an exclusivity standpoint, the reviewers and others have suggested improvements including permanent closures of high seas enclaves, or donut holes (Shanks 2010, PNA 2015). The reviewers also see the external competitive fringe as a threat to the value of the VDS, and the PNA should expand the coalition or seek their cooperation (PNA 2015).

The reviewers suggest that there are gains to be had with freer trade, and advocate making the VDS right more homogeneous so that they can be used across EEZs. They also suggest free trading within the Palau Agreement parties along with developing a framework that facilitates open trading. They feel that fishermen should be allowed to switch their days across EEZs, but the transfer of VDS between vessels should continue to be off-limits until a better way to account for individual vessel capacity differences can be developed. These trades must be transparent, and any changes or trades that impact others must be treated as public information. Trade prices should be reported, but treated as confidential information and available to all parties. The Administrator should publish an annual report that summarizes trade information in a non-confidential way. This annual report should be reviewable, and the Administrator and the board should be required to clarify any questions (PNA 2015).

Some vessels that used to fish in the region have been forced out by the fees charged for access to waters they once fished. While the PNA has a right to band together and use that combined power

to extract as much rent as possible from DWFs, this may have unintended social consequences. For instance, many DWFs are highly subsidized. Those subsidized fleets can remain profitable in the face of increasing access fees. There is wide literature on the distortionary impacts of fishery subsidies, and this dichotomy is brought front and center in the PNA. If those subsidized fleets are also bad actors with regards to discards, pollution, or exploitive labor practices, then the VDS will unintentionally push out the good actors and favor the bad actors if those bad actors are heavily subsidized. Future revisions of the VDS should incorporate safeguards for labor and environmental externalities. Additionally, attention should be given to the impact that subsidized fleets have upon incentive compatible regimes.

Another un-intended consequence of high rents disadvantaging some DWFs relates to the way MCS is funded by the RFMOs. Many of the DWFS have been consistent contributors in the past to MCS costs. If these fleets are being pushed out of the region, their respective governments may decide to contribute less to MCS. Meanwhile, MCS costs increased under VDS. Future revisions of the VDS should consider more incentive-compatible methods to fund MCS through cost recovery at the PNA level from the rents being collected.

Finally, the reviewers discussed amending legal instruments to improve the VDS. They suggest amending the Palau Agreement, or enter into a new integrated legal instrument allowing for a range of appropriate mechanisms to manage effort creep through remedying weaknesses in existing legal documents. Additionally, there may be a need for additional legal backing for the compliance enhancements suggested above. This may mean replacing the existing document or amending the existing legal arrangements (PNA 2015).

PNA and the Longline Vessel Day Scheme

Problem

Similar issues exist in the LL fishery as used to exist for the purse seine fishery. Mainly, the PNA wanted to cover the entire tuna fishery under the VDS umbrella to bring the LL tuna value back to the member states and protect member state rights. It may be possible in the future to address the PS recruitment overfishing by trading days between the LL fleet and the PS fleet, as suggested in the review of the PS VDS above. Finally, the LL VDS was designed to maintain control of the fishing in the EEZs of member nations with an aim to reign in the high seas longlining. Dr. Transform Aqorau was quoted as saying, "There has to be better control [of tuna longlining] overall, including Indonesia and the Philippines, and the high seas, particularly the Eastern High Seas areas, which are open."¹⁸ It is hoped that this effort reduces high seas effort and harvest by transitioning catch to national fleets that land at their domestic ports or to foreign fleets that would be locally based, also landing their fish locally before exporting. It is hoped that an effort-based system will improve the enabling conditions in the fishery to eventually transition to a catch-based system.

Many of the high seas longliners are equipped and provisioned to stay out at sea for very long periods of time. Because they can spend long times at sea without porting, keeping LL vessel accountable is very difficult. Less than 5 percent of all LL vessels have observers, and few report any information to the authorities. It is hoped that the LL VDS brings more accountability to this fleet. It is hoped that the LL VDS, like the PS VDS, will help rationalize the entire LL industry and bring value back to the island nations.

Implementation

The plan for the LL VDS has been in existence since 2014, when five members agreed to begin implementation by signing a memorandum of agreement. Beginning in late 2015, these nations began a trial of the LL VDS. In 2017, the number signing on to the agreement reached eight nations and the PNA is set to fully implement the LL VDS across more than 3,000 active LL vessels.

Currently, the LL VDS is being implemented as a response to this advice (PNA 2016). The documentation lists eight objectives (PNA 2016, p. 2):

1. Promote optimal utilization, conservation, and management of tuna resources;
2. Maximize economic returns, employment generation, and export earnings from sustainable harvesting of tuna resources;
3. Support the development of domestic locally-based longline fishing industries;
4. Secure an equitable share of fishing opportunities and equitable participation in the tropical longline fisheries for the Parties;
5. Increase control of the tropical longline fishery for the Parties;
6. Enhance data collection and monitoring of the fishery; promote effective and efficient administration, management and compliance; and
7. Encourage collaboration between the Parties.

Design

This program is organized much like the VDS for the PS gear. Total Allowable Effort (TAE) will be set and that TAE may be set for one to three years. The TAE will be allocated to parties as the Party Allowable Effort (PAE). Management of the scheme will be the responsibility of the LL Vessel Days Scheme Committee (LLVDSC). The LLVDSC is a subcommittee of the Palau Arrangement Parties. The scheme does not apply to artisanal

vessels. Quota is deducted based on vessel size with boats less than or equal to 40 meters receiving a deduction of 0.8 days for each fishing day (or portion thereof). Any vessel longer than 40 m receives a deduction of 1.3 days for each fishing day. If a vessel is in a Party port, there is no deduction. The scheme does not apply to artisanal vessels. All vessels receiving days must be an FFA registered vessel, with all that entails. All vessels must have an Automatic Location Communicator (ALC), and it must transmit every four hours. There is provision in the plan for a LLVDS fee floor, but one has not yet been set. The

The Parties are responsible for setting a protocol for transferring days between Parties. Any transfer must be reported to the Administrator, and is subject to Administrator approval.

first three years of the program, through 2018, is the transitional period. If any vessel holding days are at any Party's port, those days in port will not be counted against their vessel days. Unlicensed vessels transiting Party waters will not be included in the calculation of total vessel days used.

The Parties are responsible for setting a protocol for transferring days between Parties. Any transfer must be reported to the Administrator, and is subject to Administrator approval. If approved, the Administrator will adjust the PAE of the Party. All vessels must be registered to participate and a registration fee paid.

The LLVDSC will appoint a chair and a vice chair for no more than three years, with the vice chair assuming the chair's role at the end of three years. The LLVDSC will be responsible for

managing the LLVDS through periodic meetings, whereby they will refer items for decision to the annual meeting of the Parties to the Palau Agreement for decisions. At each annual meeting, the participants will consider a report on the total effort and catch from the previous year to evaluate any increase in effective fishing effort. If effort creep is found, the Parties will move to insure sustainability moving forward. Transfer of days will be monitored at the annual meetings to insure there are no detrimental transfers. At each annual meeting, pursuant to the information applied above, the Parties will set the TAE for the next year. Actions to be taken could include controls on vessel length, vessel capacity, number of hooks deployed, or any other necessary measure. The Parties will also establish procedures to consult with distant water fishing nations, parties, organization, or other relevant

organizations, and will provide direction to the Administrator regarding those.

Compliance in the effort cap is monitored by the Administrator. If a Party reaches 80 percent of its PAE, they will be notified within seven days. The Party must respond with its correspondence to that catch level within 21 days. If the level of effort exceeds the PAE in a management year, the Party will have their PAE reduced in the following year using this formula: if under 10 percent over, the PAE will be reduced by the amount of the exceedance; if more than 10 percent over, the PAE will be reduced by 120 percent of the overage.

Performance

There is little performance information as the program has just begun. The 2017 Administrator's



report indicated that only 25 percent of allocated days were leased in 2017. At present, some of the problem is LL vessels moving their operations outside the area under the coverage of the LL VDS. This indicates a need for support from the WCPFC to control high seas effort as well. There has been some movement from nations outside the PNA expressing interest in joining the system.

Tokelau Arrangement

Southern albacore (ALB) is an important target of the LL fleet in the EEZs of FFA members. Around 65 percent of all LL harvest of ALB falls within the FFA's area of influence (Reid et al. 2016). The Tokelau agreement is an agreement between southern FFA members to work together to cooperatively manage ALB through the development of a zone-based management regime and agreement to interim EEZ limits (McDonald 2017).

Problem

South Pacific ALB is in a depleted condition but remains above MSY and the WCPFC Limit Reference Point (Cartwright 2015, FFA 2014). The number of hooks set in the fishery has been increasing, and increased nearly 50 percent between 2008-2010 and 2015 (Reid et al. 2016). Even with a 50 percent increase in effort, catches only went up by 22 percent. Additionally, CPUEs had dropped enough that many boats found it not profitable to take fishing trips, and remained tied up at the docks (Reid et al. 2016). These crises in the ALB fishery triggered a strong desire among FFA members to reign in harvest (Reid et al. 2016). FFA members have advocated for the adoption of a target reference point that would return the stock to levels that would produce profitable catch rates. Looking at maximum economic yield, the target reference point (TRP) would need to be 59 percent of the unfished biomass, but would require a 75 percent reduction in harvest regionwide (Cartwright 2015, Reid et al. 2016). The TRP proposed by FFA

members in 2015 and 2016, and adopted by the Participants to the Tokelau Arrangement (and sub-regional grouping of southern FFA members), is 45 percent $SB_{F=0}$ (Cartwright 2015, Reid et al. 2016). Projections undertaken in 2016 suggested that achieving this TRP would require a 41 percent reduction in harvest and, to stay above the LRP, would require at least a 33 percent catch reduction.

Maintaining current effort would result in continued ALB decline with CPUE dropping a further 14 percent by 2033. Projections undertaken in 2016 indicated that the LRP of 20 percent $SB_{F=0}$ has a high probability of being breached without fairly drastic action (Reid et al. 2016). If the TRP was set at MEY (59 percent $SB_{F=0}$), CPUE would go up 50 percent by 2033, and there would be no risk of breaching the LRP (Reid et al. 2016). A 25 percent reduction in effort would keep current CPUEs that are too low to allow profitable fishing for some vessels (Cartwright 2015, Reid et al. 2016). Effort reductions of 40-50 percent would return CPUEs to levels prior to the rapid expansion of the fishery post-2008 (Reid et al. 2016). The TRP of 45 percent $SB_{F=0}$ would increase CPUEs 15 percent over 2013 levels, which is the bare minimum to bring back profitability in this fishery and would return the stock to pre-2008 levels (Reid et al. 2016). Several WCPFC members balked at the proposal of a TRP of 45 percent $SB_{F=0}$ (Reid et al. 2016). The TRP has been adopted by the Tokelau Agreement Participants as an interim TRP, and that proposal has been moved forward to the WCPFC for approval at the RFMO level. However, actions and harvest control rules to achieve the TRP have not yet been adopted (McDonald 2017).

A critical part of any FFA intervention will hinge on accurate catch monitoring and ensuring that sacrifices made within the FFA area of competence are not just absorbed by fishing outside that region by other WCPFC members.

Implementation

Again, as above, this has been a process, a progression. Also, this is still very much a plan in development and not a completed intervention. That is to say, the Tokelau agreement is a multilateral agreement that is solidly in place, but the conservation interventions are very much a progression that includes nudging the WCPFC to improve ALB conservation regionwide. The Arrangement is a multilateral agreement between 11 Coastal States to manage the South Pacific LL fishery. The goal is to reduce LL harvest, increase control, and enhance economic values from the LL fishery. The TA came into effect in December of 2014, and agrees to cooperatively manage ALB and limit the amount of ALB within each participating EEZ to a set of interim limits.

Also, this is still very much a plan in development and not a completed intervention. That is to say, the Tokelau agreement is a multilateral agreement that is solidly in place, but the conservation interventions are very much a progression that includes nudging the WCPFC to improve ALB conservation regionwide.

Cartwright (2015) describes a process of four WCPFC workshops beginning in 2012 to develop harvest control rules for the ALB fishery, beginning with a preliminary discussion of strategies in 2012, a strawman list of candidate management objectives, performance indicators and targets in 2013, preliminary advice on a proposal for a harvest strategy for ALB, and the adoption of a harvest control rule in 2014. In the meantime, FFA began their own process to address ALB harvests. South Pacific countries were frustrated by the lack of WCPFC action on ALB, prompting the Tokelau Arrangement (TA).

FFA, after the success of the VDS, wanted to build a system that maximizes the value of the ALB harvest that stays in the local economies of the parties. In 2015, they adopted a broad Regional Roadmap for Sustainable Pacific Fisheries that contained two overarching strategies: take control of the fisheries and lever control to maximize economic benefits for national economies (Reid et al. 2016). This statement concluded that zone-based management is the key to control with a system of national rights, with a cooperative framework of binding limits and formal harvest strategies (Reid et al. 2016). Overall, the design is flexible with regards to how the States utilize their national allocation (FFA 2016). They could choose to use an effort-based system or a catch-based system, or limited entry in their EEZ. Day-to-day implementation is up to the States as long the national TAC is met and the nation is compliant.

One note mentioned by Cartwright (2015), speaking on behalf of the WCPFC, is that harvest control rules and LRPs and TRPS are easier to set when country allocations are already in place, as in the ICCAT case. Trying to agree to harvest control rules simultaneously with country allocations has proven very difficult.

Design

The TA has the following six objectives (FFA 2014):

1. Maximizing economic returns, employment generation, and export earnings from sustainable harvest of these resources
2. Supporting the development of domestic and locally-based fishing industries
3. Securing an equitable share of fishing opportunities and equitable participation in fisheries for these resources for the Participants
4. Increasing control of the fishery for the Participants
5. Enhancing data collection and monitoring of the fishery

6. Promoting effective and efficient administration, management, and compliance, and encouraging collaboration between participants

The TA welcomes any FFA non-member state or territory with an EEZ overlapping the effective range of ALB stocks to become a Participant (FFA 2014). The region is very interested in maintaining control of the rights, and knows that a flag-based allocation based solely on historic catch will take control away from the region and will harm coastal States, whereas a zone-based system recognizes coastal State control (Reid et al. 2016). Currently, a management scheme to actively manage catch limits and allow for transferability is under development (Reid et al. 2016).

To date, the TA has adopted national catch limits that recognize history and allow countries to nominate lower catch limits. Those zone limits came into force 14 days after at least five FFA members had signed it, which happened 15 December 2014. The TA has now been signed by eleven FFA members. The design plan is for TA parties to meet once a year to establish necessary management measures. The TA management body has been empowered with the ability to consider (FFA 2014):

1. Implementation of harvest strategy that may include precautionary TRPs and LRPs and harvest control rules for ALB;
2. Establishing catch allocation units and determining zone limits and inter-zone trading mechanisms;
3. Adding local value through allocation of units as equity in joint ventures, allocation unit pooling, and multi-zone access schemes; subregional agreements on minimum license fees; and sub-regionally applied standards for licensed foreign vessels to land a proportion of catch at designated ports or to employ a proportion of local crew and officers;
4. Mechanisms for quantifying by zone the burden of conservation falling upon Participants and Associate Participants as a result of any management measure, with a view to determining whether such burden falls disproportionately on a Small Island Developing State or Territory; and the development of mechanisms for removing or otherwise compensating for any such disproportionate burden;
5. The establishment of fishing gear restrictions, closed areas, and closed seasons; and
6. The establishment and publication of a regularly updated list of vessels licensed to fish commercially in the fisheries waters of each Participant and Associate Participants—or authorized by them to fish in the high seas of the WCPFC Convention Area—and taking stocks covered by the Scope of this Arrangement

It is clear from this list of powers that the TA was informed by the lessons learned during the VDS. This, combined with the VDS, is a good proof of concept. It is possible to push, or nudge, a larger RFMO by having these strong sub-RFMO agreements between nations. This “leading by example” is an explicit goal of the TA (FFA 2016).

In 2016, the TA is in the process of developing a catch management scheme, and TA participants have agreed to managing national catch limits (FFA 2016). To-date (end of 2016), the TA has developed a draft catch management scheme. The key provisions of the catch management scheme include setting a TAC, creating national catch shares, developing transferability rules, providing for reciprocal licensing, and developing the MCS protocols (FFA 2016).

There are several industry implications to what is being discussed. There will be different TACs in each EEZ, and those TACs will change from year to year. Therefore, their day-to-day operations will

depend on communications with the state whose EEZ they are fishing (FFA 2016). The TA mandates a vessel register and electronic reporting of catch and effort, and at least some of that burden will fall on the fishing industry (FFA 2016).

The catch management scheme proposes the establishment of national catch shares, whereby each state has a proportional share of the TAC, which may move up and down through time. The TAC may change in response to stock changes, whether to adapt to meet sub-regional or WCPFC harvest control rules or to allow for a new Party to the TA. The catch management scheme is still under development. There is a stated goal of “removing latent catch,” and the TA needs to address development aspirations. There are also serious reductions in harvest needed to meet both the LRP and the interim TRP adopted by TA Participants, and the path to reach those reductions has not been decided (FFA 2016). They also need to work out a mechanism for trading across nations (FFA 2016).

Performance

Tokelau Agreement is still in the early implementation phase. The Solomon and the Cook Islands, the two biggest southern albacore fishing nations, expressed dissatisfaction with the Arrangement at the December 2017 WCPFC meeting. The Solomon Islands subsequently pulled out of the Arrangement, weakening the Arrangement. The Solomon Islands stated that the Arrangement was too restrictive, and contradicts the LL VDS. It remains unclear if this break with the Arrangement renders it dead. Some argue that if not dead, it is severely weakened.

Market/Financial-Based Tools

MSC Implementation

The first entry in Table 7, the PNA Western and Central Pacific SKJ and YFT unassociated/non-FAD sets tuna PS fishery, was the first MSC certification

in the region. It was basically a building block for all the other MSC certifications in the region. Simultaneous to the development of the VDS, the FFA moved toward MSC certification (Yeeting et al. 2016). Recognizing the need to end recruitment over-fishing of BET and YFT in the PS fishery over FADs, the PNA felt pressure could be placed on the industry by certifying “clean” SKJ fisheries. Seeing weaknesses in the sustainability claims with pole-and-line fishing, the PNA moved to certify free school PS sets, which protect BET and YFT juveniles (Yeeting et al. 2016).

It was hoped that this could create a new market for PS-caught canned tuna that was labeled sustainable. It was also hoped that this new market would lead to greater overall recognition and credibility for all of the PNA implementing arrangements (Yeeting et al. 2016). The certification process itself could also yield higher control over their fishery products and the supply chain while earning higher economic returns and providing commercial opportunities for member countries.

Design

To meet their economic and sovereignty goals, the PNA entered into a joint venture in 2010 with the Dutch-based Pacifical BV to promote and market MSC SKJ (Yeeting et al. 2016). This was to be a 50/50 joint venture. If fishers were able to verifiably follow the MSC label rules, they would receive a 10 percent price premium at the landing. Canneries that handled the MSC fish would receive a 3 percent premium for canning the product, and PNA/Pacifical BV would retain a 7 percent premium, for a total price premium of 14 percent over non-certified product (Yeeting et al. 2016).

MSC was granted in 2011 and the fishery received chain of custody certification in 2013 (Yeeting et al. 2016). The first can of certified tuna hit European market shelves in November 2013 (Yeeting et al. 2016).

Table 7. MSC Certified Tuna Fisheries in the Western Central Pacific Ocean

FISHERY	SPECIES	GEAR TYPES	LOCATIONS	MSC STATUS	MT	YEAR
PNA Western and Central Pacific skipjack and yellowfin, unassociated / non-FAD set, tuna purse seine	SKJ, YFT	Surrounding Nets – With purse lines (purse seines)	Western Central Pacific (FAO Area 71)	Certified	790,670	2011
Fiji albacore tuna longline	ALB, YFT	Hooks And Lines – Longlines	Western Central Pacific (FAO Area 71)	Certified with component(s) in assessment	1,417	2012
SZLC, CSFC & FZLC Cook Islands EEZ South Pacific albacore & yellowfin longline	ALB, YFT	Hooks And Lines – Longlines	Eastern Central Pacific (FAO Area 77)	Certified	4,667	2015
Japanese Pole and Line skipjack and albacore tuna fishery	SKJ, ALB	Hooks And Lines – Handlines and pole-and line.	Western Central Pacific (FAO Area 71)	Certified	2,730	2016
Solomon Islands skipjack and yellowfin tuna purse seine and pole and line	SKJ, YFT	Hooks And Lines – Handlines and pole-lines	Western Central Pacific (FAO Area 71)	Certified	27,192	2016
Tri Marine Western and Central Pacific Skipjack and Yellowfin Tuna	SKJ, YFT	Surrounding Nets – With purse lines (purse seines)	Western Central Pacific. (FAO Area 71)..	Certified	43,055	2016
French Polynesia albacore and yellowfin longline fishery	YFT, ALB	Hooks And Lines – Longlines	Western Central Pacific (FAO Area 71)	In Assessment		
PT Citraraja Ampat, Sorong pole and line Skipjack and Yellowfin Tuna	SKJ, YFT, ALB	Hooks And Lines	Western Central Pacific (FAO Area 71)	In Assessment	3,190	
WPSTA Western and Central Pacific skipjack and yellowfin free school purse seine	SKJ	Surrounding Nets – With purse lines (purse seines)	Eastern Central Pacific (FAO Area 77)	In Assessment		
SZLC CSFC & FZLC FSM EEZ Longline Yellowfin Tuna	YFT, ALB	Hooks And Lines – Longlines	Western Central Pacific (FAO Area 71)	In Assessment		

The remainder of the certifications listed in Table 7 followed a similar implementation and design to the first one in 2011. If it were not for the VDS and other conservation and management measures, plus the success of the PNA non-FAD set MSC, the others would not have followed so quickly or at all. The latest was certified in 2016. The Tri-Marine Western and Central Pacific SKJ and YFT tuna fishery is a PS fishery that sets on free

swimming schools. The main reason cited for this certification was the VDS scheme in place in the region. Since that last certification in 2016, four more certifications are currently in assessment, including the French Polynesia LL ALB and YFT fishery, the PT Citraraja Ampat, Sorong pole and line SKJ and YFT fishery, the WPSTA WCP SKJ and YFT free school purse seine fishery, and the SZLC CSFC and FZLC FSM EEZ LL YFT fishery.

Performance

A number of U.S. and European retailers have agreed to sell only MSC-certified tuna by 2018 or 2020 (Yeeting et al. 2016). Also, only about 0.2 percent of potential MSC certification-eligible catches are being certified (Yeeting et al. 2016). PNA hopes that certification percentages go up to 60 percent, or the amount of SKJ currently being harvested under free school sets (Yeeting et al. 2016). While it has not happened yet, it is hoped that chain of custody certification will induce investment in domestic processing plants producing much-needed employment opportunities and keeping more of the value added in the region (Yeeting et al. 2016). There is evidence of increased investment in new processing plants due to this certification, and local employment is on the rise (Yeeting et al. 2016).

It took two years from certification of the chain of custody to get the product in the marketplace. This can be blamed on three factors. First, there was a brand conflict between the Pacifical and Ell Dolphin Safe label that had to be resolved (Yeeting et al. 2016). Second, there was, and still is, a limited supply of certified tuna available. Third, there were supply chain delays in delivering the product to Europe (Yeeting et al. 2016).

It is still too early to assess economic outcomes of this certification. Annual net wholesale value is up to \$4.5 billion, and the PNA could earn up to 5 percent of net whole value with this label above the value of access fees (Yeeting et al. 2016). Control has been increased in two dimensions. First, the certification reinforces existing state-based MCS such as 100 percent observer coverage. The observer coverage allows the separation of FAD free catches which the entire certification hinges upon. This additional coverage is expected to have spillover effects

for the overall VDS MCS (Yeeting et al. 2016). Second, the certification program has increased transparency on where, when, and how a fish is caught and processed, which was one of the original goals of the FSMA (Yeeting et al. 2016). It is expected that the region may one day compete with the industry giant, Thailand, with catches staying in the PNA region. It is further expected that the region, by exercising greater control over the Thailand supply by restricting effort (or catch) further, will be able to focus on gains from trade rather than maximizing VDS days (Yeeting et al. 2016).

Right before publication of this document, it was reported that Papua New Guinea was leaving the joint venture due to a lack of financial transparency within Pacifical.¹⁹ Papua New Guinea is leaving to pursue its own, independent MSC certification, with the hope of securing a price premium for its tuna. Pacifical disputes these claims. This signals a larger break away from the PNA with regards to certification strategies in the region.²⁰ At time of publication, it was too soon to assess the implications of this break for Pacifical. However, it does demonstrate that the PNA is interested in pursuing market-based reforms in addition to the VDS.

FIPS

Table 8 contains all of the current FIPs in the WCPO. The WCPO contains the most FIPs of any region examined in this report. The first FIP, the Vietnam YFT FIP, focuses on the LL and handline gears used by the Vietnamese tuna fleets. There are approximately 2,000 vessels in this fishery, and in 2014 they generated an export value of \$370 million. This very important fishery faces many challenges including data gaps, no real harvest strategy, and bycatch of sharks and turtles. The only objective of this FIP is to achieve MSC certification by 2020. This FIP began in April

19 <https://www.undercurrentnews.com/2018/09/19/png-tuna-firms-forge-ahead-with-break-from-pacifical-gain-govt-backing-for-msc-drive/>.

20 <https://www.undercurrentnews.com/2018/09/14/trouble-in-msc-tuna-paradise-as-png-seeks-to-break-from-pacifical/>.

of 2014 and will end in April of 2019. This FIP is listed as 80 percent on track regarding overall actions and 100 percent on track regarding progress on programs to address red indicators. It is 20 percent complete in terms of actions taken/need to be taken.

The second and third FIPs in Table 8 are the Cook Island LL fishery that targets BET and YFT. In March 2017, the YFT portion of this fishery became MSC-Certified. The third FIP in Table 8 is the Cook Islands LL BET fishery. This project is being led by Anova Food/Fishing and Living and Luen Thai Fishing Ventures, and covers all vessels in the Cook Islands that fish LL gear. As a result, this FIP only covers BET now. Vessels in this fishery fish primarily within the Cook Island EEZ and only 5 percent of the effort occurs in the adjacent high seas. The Cook Islands Ministry of Marine Resources is also a participant. The only objective of this FIP is to attain MSC certification for Cook Islands LL BET by 2019. This FIP was started in 2017 and is expected to end at the end of 2018. This FIP is listed as 100 percent on track regarding overall actions and 100 percent on track regarding progress on programs to address red indicators.

The fourth FIP in Table 8 is the Federated States of Micronesia (FSM) YFT and BET LL fisheries. This FIP was launched in 2012 and started its second stage in January of 2016. It covers locally-based LL fishery that operates in the EEZ of FSM that targets YFT and BET, but catches other market species. It has been designed to meet the Conservation Alliance for Seafood Solutions definitions of a comprehensive FIP and in response to the MSC pre-assessment. The key objective is to seek MSC certification of this fishery. To reach that goal, the region needs to institute robust harvest strategies, augment the institutional capacity to achieve the minimum prescribed observer coverage, and augment the management system for stocks and populations

of vulnerable secondary and WCP species. This FIP is 13 percent behind schedule, 88 percent on track regarding actions, and 100 percent on track for red indicator progress.

The fifth FIP in Table 8 is the Marshall Islands LL tuna FIP. This FIP was launched in 2011 for the domestic LL industry. There are approximately 38 active vessels that target YFT and BET with the gear. The fishery occurs entirely within the EEZ of the Marshall Islands. Their objective is to improve management practices such that the fishery can pass MSC certification by 2021. Regarding actions, they are about 17 percent complete and on track with the remainder of those activities. They are 25 percent complete addressing red indicators and 75 percent on track with the remainder.

The sixth FIP in the table is the Philippines YFT handline fishery. The handline fishery nationwide only harvests <5 percent of the total harvest of YFT. The handline fishery only occurs in the Philippines and Indonesia. Despite having a low impact on the stock, it is very important to small-scale fishermen supporting at least 10,000 artisanal fishermen. It is a highly selective fishery. Large YFT are caught using single circle hooks baited with squid or small pelagic fish set at a depth of around 100m. Eighty-eight percent of the landings consist of YFT. The objectives of the FIP are:²¹

1. Implement vessel registration and FCR for ARTESMAR® suppliers in three pilot sites – DONE
2. Design CDS and traceability system from vessel to export and implement it for all ARTESMAR® suppliers – DONE
3. Design database for capturing all FCR, CDS and traceability information, and implement it for all ARTESMAR® suppliers – DONE
4. Knowledge transfer to fishermen for better handling to improve quality, and thus

21 <https://fisheryprogress.org/fip-profile/philippines-yellowfin-tuna-handline>.

Table 8. FIPs for Tuna Fisheries in the Western and Central Pacific Ocean

FIP NAME	SPECIES	MT	START DATE	PARTICIPANT(S) – ORGANIZATION(S)	CURRENT STAGE
Vietnam yellowfin tuna – longline/handline	YFT	17,859	Apr-14	WWF/Anova Food LLC	Stage 5: Improvements on the Water
Cook Islands bigeye tuna – longline	BET	350	Mar-17	Anova Food LLC	Stage 4: Improvements in Fishing Practices or Fishery Management
Cook Islands yellowfin tuna – longline	YFT	1,000	Jul-13	Anova Food USA/Fishing & Living program	Stage 4: Improvements in Fishing Practices or Fishery Management
Federated States of Micronesia yellowfin and bigeye tuna – longline	BET, YFT	1,400	Jan-16	Co-Lead: Luen Thai Fishing Venture/FIP Secretariat	Stage 4: Improvements in Fishing Practices or Fishery Management
Marshall Islands bigeye and yellowfin tuna – longline	BET, YFT	5,100	May-11	Co-Lead: Norpac Fisheries Export	Stage 4: Improvements in Fishing Practices or Fishery Management
Philippines yellowfin tuna – handline	YFT	500	Apr-14	Blueyou Consulting	Stage 4: Improvements in Fishing Practices or Fishery Management
Western and Central Pacific Ocean tropical tuna – purse seine (OPAGAC)	BET, SKJ, YFT	50,000	Oct-16	OPAGAC	Stage 4: Improvements in Fishing Practices or Fishery Management

incomes through better pricing – WORK IN PROGRESS

5. Improve cost-benefit control of fishery stakeholders – WORK IN PROGRESS
6. Establish vessel registration scheme with BFAR to be applied nationwide by 2017
7. Extend FCR implementation from pilot sites to other ARTESMAR® suppliers by 2017
8. Define management structures with BFAR to interpret FCR information and create mechanisms for intervention by 2017
9. Organize fishery stakeholders in communities, optimize economics and capacities, and participate in management decisions by 2019

This FIP was started in April of 2014 and will end on April of 2024. From an activity standpoint, it is 25 percent behind and 75 percent on track. From a red indicator standpoint, it is 25 percent behind and also 75 percent on track.

Pilot Projects

The WCPO pilot projects are linked with the Pacific Regional Oceanscape Program (PROP). As seen above, the VDS has been very successful in returning more value to the Pacific Islands and the PNA specifically. Further increases in value are possible, as evidenced by the independent review detailed above, but it will require some further developments in the VDS system itself. The review called for and the pilot projects will focus on increasing compliance across the resource management systems, increasing the scope to eliminate high seas free-riding, and enhancing flexibility, transparency and efficiency in the VDS system. In addition, there is expansion of the VDS to cover LL fishing in the region, and Tokelau is expanding the program to ALB and other tunas.

The overall method to accomplish these broad reforms and expansions of the VDS will be through strong public/private partnerships. The projects have been broken up in several components including:

- Component 1: Strengthen VDS for the PS and LL gears
- Component 2: Ensure equitable distribution of benefits from a more valuable natural capital asset
- Component 3: Global outreach and knowledge sharing by FFA

PROP Component 1

Broadly this component sets out to strengthen VDS for PS and extend the lesson learned to the new LL VDS. More narrowly, these pilots under this component seek to improve the governance and enhance the integrity of VDS. The objectives of this component are threefold. First, they seek to consolidate the PNA legal framework under a single agreement that adheres to international standards and provides guidance on implementation of consistent management measures at a national level. Second, they seek to implement a robust compliance regime. This regime would strengthen exclusivity and security of the right and increase integrity in the system. Third, they seek to support participating countries in implementing the LL VDS to provide consistency of application and cohesive management for all participation countries. This entire component was developed in response to the 2014 VDS independent review (PNA 2015).

HARMONIZING AGREEMENTS

The 1982 Nauru Agreement started the management ball rolling in the region with some general fisheries ground rules. The 1992 Palau Agreement established PS specific rules and was amended multiple times, eventually being amended to create the VDS. The FSMA was a reciprocal access agreement that required a commitment of vessel days to a common pool for access by PS vessels flagged to participating Parties. All of these agreements are being administered separately. They hold separate meetings and make different decisions that are not subject to confirmation or endorsement

by the other agreements. This current legal framework is full of constraints, gaps, and inadequacies (Maharaj 2016).

The independent VDS review recommended (Maharaj 2016, PNA 2015):

1. Developing and adopting a new integrated legal instrument based on and incorporating existing legal instruments. This new instrument would replace the existing legal instruments as appropriate, or combine issues relating to cross-cutting and/or interdependent matters and accordingly amend the existing legal instruments.
2. Amend the Palau Arrangement only. Amendments of other legal instruments may be considered separately.
3. Amend the Palau Arrangement and agree on a new separate protocol or other form of instrument applicable to the Nauru Agreement and the FSM Arrangement to harmonize them with the amendments.

The harmonization task was definitized before the 2016 GloTT meeting, and the following three implementation phases are underway. Phase 1 is a legal review and consultation process that was completed in 2016. Phase 2 included the completion of a consolidated arrangement, also in 2016. Lastly, the final draft of this arrangement is to be presented as Phase 3 to officials and Parties in 2017.

IMPROVING COMPLIANCE

The process to increase compliance began at the 44th PNA meeting on July 2016. At this meeting it was recommended that compliance be incorporated into a proposed VDS Committee (VDSC). It was also decided at this meeting that the VDSC would be responsible for:

1. Monitoring Parties' performance against obligations
2. Reporting on obligations



3. Facilitating independent verification/audit of performance against obligations
4. Reporting back to Parties on efficacy of program and on compliance
5. Providing advice to Administrator on implementation of compliance measures
6. Monitoring compliance of fishery management measures adopted by Parties
7. Providing forum for information sharing
8. Compliance reporting
9. Recommending corrective action required for VDS compliance
10. Recommending new compliance measures
11. Recommending further development of compliance regimes

The compliance system will incorporate the use of the Fishery Information and Management System (FIMS) and Integrated Fishery Information and Management System (iFIMS). This system presents a secure interface that tracks and warehouses nearly all MCS and electronic monitoring functions.²² That system will facilitate the creation of an audit process that will produce periodic compliance reports. The tasks required under this output include designing a template for these annual reports in 2017, develop audit screening protocols in 2017, begin country visits in 2017-2018, prepare an audit report in 2018, and facilitate triennial external audits at the direction of the VSDC in 2018.

22 <http://www.ifims.com/>.

SUPPORTING THE IMPLEMENTATION OF THE LL VDS

There are seven participants in the newly formed LL VDS, which became operational in January of 2017. Those participants include all of the Parties to the Nauru Agreement except for Kiribati, plus the addition of Tokelau. These nations need technical and economic support for implementing in-zone MCS, electronic reporting, developing cost recovery options, pricing of vessel days, cash-flow models of vessel operations, legal aspects of LL VDS management including electronic monitoring and reporting, dialogue on VDS pooling and other operational issues that are expected to surface. These general goals have been focused to a set of specific actions that include:

1. Conducting a rolling regional review of the functions and services required to manage tuna fisheries and identify opportunities for regional, sub-regional, and national-level location, and provision of fisheries management services (e.g., management, science, monitoring and surveillance, and enforcement hubs, etc.);
2. Support to countries for policy reforms and stakeholder consultations;
3. Legal advice to countries;
4. General implementation support, including business plan development, for the results of the functional reviews;
5. Development of a model to incorporate financial flows (revenues and expenditures) into national information management system portals; and
6. Development and implementation of a training course on commercial and economic management of fisheries, for officials from both Finance Ministries and fisheries agencies

Implementation of these specific actions will require a work plan based on the review recommendations from the PS independent review. A memorandum of agreement (MOA) between FFA and PNAO to enable OPP funding for this work was put in place in November of 2016. Under this MOA, various tasks have been identified that include:

1. Provide advice to participating countries individually and collectively in relation to the effective implementation of, and compliance with, the rules, systems, and processes of the LL VDS and related provisions, including related provisions of the Palau Arrangement;
2. Undertake combined economic analysis and stock assessment for the fishery and assess the potential for medium to long-term rent optimization strategies;
3. Undertake an evaluation of options to develop a medium to long-term LL VDS harvest strategy that will maximize the economic benefits to Party economies;
4. For each participating country, quantify the benefits of domestic development so that trade-offs with DWFN access can be properly evaluated;
5. Provide advice in the development of e-Tracking (ATS), e-Reporting (FIMS), and e-Monitoring (cameras and sensors) systems which underpin the monitoring and control of the LL VDS; and
6. Provide technical support to participating countries in the development of regulations for the implementation of e-Reporting and e-Monitoring platforms

These tasks will be completed across three phases. Phase one involved country visits to assess operational issues, monitoring requirements, economic priorities, and local legal constraints during 2016-2017. Phase two includes undertaking country workshops to

review the findings from phase one and identify implementation weaknesses during 2017. The final phase involves the review of these priorities in a Management Strategy Evaluation workshop in 2017.

There have been delays in implementing all of these tasks, as there were delays in the creation of PROP and PROP Program Support Unit within FFA was not yet established. However, FFA has provided some legal advice already to some PROP-participating countries regarding legislative underpinnings of LL VDS. FFA is currently discussing implementing several business case concepts. One concept is to design, develop, and disseminate a robust auction/tender system for the sale of both PS and LL days that Parties might use to maximize revenues from vessel days. They are also considering a study regarding the capitalization of vessels days so they could be viewed as bankable assets that Parties might leverage for development purposes. Another study under consideration focuses on the technical and business potential of implementing a FAD deployment and lease/sale venture both to better manage FAD use and increase revenues using FAD set premiums. Finally, FFA is considering the design and implementation of robust HCRs aimed at keeping SKJ stock at or close to the agreed TRP, including capacity-building and extension processes, both within the PNA and the wider WCPFC membership, so as to nudge towards compatible measures regionwide.

PROP Component 2

As the value of the natural capital assets continue to increase, this component focuses on ensuring the distribution of benefits from those assets is equitable and improves livelihoods in small island States. The objective here is to provide support and technical advice to Pacific Island Countries, enabling them to make informed decisions regarding investments that ensure inclusivity in the distribution of increased tuna revenues. The idea is to develop a series of

scenarios, and analyze those scenarios to create a pilot community VDS fund securing a share of tuna access revenues for fishing communities. Tuvalu has been selected as the first case study location. The process will begin with discussing issues and defining community needs from the bottom up. These inputs will be used to design a community VDS fund and develop a business plan around the developed scenarios to catalyze fund capitalization. If successful, it will be expanded to all eight Tuvalu islands.

The VDS has been increasing asset values and therefore public monies generated in Pacific Island Countries. Unfortunately, job opportunities in these countries have not followed suit. Currently, all local fisheries are coastal fisheries supported by fringing reefs. The job opportunities in most of these locations have always been scarce, but with climate change predicting less productivity in reef ecosystems, food availability and employment opportunities will likely decrease, exacerbating the livelihood issues already being experienced. Some of these increased public monies could be used to empower these communities.

The idea is straightforward and has been used in other locations. A group of people would be defined as a community, and that community would be allocated a portion of the property right, in this case vessel days, to manage as they see fit. They could fish it themselves or lease the rights to provide revenue. This has been done in New Zealand with the Maori and with Alaskan natives using community development quotas (CDQs) for halibut and salmon. In these examples, the communities form corporations that own and manage the rights on behalf of the community.

The initial pilot is already in place and was jointly implemented between FFA and Tuvalu. The pilot should have started in the first quarter of 2017. These social funds will be granted 20 vessel days per each island. At currently vessel day prices, that is approximately \$160,000 for each.

Currently, those funds are earmarked for coastal fisheries infrastructure, but could be expanded later. The hope is the Tuvalu project nudges the rest of the region in this direction.

The objectives with this Tuvalu pilot include reviewing global experience with social funds and community development quotas, then take those lessons learned globally and approach stakeholders to develop scenarios that include the costs and benefits of each. Based on the results of the scenario analysis, FFA plans to work with other interested governments to establish funds focusing on Tuvalu as the first case study. There are currently two contracts in progress to foster this work. FFA has issues one to review and summarize comparable models around the world including other social funds such as the Solomon Islands Rural Development program. Based on that analysis, the contractor will prepare a suite of scenarios for the development of community VDS funds in the context of different PNA member countries. Finally, the FFA contractor will assess the costs and benefits of each scenario and identify feasible plans for moving forward in at least two PNA countries. Tuvalu will issue another contract that will take the initial phases of the FFA contract and the global review, and identify the most feasible options for strengthening and expanding their nascent program through stakeholder engagement in the region.

PROP Component 3

This component is a component required of all OPP projects, and includes global outreach and knowledge sharing by FFA. Generally, these components support the travel and meeting attendance necessary to share knowledge supporting components one and two. It is also designed to support integration with the GloTT. Overall, it will be used to bring GloTT findings back to the WCPO region and raise awareness of key lessons from the WCPO. In this respect, as evidence here, it is working.

PNA FAD Management Scheme

This project has been more focused on developing and reviewing options for FAD management that include RBM tools, such as FAD ownership privileges that would convey fishing rights to floating FADs. Most of the work thus far has focused on examining options to improve tracking of FADs and options for their management. FFA issued consultancies to gather information on global management strategies and to investigate tracking technology. The Parties have been asked to provide feedback on management options in June 2018. Options included:

- Require vessel operators to provide better information on FADs, marking, registration, monitoring, and environmental measures such as requiring FAD recovery. These address the enabling conditions making further measures possible.
- A number of economic measures, including FAD day charge, charging for FAD set, charging for each FAD deployed, FAD leasing, and rebates for free school days.

One of the economic measures included PNA deploying, maintaining, and owning all FADs placed in the PNA area of competence. The intervention would cap FAD placements and would bar setting PS gear on any non-PNA FAD. PNA would monitor their FADs and charge a premium fee to anyone that set on their FADs. This project would require soft money funding in the form of donor funding, OPP funding, or a combination of funds. The soft money would be used to fund a trial run whereby they would deploy and monitor FADs, offer rights to fish for sale, and infer a monopoly premium. The funding could come from VDS revenue and could be used to cover the reporting cost of existing FADs; capital costs of new FADs; and the operational cost of deployment, reporting, and administration. This plan would require policy and legislative changes to implement. It would also require electronic monitoring on all PS vessels,

and would require the creation of a corporation to manage FADs, sell access, and share returns. The objectives of such a program would include BET conservation, increased returns to the capital asset, reduced or no FAD closures, and increased LL value.

A SWOT analysis for the implementation of an adaptive FAD management scheme is due in September 2018 and it will form the basis of a business case for FAD management.

Tuna Transshipping Port

As reported in previous progress reports, FFA had entered into discussions with an entrepreneur in Majuro, Republic of Marshall Islands, to develop a major tuna transshipment base. Terms of reference were developed in 2017 and were approved as part of the OPP work plan for business case development. Requests for expressions of interests were distributed, and Marine Resources Assessment Group Asia Pacific (MRAG AP) was selected. After consulting the bank, FFA asked MRAG AP to submit a combined technical and financial proposal. After receiving the proposal and discussions between FFA and entrepreneur, the entrepreneur decided to pursue the transshipment facility on his own. This activity was then removed from the OPP package.

Other Proposals Under Consideration

While not explicitly presented as pilot projects within the OPP, another proposal was ALB catch limits. All countries would be required to reduce harvest, as an allocated TAC, and would get credit for their sacrifice. If they can keep harvests under the TAC, they can keep the harvest credit. If they exceed their TAC, they have to pay back the credit. At some point in the future, the TAC, equal or less than the credit, would become that country's ALB allocation. This project would require soft money from donors, OPP, or a combination of the two. For hard money, the program could be funded by the sale of catch limits cashed in through the "use it or lose it" approach. To implement this project, there would need to be policy and legislation changes and various requirements for catch monitoring systems. It would require a high level of political commitment by the participants, and would benefit from WCPFC action on ALB catch limits on the high seas. It is hoped that this intervention would result in ALB conservation, profitable EEZ fisheries, and viable domestic fleets.

Gaps and Strengths Regional Summary

Atlantic

1. NMFS manages their BFT fishery using stakeholder Advisory Panels (APs), which are seen by all stakeholders as open and transparent communication and policy creation bodies.
 - a. The industry recognized there was a conservation issue.
 - b. Industry recognized that they faced too many regulations that weren't working.
2. Paying for the full cost of electronic monitoring (EM) materials, installation, maintenance, and auditing proved crucial. Additionally, now that the program has been in operation nearly three years, some captains view the data collected via the EM system to be helpful to their business by improving safety on the back deck and resolving accident disputes quickly.
3. NMFS has been very flexible with the implementation of EM never keeping a boat from fishing for EM failures.
 - a. As long as NMFS is notified and attempts made to have the system repaired, the boat can leave the dock.
 - b. They also do not require the vessel to stop fishing if the EM system fails while on the water.
 - c. This flexibility has bought a lot of good will with the harvesters.
4. The program took a phased approach to implementation.
 - a. While the program started in January 2015, EM did not have to be installed until June of 2015.
 - b. During the first year, the program allowed fishers to balance quota only at the end of the year. If they had already expended their quota, they could still go fishing before acquiring the trip-level minimum required in the program.
 - c. The trip-level accountability measures started in the second year.
 - d. There were a lot of changes in 2015, including the individual bluefin quota, compliance requirements, and two new closed areas.
 - e. NMFS felt this phased-in approach would enhance success.
5. Quota redistribution
 - a. PS effort has been low and decreasing for years.
 - b. The PS fleet has a large allocation of BFT quota.
 - c. Because the fleet appeared to be hoarding quota, not fishing it and not leasing it, NMFS began taking that quota back and redistributing it to the LL fleet.
 - d. If a vessel was inactive for an entire year, they would only be allocated 25 percent of their quota in the next year.
 - e. These injections of retired PS quota helped reduce their risk and increased trades.
6. No permanent transfers of quota are allowed, although that will be evaluated during the upcoming three-year review.
7. No cost recovery is required, although that will be evaluated during the upcoming three-year review.

8. One of the new closed areas off Cape Hatteras is only closed to boats with high BFT bycatch.
 - a. If a vessel has a low BFT interaction ratio, it is allowed to fish in the closed area.
 - b. This is both an added incentive and proof that in less than three years the fleets' marginal cost of avoiding BFT is declining.
9. Quota are allocated using a scoring system that rewarded low bycatch with larger amounts of quota.

CCSBT

1. Industry and the Australian government were aware of stock crisis for many years.
 - a. Industry was too large and profitability suffered.
 - b. One segment of the industry, Western Australia, is doing very well; two other segments are earning negative returns.
 - c. This set the stage for the move to RBM.
2. In response to the hardship, the government formed the Tuna Task Force to develop innovative solutions. Catch shares were one idea that came out of that group and after a series of stakeholder meetings, the TTF issued a management plan containing catch shares as an option.
3. This fishery was a good candidate for catch shares for these reasons:
 - a. Single-species fishery.
 - b. Very little potential for developing black markets because the majority of the fish were headed to Japan's sashimi market and export pathways were limited in number and tightly controlled.
 - c. Annual fish abundance is very consistent.
4. CCSBT began with an interim program that abolished input restrictions and set an aggregate quota. It was strengthened to individual rights the year after.
5. Quota awarded were 75 percent based on catch history and 25 percent on boat value, as established by an independent surveyor.
6. It eliminated a minimum-size limit in lieu of a two-month closure and an area closure to avoid undersized fish.
 - a. Both the elimination of the minimum size limit and the western zone quota were a concession to the Western Australian government to get them to agree to the ITQ.
 - b. There were reports of excessive dumping of small fish in 1983; so to balance removing the minimum size limit, they instituted a closure during the time the small fish were present and closed an area that typically held small fish.
7. Entire system cost \$600,000 to implement, and fishers paid back 44 percent of that proportional to quota holdings.
8. More than two-thirds of the fishers left the fishery.
 - a. The 82 vessels that were left targeted more than just BFT.
 - b. Conditions were so bad that 70 percent of those that left would have left anyway.
 - c. Western Australian fleet, which shrunk by 70 percent, made 50 percent more profit by leaving.
9. Fishery value rose six times higher, while TACs declined by 75 percent.
10. It resulted in a joint venture with the Japanese to train the Australians to farm fish for larger sizes and higher prices.

EPO

1. BET is overexploited, YFT appears to be headed down but SKJ stocks are in good shape. There is a growing realization from the industry that something needs to change.
2. Weakly defined right to vessel hold capacity with a non-binding cap has resulted in a lack of a market developing and a continued creep upwards in total capacity, heightening sense of crisis.
3. Time and area closures are not liked by the industry, and are not currently working.
4. There is a long history of involvement by NGOs to educate stakeholders about the benefits of RBM.
5. Industry is beginning to advocate for something besides well volume caps, which are largely ineffective.
6. There is wide agreement on the enabling conditions, the objectives, and the pitfalls to be avoided due to the long history of NGO-driven stakeholder workshops.
7. There are many constraints to capacity market formation.
 - a. There is a lack of secure rights.
 - b. There is a lack of strong transparent rules prevents markets from forming.
 - c. Naïve participants or participants without a history of participating in markets hamper market development.
 - d. Lack of capital or financing keeps transactions from occurring.
 - e. There is a lack of enabling conditions, such as sustainable management, equitable rules, long-term right security, secure and stable legal environment, secure market access, secure fishing access, conducive investment climates, and national development plans that include the sector.
8. The region has agreed on proceeding gradually.
9. The long process of stakeholder engagement may be paying off with several proposals on the table:
 - a. Improved enabling conditions so a capacity market could develop, coupled with an industry-funded buyback.
 - b. VDS program modeled on the PNA system, with limits on FAD sets.
 - c. TAC and quotas for YFT and BET EPO-wide.
 - d. TAC and quota for YFT and BET in a couple of main countries.
10. Stakeholders currently prefer some catch quota system.
11. Lost wealth, or conversely potential wealth gains, is seen as the best driver to convince the industry to participate. To that end, WWF commissioned a cash-flow analysis comparing moving to a quota versus longer seasonal closures.

Indian Ocean/BOBP-IGO

1. The multi-layered institutional arrangements in the BOBP have been invaluable, providing the base for networking, coordination, and policy intervention ideas.
 - a. Governing Council
 - b. Technical Advisory Committee
 - c. Project Coordination Committee
2. These arrangements have helped build trust with stakeholders and have been very helpful in the development of the pilot projects.
 - a. Overall, the pilot project organizers feel this radical inclusion has been very helpful.
 - a. They joke, actually, that the BOBP has become a famous four-letter word, but in truth the organization is quite popular

- in the region, and that trust opens doors.
- b. This trust and rapport lead to many partnerships with other NGOs, as they are seen as an honest broker for change in the region.
 3. Industry is beginning to realize there is a sustainability crisis looming, and that value is being squandered. There is a high degree of willingness to engage, as well as an interest in maintaining reform momentum
 4. There is more concern about artisanal fishers and food security than in other regions, and stakeholders have asked that managers look at RBM with a livelihood approach. Graduality is likely more important for the artisanal sector.
 5. Interventions should be presented as a holistic package, not just bits and pieces to address winners and losers in the transition to RBM.
 6. Stakeholders realize that it will take much iteration to train participants in markets and RBM.
 7. Progressive nudging and education by NGOs have resulted in an increased membership in the IOTC, and an increase in management proposals to the IOTC
 8. Socioeconomic advocacy vitality is important.
 9. With heterogeneity, it is important to build a platform on common goals and trust.
 10. Sub-regional RFMOs can push the process at the larger RFMO level. This is also an important point in the WCPO.
 11. There is recognition that true sustainability cannot occur until the entire range of the tunas is under sound management.
 12. In 2016 a quota allocation program was proposed for BET, YFT, and SWO, the outgrowth of several previous proposals and the pre-implementation work.
 13. The scheme allocates quota to countries based on historic catches and other metrics, including special allocation rules for developing nations. The allocation scheme is quite complicated.
 14. Market-based initiatives have been desired by stakeholders, and MSC certifications have been issued and even a few retracted. Infrastructure is an important desire of many of the nations in the IOTC.
 15. Success improves with community cohesion. Failures have come in communities that were not closely associated, did not work together, or did not have strong ties to each other.
 16. The most successful projects to-date have come out of a process of progressive nudging.
 - a. Two of the pilot projects were developed through a fisheries characterization study that identified a lack of trust and transparency between first dealers and harvesters.
 - b. Working through these concerns led to selecting two ports that had the right characteristics amenable to increasing market access and hopefully dockside prices.
 - c. In my experience with the FPIs, they are a perfect tool to discover opportunities in a way conducive to effecting change.
 17. Bringing in industry and financial backers early helps smooth transitions and lubricate change.
 18. General marketing principles can work. Social media, web sites, short films, and animations can really help educate.
 19. Many enabling conditions are missing in the region.
 - a. India has stock assessments in their EEZ but most other countries do not.

- b. Management capacity is low in some countries.
 - c. Some countries have little to no catch monitoring, particularly when it comes to artisanal fleets.
20. Delivering quality product seems to be the biggest impediment to value growth. There is a lack of:
- a. Proper handling on land.
 - b. Ice capacity on boats.
 - c. Proper handling at sea.
- d. The Sablefish IFQ was used to design the AK halibut IFQ due to significant stakeholder overlap.
 - e. Simultaneous development in two related U.S. fisheries was thought to enhance successes.
7. AK quota was allocated by management zone to minimize local depletion and use catch history.
8. AK created allocation policies to reward certain groups of stakeholders and to address stakeholder goals in the fishery:

Northern Pacific

1. The fishery was in definite crisis. Sometimes, season length was a matter of hours.
2. Crew safety was a huge concern.
3. Lost gear and mortality due to ghost gear were a huge problem.
4. Canadians developed a state-level IVQ first, which nudged AK to do the same.
 - a. IVQ was proposed by industry.
 - b. It was initially instituted for a two-year trial, which is a type of graduality.
 - c. Trial was approved by 70 percent of fishers, continuation approved by 90 percent.
5. Canadian program banned any quota trades for two years, unless the vessel was being sold, to keep processors from aggregating quota. Trading was later allowed, but limited by vessel size.
6. AK effort, which began as an attempt to limit entry, failed.
 - a. With that loss of momentum in halibut, focus shifted to sablefish fishery.
 - b. NPFMC began a series of workshops as a form of stakeholder engagement.
 - c. This resulted in a plan that included an IFQ for sablefish.
9. Stranded capital in the processing sector was a huge issue that was basically ignored.

Western Central Pacific

1. The implementation of RBM is often the result of a path or progression from completely open access to regulated open access to limited entry and, finally, to right creation. The VDS in the PNA is a good example of this.

2. Nauru Agreement organized management of tuna fisheries in a subset of WCPFC EEZs. It thereby created the Parties to the Nauru Agreement with the goal of cooperative management of the fisheries in common interest. They had the following objectives:
 - a. Give coastal States preference.
 - b. Require/enhance development of domestic fisheries, ports, and infrastructure.
 - c. Provide for local employment.
 - d. This formation and these goals, while not the definition of a full property right, are an assertion that a right exists and an agreement to improve the value of those rights.
3. Next, the Palau Arrangement (PA) came out of concerns that YFT stocks were being overexploited and measures should be formulated to reduce harvests.
 - a. Capped vessels initially at 164, expanded to 205.
 - b. The PA did not create the competition to raise fees simply by limiting entry because the caps was set too high and also because the limited entry permits were given to the vessels and not to PNA members.
4. Federates States of Micronesia Arrangement (FSMA) followed the PA closely.
 - a. FSMA discounted access licenses and reciprocal access if fishers would use local labor and local provisions, and offload locally.
 - b. FSMA increased licenses with removing other licenses.
 - c. Ultimately, it did not reach its goal due to a lack of transparency.
5. Capacity continued to grow, fees remained flat. This resulted in motivation to create a market for stronger rights.
6. PNA under the VDS capped total effort and allocated all parties a proportion of that cap based 50 percent on biomass estimates in their EEZ and 50 percent on catch history.
7. Effort was selected over harvest due to the ease of monitoring effort, as DWFs land fish in distant ports.
8. Part of the motivation to create the VDS was one of regional sovereignty in the face of the newly created WCPFC.
9. Design and implementation were gradually phased in over five years or so:
 - a. It took three years to create the allocation strategy.
 - b. Second phase was full implementation and hard effort limits.
 - c. Third phase was full adoption by all parties.
 - d. Fourth phase was market development, which is still ongoing.
10. Benchmark vessel day prices kept one party from undercutting another.
11. VDS is an attenuated access right.
12. Allocation was set every three years to take into account climatic variations that drive regional tuna abundance.
13. VDS is very successful in increasing license fees, not successful controlling harvests.
14. VDS has demonstrated that exercising these rights allows collective and direct negotiations for access without difficult and slow-moving RFMO process or complicated bilateral treaties.
15. Success of the VDS increases the PNA's leverage over vessels in the FSMA and U.S. Treaties.
16. Quota were allocated to Parties. Parties have flexibility regarding how they manage that quota.

17. The WCPFC has since noted that setting HCRs, limit reference points (LRPs), and target reference points (TRPs) is easier when country allocations are already in place, as in the ICCAT case. Trying to agree to harvest control rules simultaneously with country allocations has proven very difficult.
18. Joint ventures have been used to pave the way for certified product and to create access to markets.



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General Conclusions

The above regional bullet points can be summarized into some general guidelines regarding the design and implementation of successful ICM. These general guidelines are detailed below using the following bins for organizational purposes: definitions, motivation and cohesion, equity and fairness, side payments, markets and nudging, graduality, enabling conditions, and the role of NGOs in the process. These recommendations are design recommendations and not prescriptive directions on how institutions should be changed. There is no single solution or path. Instead, this summary assembles solid directions to proceed, tempered by general conditions found across case studies in incentive-compatible reform in tuna fisheries. Overall, design of successful ICM is a long process, and the process itself should be used to dictate the system that emerges.

Definitions

If one agrees that process and graduality are important to the successful design of policies, the process of defining the intervention will help pave the way to successful implementation. It is important to first define the scope of the ICM intervention and who has a legitimate claim to the fishery. Some have more at stake than others (history, value, standing in community, etc.). Second, what capacity should these representatives have in the process? Will they represent a group or just themselves? Third, how much should they be involved? Both their capacity to participate and the burden that participating places on their lives should be taken into consideration. Fourth, are there historic tenure arrangements that can be tapped to

take advantage of existing social capital? Finally, designers must define the system that organizes participation in the design process.

The definition and measurement scale of the asset unit must be defined carefully. Should the right be available at any time and any place or should there be restrictions? Will this be a region-wide solution or an individual nation design or something in between? Spatially, issues of localized depletion are good reasons to control the geographic extent of the right. Closely tied to localized depletion is congestion, which reduces benefits. Additionally, there will be equity concerns if all the right ends up in one particular region or in too few hands. Regarding the temporal definition of the asset unit, if the asset expires annually, it can be counter-productive as it might induce a year-end wave of mortality.

This process requires a deep knowledge of the community. Tenure rights are already embedded within the existing social and political relationships, and those should be recognized and codified in the new institution. Property rights should be thought of as more than a right to access fish resources, but should include the right to benefit from fisheries resources. The focus should be on capability and the existing social and political processes already at work.

The allocation of the right in question is often the hardest part of moving towards RBM because its central question is the redistribution of wealth. Those who are having wealth taken away from them will resist and those who will gain wealth will accept the change. Allocation is therefore an important tool for gaining agreement, and allocation can be used to also compensate those who will not do as well after the change. As

mentioned above, historic catches are often used to allocate rights because it rewards the highliner who may lose post-implementation. More on the use of allocation for side payments is in the text below.

Of the six dimensions of strong rights listed above, trade is perhaps the most important one to keep open. Trade is the mechanism that creates value and drives most of the recapturing of resource rents. While there may be many equity and fairness reasons to at least initially restrict trade, keeping trade in the design is a must. Allowing trade will produce the most efficient outcomes and the highest values without minimal intervention, but there are potential downsides. If the purchasing sector is geographically concentrated, regional depletion could occur. Free trade also raises the risk of market concentration. There are also potential secondary impacts. If the industrial fleet bought the entire quota, it could impact the incomes of small-scale and recreational fishermen. If it were determined that the artisanal sector needed to be protected, sales could be banned with quota only available for lease. There are many ways to structure the trade instrument to protect equity and livelihoods. There are precedents in commercial rights-based programs for restrictions on trade for equity and other concerns.

Motivation and Cohesion

The most important finding from this work is that the design of any new management regime must be participatory and start from the bottom up. Discussion should begin as soon as possible to evaluate the existing communities and how existing rights structures and tenure in those communities could be used to formulate changes that improve livelihoods. All institutions emerge through a bargaining process. In a top-down system, participants attempt to capture the process and seek rent across groups with varying

power and potentially conflicting interests. In the movement towards new institutions, existing successful institution members will try and dominate the discussion and will resist change strongly. It is very important—for fairness and equity—to carefully define who gets a seat at the table moving forward. Another caution is including too many interest groups, particularly outside groups, which can weaken the power of the community. It is difficult but necessary to balance these issues.

More data needs to be collected on the stock and on the political and economic structure of the countries where these changes are being considered. Conducting assessments of current infrastructure and governance will allow the targeting of scarce program funds to ensure success and be able to gauge success. All solutions will involve enhanced monitoring and data collection. This evaluation must include the wider systemic consequences of intervening. Failure to include all factors can result in unforeseen threats to the intervention.

Another important conclusion from this global examination is that the crisis needs to be felt by stakeholders. That crisis can be an economic or a stock crisis, but generally those two crises go hand in hand. It is also important to define how much better economic conditions could be and use those estimates to motivate stakeholders. To that end, it is helpful to collect economic and fisheries data as part of the design process, and to use rapid assessment tools like the Fishery Performance Indicators (Anderson et al. 2015). It is important to develop estimates of the benefits and costs of the intervention up front and use those to advocate for reform.

Finally, in-person testimonials have been very successful to motivate change in the United States and elsewhere. Bringing captains who have benefitted financially from other successful RBM or market actions is a very powerful tool for winning over stakeholders.

Equity and Fairness

Livelihoods are an important part of the overall project funding that funds this work, and the livelihoods of all participants should be considered when designing new institutions, focusing on the entire income portfolio of all sectors involved.

However, RBM and livelihoods are not a threat in all RBM cases. In fact, with consolidation concerns, some livelihoods, usually of the large-scale fishers, will increase while others, usually SSFs, suffer. Also, many of these fisheries are purely industrial fisheries. Some of this can be addressed by focusing on livelihoods in the design, but in other cases it may be necessary to address this using a Coasian bargain, whereby the winners compensate the losers. To be successful, the designers need to focus on more than fishing and look at the portfolio of activities that contribute to local livelihoods, with a particular focus on their assets and how participants use their assets to ameliorate risk. It is good practice to look at this portfolio with an eye towards their sensitivity to changes and their resilience in the face of change.

Often small-scale fishermen are trapped in shared poverty. This happens when the population exceeds local employment opportunities and the communities begin to share work. This is often the case when fishing is the employer of last resort. When a right is assigned in such a situation, it can make it difficult to slice up that piece of the pie into smaller and smaller pieces, as rights tend to enhance efficiency while shared poverty focuses on addressing poverty by maximizing employment, which to an economist, is a cost.

Side Payments

Side payments come in many forms and are the necessary grease that keeps the machine of ICM

implementation moving smoothly. There are all sorts of ways to make side payments and all sorts of reasons to make them. Generally, however, there are two ways to make side payments in practice: allocation of the right or the re-distribution of rents through Coasian process. The allocation of rights can be carried out in a nearly infinite number of ways. Grandfathering allocation through the use of catch histories rewards highliners and protects their highliner rents, making them more likely to participate. Allocations based on regional catch history take that a step further by respecting national interests. Allocations based on the value of existing capital is similar to protecting highliners, but may also protect recent entrants and nations that have recently made significant investments in harvesting or processing capital. In terms of processing capital, some allocation can be given to the shore-side business to protect their investments, in what will surely be a changed marketplace post-rationalization. Allocations based on EEZ abundance have been used as side payments to small island developing States to honor their development aspirations. These are just a few of the methods encountered in this review to make side payments using allocations.

While not typically considered side payments, many trade restrictions act as side payments in practice. Caps on quota aggregation are concessions made to small communities and small-scale fishermen. These include quota aggregation caps, vessel size trade limits, and total trade limits. Quota set-asides for new entrants or used as incentives for conservation activities are also ways to make side payments. Along the same lines, quota re-balancing can be used as an incentive with direct value consequences. Quota price floors, such as those used for the VDS, are effectively side payments to the member States. Finally, the easing of certain current command-and-control regulations, such as minimum size limits, gear restrictions, access limitation, and time and area closures, can be used as side payments.

Finally, as sure as there will be winners, there will also be losers. The disadvantaged may have no way to access allocation and benefit from the other side payments mentioned above. That does not mean they cannot or should not be compensated. Instead, Coasian bargains can be had that collect the new, higher rents in the fishery and distribute them back to the disadvantaged. This can include allocation-based quota set-asides that can be sold or leased on behalf of the disadvantaged, or can involve other rent collection mechanisms such as landings taxes or levies on the trade of rights. These collected rents can be used for any number of community investments, such as job training, infrastructure, education, etc. The options are truly limitless.

Markets and Nudging

Any intervention to improve the value chain needs to be part of a holistic program to retain economic gains for local communities. If value improvements are piecemeal and not part of a larger effort to prevent free-riding, value improvements will be dissipated. FIPs and fishery certifications can nudge fisheries towards better management by incentivizing stakeholders through improved access to markets. Joint ventures can be used to provide needed capital for market interventions.

It is currently unclear in the literature or the practical experience in the ABNJ fisheries detailed above whether using the value chain to leverage change in the harvest system (push interventions) will have a strong link to changing harvest behavior. This is borne out in other certification programs in other resources. It is important to focus on capturing the “trickle up” of benefits. However, FIPs and certifications can improve enabling conditions that lead to better ICM outcomes and create interventions that can have a positive impact on harvesting behavior.

Graduality

It is important to highlight that systems of regulations and combinations of interventions will emerge serendipitously from following these recommendations. Process is the important part. The process needs to focus on the first best, but that perfection as goal should not prevent the good from emerging. Good governance, after all, is the end of process, not the starting point. This is the essence of graduality and nudging. It has paid to be gradual across implementation time, right strength, and the continuum from access to use rights. This means often following a phased implementation. Proceeding slowly allows for data collection that defines benefits and educates participants, reducing the naivety mentioned in the presentation above. Educating participants reduces transaction costs, which are always a concern in RBM and market systems. Reducing transaction costs and educating participants generally help small-scale fishers the most.

Enabling Conditions

The literature, as well as the practical experience, on switching to ICM is full of the need to improve basic management tools, such as monitoring and enforcement or governance structures. These management tools are generally called “enabling conditions.” While the first best RBM solution has very strict enabling condition requirements, it is very important to point out that all of these enabling conditions are public goods that benefit all of society, and many of these conditions would be necessary to improve struggling command-and-control regimes, as well. As a result, it is important to evaluate the existing governance structures and start from there. It is also important to evaluate the costs of the enabling conditions relative to the costs of providing them.

Monitoring and enforcement are critical components of rights-based regimes. Rights-based regimes will fail to increase values if they are not accountable, as exceeding quotas reduces value for other rights holders. With the rationalization of the fishery, the value of the right will increase, increasing the incentive to cheat. Penalties for violations must be high enough to discourage cheating. Because these rights will be valuable and because they incentivize fishers to be good stewards, the entire community has the incentive to assist in enforcement. Finally, regarding enforcement and monitoring, managers should use cost recovery to enhance monitoring and increase enforcement.

Enforcement and particularly complete enforcement are difficult, if not impossible, to attain. Fishers are the first link in the compliance chain, so if they buy into the community system, enforcement will work. If not, compliance will be weak at best. Sometimes, as important as finding the change leader is finding the anti-change leaders. Often, just one influential person in a community can stop everything.

Lack of formal exclusivity is not a deal killer. High seas are distant and expensive to reach, and may represent a practical barrier versus creating de jure perfectly strong rights. It is important to search for factors that can discipline the scope of free riding. It is not necessary to control all free-riding, just enough of it to be successful. Too much free-riding will collapse incentive-based

interventions, but there is a certain level that is acceptable.

Finally, the one aspect that is particular to RBM is market conditions for rights transfer. Trading in rights is the mechanism for capturing the foregone resource rents, and is therefore an important part of RBM success. It is important to focus on the development of market transparency. It is also important to create institutions that reduce transaction costs because if they are too high, trade will not occur. Finally, it is important to focus on market risk and ways to ameliorate those risks.

Role of NGOs

Finally, NGOs have played an important role in every regional program profiled here. From meeting convener to local organizer to data gatherer, NGOs are uniquely positioned as independent arbiters and influencers in the design and implementation of ICM. They have pursued financing for everything from outreach to improving enabling conditions. They held numerous stakeholder listening and education workshops. They have paid consultants to collect economic data and analyze that data to provide estimates of the costs and benefits of ICM. All in all, they have shown to be great facilitators of the design and implementation process because of their independent position.



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Appendix 1—Rights Based Management

This technical appendix focuses on providing more detail on the first best in RBM and cases from the literature across a wide range of disciplines to examine why the first best may not be attainable or desirable. From the discussion above, however, any movement away from the open-access status quo to further definition of access, management, or resource right can increase benefits if designed correctly. This section delves into the definition of a completely secure right and the conditions that enable the shift in management paradigms. This section is meant to give the reader a sense that RBM has evolved since the 1970s to address many distributional and fairness issues. While this section contains the basics of RBM, it is not an exhaustive summary of all the work that has been published on the design and implementation of RBM. The reader is directed to the literature cited for greater detail on design characteristics.

First Best Resource Rights Defined

Resource right strength has six dimensions: exclusivity, duration, quality of title, transferability, divisibility, and flexibility. A well-defined right should have all of the following characteristics as defined by Scott (1988):

1. Exclusivity: Must be closed with respect to competing claims on the harvestable stock (Sharp 2009) and therefore requires an end to open access
2. Permanence: Ownership must be of a set period of time that can be depended on and defended. Does not mean that the right is infinite, but it has defined bounds.
3. Security: The ability of the rights owner to defend property from claims of other individuals, institutions or the government.
4. Transferability: Owner of right must be able to use and manage right, sell, or dispose of right, and be the recipient of the stream of benefits from the right. This is the key to value generation and the optimal allocation of the resource
5. Divisibility: Owner has the right to dispose of the right as they see fit and can divide and dispose of the ownership in smaller sub units. This quality is often listed as a subset of transferability.
6. Flexibility: “The ability of the rights holder to freely structure their operations.” (Ridgeway and Schmidt 2010, p. 313)

Enabling Conditions and General Design Questions

For any major shift in management regimes, the devil is in the details. In most fisheries, many conditions have to be present or created to enable the shift to more secure rights. Many of these enabling conditions are missing or needed for any regime that moves towards better, more sustainable management. For instance, many ABNJ fisheries lack adequate HCRs. HCRs are essential to managing within any sustainability target with or without RBM. However, HCRs are a necessary condition for defining a resource use right, such as an individual or community quota. Creating these enabling conditions is a large part of designing RBM systems, but to be clear, any management improvement would likely require many of the same enabling conditions.

The following paragraphs address the gaps often found in these enabling conditions, particularly in ABNJ fisheries, and highlight design ideas to increase the likelihood of success of these programs.

Ridgeway and Schmidt (2010) have an excellent chapter that details various global RBM programs and maps the strength of these RBM examples using these six dimensions. They can also be organized at various levels of interaction from individual rights to collective rights such as co-management, community management, corporations, or cooperatives. While the rankings of various RBM systems will not be detailed here, the point of the Ridgeway and Schmidt (2010) chapter is that benefits of RBM can be derived from relatively weak rights held individually or cooperatively.

From the difficulty obtaining agreement across multiple sovereign nations to criticisms of rights-based management itself to questions of international law, there is a whole host of challenges facing the institution of rights-based management in tuna fisheries. It is evident that a starting point, such as allocation to members or limited entry/controlled access, could reduce some of these challenges. While Allen et al. (2010) state the “time has passed for unlimited entry into tuna fisheries,” limiting entry may be one of the toughest hurdles facing the institution of rights-based management in international tuna fisheries. Limited entry is usually a good first step for the institution of rights-based regimes, and yet international laws require that new entrants be allowed until the stock is fully exploited.

Barrett (2003), while not addressing rights-based regimes specifically, outlined a series of conditions that must exist for international environmental management treaties to be self-enforcing. In his list, participants in the treaty enjoy an aggregate increase in benefits or the treaty will fail. Gains from the treaty must be distributed to participants equitably and transparently. The

treaty must include penalties for violators and the ability to enforce those penalties. While Barrett (2003) lists the elimination of free riding as another prerequisite, the enforcement of the treaty and the prevention of cheating is the elimination of what Munro calls explicit free-riding, while new entrants and allowing nations to avoid sacrifices but enjoy the benefits legally is deemed implicit free-riding. Finally, these sorts of treaties must provide strong and clear incentives to comply with treaty terms.

Munro (2007) explores both the law and the difficulty of instituting transnational catch shares from a game theory perspective. While the creation of EEZs was a huge step forward in the assignment of property rights on the seas, assigning rights to straddling stocks may require another huge step forward. Munro begins his examination of the viability of rights-based regimes for straddling stocks by examining simpler bargaining games for transboundary stocks. Transboundary stocks involve a relatively small number of players and the prisoner’s dilemma dominates the results. For an agreement to succeed, players must foresee surplus from cooperation and side payments enhance the ability to obtain this surplus. These side payments could be in the form of quota trades and they act to broaden the scope of bargaining.

Pintassilgo and Lindroos (2008) also agree with Munro (2007) that agreement gets harder to reach the larger the number of players. As long as free-riding is possible, it will be difficult for a rights-based regime to be completely successful. However, a certain amount of free-riding is acceptable and some landscapes, such as in ABNJ, may present natural barriers to excessive free-riding. There are also market-based incentives that can assist in controlling free-riding, if used in concert with RBM. In the case of all RFMOs, it is essential to success that the legal regime prevents non-cooperators from accessing the resource. To this end, Munro recommends ending the “freedom of the seas hangover” by

establishing property rights in the EPO vested to charter members. New members therefore have to purchase, or be granted, shares from charter members. In Munro's opinion this action would be allowed if a stock is fully utilized, as stated in the draft UNFSAs that were never ratified.

Allen et al. (2008) echo this sentiment, saying that rights-based regimes will be slow to take root, as it requires cooperation between different sovereign nations. It is important to understand that the States themselves are groups of coalitions. There are commercial versus artisanal coalitions. PS fisheries require canneries, which coastal States like because they provide jobs, but they also compete with artisanal fisheries (Allen et al. 2010a). These coalitions will create within-State competition, and agency capture may result in State policies that are contrary to national benefits and participation in a larger rights-based institution. Labor groups, input providers, processors, and the government themselves through selling access all have a stake in the local political process and the potential for state level capture. Finally, transnational corporations and joint ventures blur the State sovereignty lines.

Asymmetric benefits are a problem, as well (Allen et al. 2010a). Even if aggregate benefits are positive or projected to be positive, if one State faces negative benefits, it will stop institutional change. Side payments can work, but they are a challenge. The design must consider the size, timing, and form of payments, as well as the payer and the payee. Given the contentious nature of RFMOs, there is no guarantee that side payments will work. Side payments must be designed carefully to avoid unintended consequences. Under many programs discussed above, over-allocation of the capped resource or input in the case of effort or capacity was the side payment, defeating the purpose of the measure.

Rights-based regimes also increase transaction costs. Transaction costs increase with the heterogeneity of participants and with skewed

distributions of potential gains (Libecap 1989, Baland and Platteau 1996, and Barrett 2003). The world's tuna fisheries are very heterogeneous and transactions costs are expected to be high. The rule of law and private property also increase transaction costs. Enforcement costs will also increase. Some nations and fishermen also have very little experience with markets, also increasing transaction costs.

Kim et al. (2009) developed nine critical rights-based management design criteria for the first best. First, the definition and measurement scale of the asset unit must be defined carefully. Dale (1968) states that the asset unit should be the smallest unit practicable. Kim et al. (2009) list three important criteria for the definition of the asset unit: control over biological impact, scope of monitoring, and transactions cost. Control over the biological impact is an important point because choice of the asset unit may have implications for discard mortality.

The second criterion is a spatial/temporal one. Should the right be available at any time and any place or should there be restrictions? Spatially, issues of localized depletion are good reasons to control the geographic extent of the right. Closely tied to localized depletion is congestion, which reduces benefits. Additionally, there will be equity concerns if all the right ends up in one particular region. Also, enforcement is often conducted by state personnel, if there is any on-water enforcement at all. Regarding the temporal definition of the asset unit, if the asset expires annually, it can be counter-productive as it might induce a year-end wave of mortality. Additionally, some fishers would prefer to wait than fish during the open season, and therefore temporal limits would reduce value.

Monitoring and enforcement are critical components of rights-based regimes. Rights-based regimes will fail to increase values if they are not accountable, as exceeding quotas impacts the value of all other rights. Kim et al. (2009)

suggest tying the fines for violation to the price of the right so that the penalty is high enough. Because these rights will be valuable and because they incentivize fishers to be good stewards, the entire community has the incentive to assist in enforcement. Finally, regarding enforcement and monitoring, managers should use cost recovery to enhance monitoring and increase enforcement.

The initial allocation of the right is very important. In commercial fisheries, the most common allocation scheme is one based on historic use. This is essentially a free handout of a public resource and part of the reason the current U.S. recreational community and many small-scale fisher organizations are so against rights-based management (Bromley 2009). Grainger and Costello (2016) show that grandfathering rights are an important side payment to highliners to cover the inframarginal rents they will lose moving to a rationalized fishery. Grandfathering as an allocation strategy is an impossible technique to use when fishers have no official history, no logbooks, and no official landing record at the seafood dealer—which may also be the case for small-scale and artisanal fishers around the globe. There may be fairness, equity, or livelihood concerns that can be addressed by allocating these valuable assets to the most vulnerable sector(s). In order to protect development aspirations, allocations can use measures based on the history of biomass occurring in the EEZs, as well.

Allocation methods not based on history include no-cost lotteries, auctions, and federal or state sale. No-cost lotteries are considered to be the most equitable because income does not influence the ability to obtain the right. Auctions are by far the most efficient mechanism, but are often criticized on equity and fairness grounds because money controls the process. To alleviate these concerns, a portion of the allocation could be held back for low-income citizens. Or in the case of the artisanal or small-scale sector, a portion of the quota, or a majority of it, could be

assigned to the small-scale sector to enhance their incomes. Again, with these questions, the actual design can be a blend of techniques. As shown in the regional examples above, there are many goals that can be met through the right allocation process and allocations can be a blend of historical catch, spatial measures, or other criteria used to address fairness, equity, and livelihood concerns.

The final design question is whether these rights are fully integrated and freely tradable. Without some sort of trade, allocations of quota between sectors can only be shifted through a paralyzed political process that is subject to capture by special interests (Wilén 2006). While trade will produce the most efficient allocations without political intervention, there are potential downsides. If the purchasing sector is geographically concentrated, regional depletion could occur. Free trade also raises the risk of market concentration. There are also potential secondary impacts. If the DWFS bought the entire quota, it could impact the incomes of artisanal fishermen. If it were determined that the artisanal sector needed to be protected, sales could be banned with quota only available for lease. The point is, there are many ways to structure the instrument to protect equity. There are precedents in commercial rights-based programs for restrictions on trade for equity and other concerns.

RBM Implementation Challenges and Criticisms

This section develops a list of considerations that need to be made in designing a right-based regime, but does not give prescriptive advice or solutions as those solutions will be predicated on the situations found on the ground in the region where the ICM interventions are being considered. It bears pointing out that every regime change faces many of the same

challenges, particularly those that restrict harvests or increase costs. This highlights the need for examining all the benefits and all the costs of these changes transparently and in advance of the design process so that challenges can be addressed through design.

This section also discusses the criticisms of RBM; that is, why it is not the panacea that it is often billed to be. Often, the biggest design problem arises from allocating the TAC. Often, current quotas are too high to begin with resulting in initial allocations that require sacrifice. Allocation issues are very contentious within RFMOs. The next allocation hurdle will be the allocation of TAC to a region or an individual State depending on the situation. Those allocations should be a proportion, in percentage terms of the total regional harvest or effort level. There are many other challenges beyond the allocation issue. One of those challenges is that institutional change can have negative consequences, but those must be balanced against the need to address the open access problem (Coulthard 2011). The remainder of this section will discuss these larger criticisms of rights-based systems.

Conflict is expected in allocation negotiations across member States. Additionally, the have/have not argument from above will factor strongly. Not all members have local tuna industries, but the EEZs of some members could be responsible for high tuna production. There will be winners and losers in a rights-based regime, and some arrangement for compensation must be accounted for in the design if the proposal is to be successful (Munro 2007). To ascertain potential side payments, it would require a completely independent evaluation of current profits generated by each member. At the very least, the forgone profit would be a good starting point for negotiating side payments. This is strictly referring to the initial allocations. If trade were allowed between sovereign nations, the marketplace would sort out these allocations at the social optimal level.

To this point, it is very important to start with an accounting of the benefits and the costs of any intervention, but particularly one that requires such sweeping institutional change and potentially high implementation costs. Foregone rents that will come back to the fishery must be high enough to compensate the fishers for their current highliner rents (Grainger and Costello 2016), pay for increased MCS, and generate funds for other potential side payments. The public/private distribution of costs and benefits is very important to examine. Generally, MCS and the costs for other enabling conditions are a public cost and those costs need to be balanced with the private gain. Some stakeholder groups also oppose any conversion of public resource wealth to private. Unless the RBM system includes all management costs and management authority, cost-effective and sustainable fisheries management is still a public good. Enforcement, IUU controls, general fishery management, and governance are all public goods. To that end, these interventions need to be transparent and be protected from corruption. For instance, if there is a dysfunctional or corrupt State government, it is likely that a State-based RBM system will not be viable; so the public's good governance still matters.

There is always an implicit or explicit public/private partnership in any RBM design. The reason for the intervention in question is generally that the public good, or bundle of public goods, is not well managed including dysfunctional bureaucracies, corruption, inefficiency and management bodies that are unaccountable. These public goods have to be accounted for in the estimation of benefits and costs and the transfer of public wealth to the private sector.

Ridgeway and Schmidt (2010) list several prerequisites that are general enough to enumerate here. Stakeholders must buy into the change, and that often involves either a massive fishery crisis or finding an industry champion. They also recommend moving forward gradually. Begin with an attenuated collective right and

move incrementally towards a strong individual right, if necessary. There is no one-size-fits-all solution (Costello et al. 2010). Every fishery will require a tailored approach to its own conditions. Until the individual cooperators are selected, going any further would be foolish. It is important to keep in mind that transferability of rights tends to aggregate and consolidate the industry, and can redistribute income across different fishery sectors.

RBM has been criticized for distributional concerns (Cope 1997 and Degnbol et al. 2006). Both McCay et al. (1996) and Pálsson and Helgason (1995) criticize rights-based management for the consolidation that occurs after their institution. This consolidation could be viewed negatively by countries that are using fisheries to develop and sustain coastal economies. Copes (1997) criticizes rights-based regimes for creating inequities due to the economic windfalls obtained by current fishery participants. Some of those windfall profits go to the highliners in the fishery, which can be a useful side payment; however, allocating the right for free to the first generation also disadvantages future generations (Grainger and Costello 2016). McCay (1995) has also bemoaned the loss of social capital and traditional ways of life resulting from the consolidation of fishing capacity. However, it must be noted that consolidation of rights may not be the only factor in loss of social capital and traditional ways of life. Coastal development, low profit margins, globalization of fishery value chains, local social change, and a movement to more skilled jobs also all play a role in changing the distribution of coastal wealth in developing economies, completely unrelated to fishery management.

Countering some of these issues, Abbott et al. (2010) examine wage impacts post-rationalization in the Bering Sea/Aleutian Island crab fishery. They find that the number of crew employed falls proportional to the vessels exiting the fishery. This supports the findings (McCay et al. 1996 and

Pálsson and Helgason 1995). It is a little spurious, though, to complain about falling employment when one of the goals of rationalization is to reduce fleet capacity. However, total crew hours dedicated to fishing remained the same. Pre- and post-season shoreside employment fell because consolidation of quota on to fewer vessels requires less shoreside work. Post-rationalization, the share contract remained unchanged. Seasonal and daily pay went up substantially for many. Pay-per-unit landings fell due to increased productivity and the need to pay for quota, which comes out of the pre-crew share in this fishery.

Cunningham et al. (2009) focus on wealth creation, not just rationalization. This expands the scope to include community and co-management that may not include strong individual rights. They describe a design process that includes developing indicators of wealth, designing new institutions, and reforming governance frameworks. Anderson et al. (2015) develop a set of wealth and performance indicators, FPI, to examine wealth and track progress. FPI, as currently designed, uses expert assessment across a series of indicators paired with a series of metrics. The system uses 68 community “output” metrics and 54 “input” metrics to develop an overall performance score. The output metrics include ecological, economic, and community dimensions, while the input metrics include macroeconomic factors, property rights and responsibility, co-management, management, and post-harvest dimensions. These scores can be used to evaluate within-country performance over time or across-country performance (Anderson et al. 2015). Some sort of rapid, baseline tool should be used to examine enabling conditions and current performance.

Governance reform is an important point (Cunningham et al. 2009). The design process should focus on legal regimes, fiscal measures, organizational arrangements, management mechanisms, and other fishery management infrastructure (Cunningham et al. 2009). For

instance, a country with strong fishery fiscal infrastructure, strong associations of fishermen, and an existing fishery information system would be far preferable to one that did not have those characteristics. If keeping wealth local is a goal of a management intervention using RBM, it will be important to examine fiscal characteristics associated with increased wealth investment and focus on distributional issues, particularly in developing States. (Cunningham et al 2009).

Following a wealth-based reform strategy combines both the rights-based approach, coupled with a pro-poor growth strategy—two directions that often do not naturally come together. Under this, strong individual rights should be tempered by equity in wealth distribution focusing on poverty reduction and growing the regional economies at large (Cunningham et al. 2009). Increasing wealth overall tends to improve the infrastructure that alleviates poverty. Defining the fishery management units is also important. It is insufficient to simply identify industrial/small scale/recreational sectors. The intervention must drill down to communities, professional organizations, or cooperatives. Design should focus beyond traditional RBM and examine corporate or communal organizational structures to keep transaction costs manageable (Cunningham et al. 2009). Rights-based regimes increase transaction costs. Transaction costs increase with the heterogeneity of participants and with skewed distributions of potential gains (Libecap 1989, Baland and Platteau 1996 and Barrett 2003). The rule of law and private property also increase transaction costs. Enforcement costs will also increase.

Costello and Deacon (2007) find that even with rights-based regimes, competition and strategic behavior may reduce rents. They found that if there is spatial heterogeneity in harvest and areas have exogenously determined time-dependent harvest rates, fishers will compete for these areas reducing rents. FAD fisheries are exactly this

sort of fishery, and the use of FADs is on the rise globally. This result suggests that in addition to fish-based catch shares, property rights may need to be granted to FADs to maximize rents from this fishery. Fell (2009) adds that this competition may disadvantage processors.

Reforming small-scale fishers (SSF) can be difficult. They are often unregulated, particularly when they are fishing for food security. SSFs must be integrated into the design in a way that makes sense and should not be “protected.” Cunningham et al. (2009) define protection as keeping SSFs out of the rights-based system and that means they do not benefit from the changes and rationalization that markets and rights can create. The design must be holistic as small boats can cause as much damage as trawlers. If SSFs are not included, they will free-ride on the increasing CPUEs.

Coastal States will want to retain rights, which may impact full transferability (Allen et al. 2010). Transferability is very important to the success of rights-based regimes, but it must be addressed carefully due to equity issues. Coastal States will have conflicts with DWFS. Coastal States with financial ties to DWFS will prefer a strong DWFS fleet. Rights-based management will pit a country's development goals with participation in the rights-based regime. These problems can all be addressed, but generally at the cost of economic efficiency.

Costello et al. (2010) addresses many of the complaints about RBM and offers solutions that can be undertaken during the design phase to manage those issues. Even a well-designed ITQ may not internalize all externalities. For conservation gains, right tenure needs to be sufficiently long and ITQs should sunset if they are not meeting their conservation goals.

Excludability is a very important characteristic of the success of rights-based regimes. Enforcement plays an important role in ensuring excludability

by curbing cheating and free-riding. Adequate enforcement will require a list of allowed vessels, limited entry, catch and trade documentation, and vessel monitoring systems. It will also require members and non-members that accept transshipped product to refuse to accept imports or transshipments without proper documentation. It will also take aggressive use of WTO-compliant trade measures, such as the denial of port privileges prohibition of imports for violators. Finally, coastal States will need advance radar technology and fast patrol boats to enforce regulations.

Whatever the design of the rights-based regime, balancing quotas will be an important part of that design (Allen et al. 2008). The design will need to outline how to handle overages. If trading is allowed, the quota registry will have to be centrally controlled. Registers themselves are a controversial subject in some RFMOs.

Ostrom (2000) calls for a better understanding of underlying social norms and existing power arrangements. “Self organized regimes rely more on what Margaret Levi calls ‘quasi-voluntary’ cooperation than either strictly enforced or coerced cooperation.” Institutional change creates winners and losers. When changing institutions, focus design on creating the least losers because losers will not want to give up their current rights for conservation. Thus, power structures matter. Strong and lasting institutions are based on incremental change over large time-scales. Those changes are typically based on collective action if they are to be sustainable. Adaptive management and co-management go hand in hand. Ratner et al. (2014) talks about focusing on not just property rights but human rights as well, and while Ostrom (2000) did not use that terminology, her work supports this focus.

Community Management and RBM

While community management is often a response to the fairness and equity issues inherent in moving towards RBM, it is not free of issues that need to be addressed, or at the very least, kept in mind. Makino (2010) identifies some issues with cooperative management in Japan. Management autonomy leads to inflexibility and reclusiveness. This makes them not willing to take top-down science advice at times, and also retards technical progress. Vested interests tend to be over-protected, or to put it another way, capture the management process. Because of their culture and cooperative structure, egalitarian pressures may prevent value maximization. Additionally, management can become very complex with so much local specificity, which makes coordination across cooperatives and fishery management organizations difficult. Another issue that can arise, particularly for developing States, is that the fishers are not savvy enough to participate effectively in the management process (Wiber et al. 2004). The large degree of autonomy across a large number of management groups can also make ecosystem-based fishery management—or any system more complicated than single-species management—difficult.

Ratner et al. (2014) state that small-scale fisheries function sometimes as cash income for the poor, seasonal food security in areas with rain-watered agricultures, and temporary work for landless poor. These are all societal welfare functions that must be considered. Straight, Western style right-based systems can exacerbate inequality and foster human rights problems (Ratner et al. 2014). Fishing is one income in a livelihood portfolio, and it should be treated as such.

Jentoft et al. (2010) describe four principles of community management design including defining the community, setting the scale of the

community, defining representation within the community, and defining the right in question. Communities can be defined using territories, geography, or functional notion. These notional communities can be defined by professional organizations, cooperatives, species targets, gear type, or quota holders in the case of ITQs. It is very important that a designer not ignore the communities inherent in the fishery in favor of designing around another sort of community. Traditional communities tend to be informal and complex, often including more than just fishing. However, the homogeneity of these sorts of communities and kinship bonds in these communities engender equality and stability, which drive lower transactions cost and increase commitment and continuity (Ostrom 1990).

Scale is a very important part of defining a community management system. Some types of fisheries, such as far-ranging mobile species, may have participants that are far too disbursed for co-management to work (Jentoft et al. 2010). The type of fishery also matters, as devolution can cause boundary disputes and aggregation issues. Designers must be cognizant of the costs associated with the burden of both vertical and horizontal coordination and conflict management, which may be significantly higher than under centralized management. The key with scale is to be flexible and take each management function to the lowest level possible. For instance, it often makes sense for the central government to set TACs, but allow the community to manage the spatial, temporal, and technical dimensions of harvesting that TAC. Centralized management regimes are often fraught with legitimacy issues. Co-management can address legitimacy issues unless power in the community is granted to a group that does not have the community trust.

Berkes (2006) discusses the impacts of scale with direct application to highly migratory species. Communities are complex systems that are embedded politically and economically in larger, more complex systems. These larger systems

respond to markets, regional governments, and international agreements. These higher levels of organization should be used for monitoring, assessment, enforcement and fostering and supporting co-management (Berkes 2006). Scale issues include failure to recognize scale, mismatch between environmental scale and human scale, and failure to recognize that different user groups or constituents view scale differently. Because this project faces a wide ranging stock, many industrialized and small-scale fishermen, and the recreational sector, scale will be a very important concern for this project. Berkes (2006) lists scale complexities to include complex communities, external change drivers and mismatch between resource and institutional drivers. This project will face these complexities. Berkes presents a case study involving Atlantic HMS because Atlantic HMS are used by local and industrial fishers, and exclusion and subtractability are difficult due to scale. Berkes (2006) concludes that regional TACs are necessary among other things. RFMOs are constrained by weak bottom-up linkages and are dominated by “big science” and powerful developed nations (Berkes 2006). Defining issues at the highest ecological level tends to hurt SIDS. SIDS see RFMOs as insensitive to their needs and unresponsive to their issues (Berkes 2006). This result advocates for a bottom-up system that allows SIDS to have the flexibility and power to address sustainability issues.

Solutions to the subtractability problem, or what economists call “excludability,” require monitoring authority, sanctioning authority, and establishing the authority to resolve conflicts. RFMOs represent a classical asymmetric relationship: science and regulation filter down, with no bottom-up feedback, and the mismatch is driven by scale issues (Berkes 2006). Often with RFMOs, disputes revolve around equity and fairness concerns. Addressing these issues will involve understanding the dynamics of horizontal and vertical linkages in the region and dealing with the existing policy networks. Addressing scale in a

region may involve a two-step process, with rule formulators operating at the RFMO or sub-region level, and organizing and operationalizing co-management at the level of those subject to those rules (Berkes 2006).

Often, and as is the case here, co-management is motivated by conflict over allocation. In this case it is the conflict over the allocation of billfish stocks. Also in this case, the conflict occurs at scales greater than the single-island scale, which requires some level of central control to address. The loss of value to local communities stemming from the over-harvest of billfish by DWFNs—and by artisanal fishers in the case of some of the rapidly expanding FAD fisheries—may provide the catalyst to move towards co-management.

Appendix 2—Summary of ISSF Capacity Transfer Workshop

ISSF held another capacity-transfer workshop in 2014 that focused on meeting the aspirations of developing coastal States in the context of global over-capacity of tuna fleets (ISSF 2014). The workshop covered nine themes. ISSF held another capacity-transfer workshop in 2014 that focused on meeting the aspirations of developing coastal States in the context of global over-capacity of tuna fleets (ISSF 2014). The workshop covered nine themes: 1) Trading rules should be consistent with RFMO goals; 2) Transfers should not increase global capacity; 3) Reducing over-capacity should be the overarching goal of the trade program; 4) Trades should be voluntary and governed by an open and transparent market; 5) Correctly assigning rights is critical to capacity-transfer success; 6) Trades need to fulfill all treaty obligations; 7) Transfers need to be transparent; 8) To ensure that global capacity does not increase, there needs to be a global vessel registry; 9) Registry needs to be coupled with real, global capacity measures.

The workshop also established a list of conditions necessary for capacity markets (ISSF 2014):

1. An enabling political and economic environment
2. Secure legal framework for investment
3. Cultural/social ties and networks
4. Economic conditions/infrastructure/inputs
5. Availability of fish
6. Market accessibility
7. Trade agreements and partnerships
8. Entrepreneurship
9. Willingness to invest and take risks
10. Availability of financing
11. Voluntary and market-based transfers

In addition, the workshop derived a list of objectives for capacity transfer (ISSF 2014):

1. Fulfilling aspirations
2. Increasing economic growth and employment
3. Building human capacity
4. Meeting property right obligations
5. Exercising sovereign rights
6. Ensuring food security

ISSF indicated the importance of considering the risks of capacity transfers. Transfers must take into account the shore-based processing capital and take care not to strand that capital. Also, government revenues could be impacted by these trades. It is important to analyze the social and political implications of trades to avoid downsides.

There are many constraints to market formation. Lack of secure rights rises to the top of this list. Lack of strong transparent rules prevents markets from forming. Naïve participants, or participants without a history of participating in markets, can hamper market development. Lack of capital or financing keeps transactions from occurring (ISSF 2014). Lack of enabling conditions—such as sustainable management, equitable rules, long-term right security, secure and stable legal environment, secure market access, secure fishing access, conducive investment climates, and national development plans that include the sector—are important to remedy. Overall, the workshop advocated the principle of graduality, or moving slowly through the market creation process (ISSF 2014).

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This report explores the interplay between incentive compatible management (ICM) at the local and regional scales for highly migratory fisheries with a high seas component. The basic philosophy of ICM is successful management outcomes can be realized through addressing the symptoms of bad behavior rather than the behavior itself. The report begins by developing a framework for ICM and discussing the application of these tools in a broad sense. It is very important to understand who to incentivize when designing incentive compatible interventions. Is it States, regional management bodies, consumers or fishers? Defining the incentives into two broad groups, push or pull is also important in understanding impacts. Push incentives originate on the consumer side of the seafood equation (e.g., consumer labels or certifications, retailer demand for a certain level of certification) and encourages purchases of sustainable seafood in hopes that increased demand and enhanced prices for these types of products encourage high production of sustainable products using sustainable practices. The push side incentives concern the production side of the seafood supply chain and include, but are not limited to, technology investment (bycatch reduction devices for instance), bycatch taxes, Coasian bargaining and secure tenure rights. Push incentives act by directly impacting the production function of the harvesting firm or the value generated for States leasing access rights. The report analyzes the incentive compatible activities in planning or underway across the globe with a focus on pre-implementation, implementation, design and performance. It covers a wide range of programs in the convention areas of the five tuna regional management bodies and develops recommendations to inform the future movement toward the use of ICM in transboundary fisheries to enhance triple bottom line outcomes.

