



**Food and Agriculture
Organization of the
United Nations**

WESTERN CENTRAL
ATLANTIC FISHERY
COMMISSION

SLC/FIAP/C1126 (En)

**FAO
Fisheries and
Aquaculture Circular**

ISSN 2070-6065

THE USE AND DESIGN OF RIGHTS AND TENURE BASED MANAGEMENT SYSTEMS FOR TRANSBOUNDARY STOCKS IN THE CARIBBEAN



THE USE AND DESIGN OF RIGHTS AND TENURE BASED MANAGEMENT SYSTEMS FOR TRANSBOUNDARY STOCKS IN THE CARIBBEAN

by

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Bridgetown, Barbados, 2016

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ISBN 978-92-5-109393-1

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PREPARATION OF THIS DOCUMENT

This document is part of a series of desk and field studies carried out under “Component 1. Generating value and conservation outcomes through innovative mechanisms” of the Caribbean Billfish Project GCP/ SLC/ 001/ WBK of the Ocean Partnership Program belonging to the Areas Beyond National Jurisdictions (ABNJ) program. The project is funded by the Global Environmental Facility (GEF) and The World Bank and executed by the Western Central Atlantic Fisheries Commission (WECAFC) of the Food and Agriculture Organization of the United Nations (FAO) based at the FAO Sub Regional Office in Bridgetown, Barbados.

The study was carried out under a contract with the International Game Fish Association (IGFA) through a Letter of Agreement with FAO. Support and guidance were provided by Mr. Raymon van Anrooy, Secretary of the Western Central Atlantic Fishery Commission (WECAFC) and Mr. Manuel Perez Moreno, Regional Project Coordinator, during the elaboration of the report.

The preliminary findings of the study were presented at the 2nd Regional Workshop on Caribbean Billfish Management and Conservation of the WECAFC Recreational Fisheries Working Group held in November, 2015 in Panama City, Panama. In addition, the document was also reviewed by the members of the Consortium on Billfish Management and Conservation (CBMC) established in the Caribbean Billfish project. The technical edition was in charge of Ms. Magda Morales.

FAO. 2016.

The Use and Design of Rights and Tenure Based Management Systems for Transboundary Stocks in the Caribbean, by Brad Gentner. FAO Fisheries and Aquaculture Circular No. 1126. Barbados, Bridgetown.

ABSTRACT

This document provides the findings and recommendations from a desk study carried out in support of the Caribbean Billfish Project. It includes an analysis of the motivating factors for rights based approaches in order to address the common pool fishery problems which dissipate rents. Human action depends on the fisheries management approaches followed. The study recognizes that it is a challenge to apply rights based approaches in the developing world. The author states that the answer is to secure rights to the fishery to end the race to fish and to put proper incentives in place to increase wealth and sustainability. The document also describes the characteristics of strong rights and several rights based approaches in commercial and recreational fisheries for billfish..

Fishery management can be characterized by top-down management controls. These controls are politicized during their creation with user groups lobbying for their own interests. As a result regulations are typically less stringent than they should be from a conservation perspective. Additionally, top down controls induce a race to fish. That is, fishermen act in their own best interest to catch as much of a limited stock as possible while competing against their fellow fishermen. This induces all sorts of strategic behavior that runs contrary to the best intended top down controls. Management goals can be met easier at a lower cost and generate higher value for the resource owners when fisher incentives are taken into account.

Regulators can attempt to control mortality through top down command and control regulations or through actions that take fisher incentives into account. Regulations that take incentives into account are called incentive compatible regulations and are designed to maximize economic value by inducing fishers to truthfully reveal their preferences elicited by the policy device. Incentive compatible tools include right or tenure based regimes, taxes or royalties or community based management. Regulations that do not take into account incentives are destined to fail and the bycatch of billfish in the Caribbean is an example of this type of failure as billfish resources are overexploited in the industrial and small scale fisheries and value is being lost in the recreational fishery. Current, top down management policies block the natural behavior and preferences of commercial harvesters, small scale fishers and recreational anglers such that their normal behavior subverts the goal of the mechanism.

CONTENTS

Preparation of this document	iii
Abstract	iv
Abbreviations and acronyms	vi
Executive summary.....	viii
Motivating factors for tenure based approaches.....	viii
Discussion of tenure based approaches	viii
Key findings and recommendations	ix
Introduction.....	1
Motivating factors for tenure based approaches	3
Common pool fishery problem.....	3
Why tenure based management is needed for billfish	4
Discussion of tenure and rights based approaches	8
Management rights	9
Resource based rights	12
Transboundary stocks and legal issues with RBM	30
RBM design/implementation challenges	47
Recommendations.....	52
Catch based rights.....	56
TURF type rights.....	58
Weak incentives to reduce billfish harvest.....	61
Infrastructure needs.....	62
References	63
Appendices	70
Appendix 1 Research in support of core area management.....	70
Appendix 2 Tag Programs Used in Fisheries	72
Appendix 3 Management Features of Harvest Tags vs. Current Management in the Gulf of Mexico Recreational Fisheries.....	73

ABBREVIATIONS AND ACRONYMS

ABNJ	Areas Beyond National Jurisdiction
AIDCP	Agreement on the International Dolphin Conservation Program
AK	Alaska
AMO	Angling Management Organization
BC	British Columbia
CARIFICO	Caribbean Fisheries Co-Management Project
CCA	Coastal Conservation Association
CCAMLR	Convention for the Conservation of Antarctic Marine Living Resources
CCSBT	Commission for the Conservation of Southern Bluefin Tuna
CMM	Conservation and Management Measure
CPC	Contracting Party
CPUE	Catch-Per-Unit-Effort
CRFM	Caribbean Regional Fisheries Mechanism
DML	Daily Mortality Limit
DWFN	Distant Water Fishing Nation
EBFM	Ecosystem Based Fishery Management
EEZ	Exclusive Economic Zone
EU	European Union
FAD	Fish Aggregating Device
FAO	Food and Agriculture Organization
FFA	Forum Fisheries Agency
FPI	Fishery Performance Indicators
GEF	Global Environmental Facility
GMFMC	Gulf of Mexico Fishery Management Council
GOM	Gulf of Mexico
GPS	Global Positioning System
HMS	Highly Migratory Species
IATTC	Inter-American Tropical Tuna Commission
ICCAT	International Commission for Conservation of Atlantic Tunas
IFQ	Individual Fishery Quota
IOTC	Indian Ocean Tuna Commission
ITQ	Individual Transferable Quota
IUU	Illegal, Unreported or Unregulated
JICA	Japan International Cooperation Agency
LL	Long Line
MAGDELESEA	Moored Fish Aggregating Device in the Lesser Antilles
MCS	Monitoring, Control and Surveillance
MRFSS	Marine Recreational Fisheries Statistical Survey
NAFO	Northwest Atlantic Fisheries Organization
NEAFC	North East Atlantic Fisheries Commission
NMFS	National Marine Fisheries Service
NPFMC	North Pacific Fishery Management Council
PNA	Parties to the Nauru Agreement
PS	Purse Seine
RBM	Rights Based Management
RBFM	Rights Based Fishery Management

RFMO	Regional Fishery Management Organization
SIDS	Small Island Developing State
SSF	Small Scale Fisher
TAC	Total Allowable Catch
TAE	Total Allowable Effort
TURF	Territorial Use Right
UN	United Nations
UNFSA	UN Fish Stocks Agreement
UNCLOS	UN Convention on the Laws of the Sea
US	United States
VDS	Vessel Day Scheme
WBFM	Wealth Based Fishery Management
WECAFC	Western Central Atlantic Fishery Commission
WCPFC	Commission for the Conservation and management of Highly Migratory Fish Stocks in the Western and Central Pacific

EXECUTIVE SUMMARY

Motivating Factors for Tenure Based Approaches

Fishery management can be characterized by top-down management controls. These controls are politicized during their creation with user groups lobbying for their own interests. As a result regulations are typically less stringent than they should be from a conservation perspective. Additionally, top down controls induce a race to fish. That is, fishermen act in their own best interest to catch as much of a limited stock as possible while competing against their fellow fishermen. This induces all sorts of strategic behavior that runs contrary to the best intended top down controls. Management goals can be met easier at a lower cost and generate higher value for the resource owners when fisher incentives are taken into account.

Regulators can attempt to control mortality through top down command and control regulations or through actions that take fisher incentives into account. Regulations that take incentives into account are called incentive compatible regulations and are designed to maximize economic value by inducing fishers to truthfully reveal their preferences elicited by the policy device. Incentive compatible tools include right or tenure based regimes, taxes or royalties or community based management. Regulations that do not take into account incentives are destined to fail and the bycatch of billfish in the Caribbean is an example of this type of failure as billfish resources are overexploited in the industrial and small scale fisheries and value is being lost in the recreational fishery. Current, top down management policies block the natural behavior and preferences of commercial harvesters, small scale fishers and recreational anglers such that their normal behavior subverts the goal of the mechanism.

Discussion of Tenure Based Approaches

RBM can be separated into two broad categories; management rights and resource rights (Schlager and Ostrom 1992; Ostrom 2008). Management rights exist on a continuum from top down, government control to bottom up local control. Resource rights exist on a continuum from open access and no assignment of rights to strong, individual rights. They are both 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.

While the term RBM is used here interchangeably with tenure based rights, FAO has switched from referring to rights to using tenure. Tenure is a concept that incorporates both management rights and resource rights and respects traditional ways in place for small scale fisheries. Tenure has been defined by FAO (2011) as "...the relationship among people with respect to land and other natural resources. The rules of tenure determine which resources can be used by whom, how long for and under which conditions." This concept takes into account basic human rights needs of small scale fishers and perhaps presents a softer side to RBM than the how RBM has been used by industrialized nations in their industrial fisheries to date. While this document discusses management rights and resource rights as separate discreet concepts, this is solely done for ease of presentation. Looking at the entire spectrum of tenure, instead of focusing solely on resource rights, as much of the economics literature does and as most of the industrialized RBM experience has, will actually improve outcomes and avoid some of the social pitfalls that can occur focusing solely on resource rights.

Resource rights base regimes run the gamut from weak, attenuated rights to strong rights. 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 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)

Looking at these six dimensions of rights, it will be very difficult, if not impossible, to achieve all of those characteristics when the playing field includes recreational anglers, small scale fishers and transboundary stocks. However, even attenuated rights can offer two major benefits. First, even attenuated rights could grant sectors far more flexibility in how they fish and the quality of fishing. Second, even with only partial integration between commercial and recreational sectors, rights can remove allocation decisions from the political process, increasing efficiency. Both will increase benefits for nations in the region. If the sectors are fully integrated, the market will take care of allocation between commercial and recreational anglers.

It is important to frame rights based management as a continuum from a strong individual right to an attenuated right assigned to a cooperative or collective. 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. The only 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 and it has been a success.

Instead of attempting to recommend a rigid direction trying to address these six dimensions, this document develops a series of questions that have to be answered when developing these new regimes. The answers to these questions inform the creation of the right to best suit the goals and objectives of the stakeholders and of the project while avoiding negative social consequences.

Key Findings and Recommendations

The following summarizes the findings from this study regarding the design and implementation of tenure based management strategies to conserve billfish stocks and improve livelihoods in the Caribbean.

1. Process must be participatory and start from the bottom upwards.
2. Process must be representative, transparent and based on consistent expectations.
3. Find an industry champion as buy-in is critical for success.
4. Collect economic and fisheries data to inform the design process.
5. Evaluate current governance structures.
6. Define scope: who has a legitimate claim and are their historic tenure arrangements that can be tapped to take advantage of existing social capital?

7. Define scale: will this be a region wide solution or an individual nation solution or something in between.
8. Define the nature of the rights at play
9. Define parameters on trade of resource rights (if applicable)
10. Define initial allocation of the right to enhance livelihoods
11. Take a livelihood approach to designing new institutions focusing on the entire income portfolio of all sectors involved.
12. Pay attention to equity and fairness during all formulation steps
13. Build enforcement and monitoring capacity for program success

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 likely that the industrial fishers will resist any attempt to take back the billfish value for the local small scale fishers. As a result, 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, weakens the power of the community. It is difficult but necessary to balance these issues. Enforcement and particularly complete enforcement is difficult, if not impossible, to attain. Fishers are the first link the compliance chain, so if they buy into the community system, enforcement will work. If not, compliance will be weak at best.

It is important to first define 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 participating places on their lives should be taken into consideration. Finally, designers must define the system that organizes participation.

A livelihoods approach should be taken when designing new community institutions. 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.

The second most important finding is that more data needs to be collected on the stock and on the political and economic structure of the pilot countries where these changes are being considered. Conducting assessments of current infrastructure and governance will allow the targeting of scarce program funds to insure success and be able to gauge success. All solutions will involve enhanced monitoring and data collection. If sub-regional solutions are to have a positive stock impact, further research on billfish regional movements and billfish life cycles will be needed to determine if core billfish areas can be targeted in a solution going forward.

This process requires a deep knowledge of the community. This means it is very important to select the community before going too far down the design path and why this document only superficially addresses potential designs. 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. Often small scale fishermen are trapped in shared poverty. This happens when the

population exceeds the 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.

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? 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.

Long term, region wide success that includes significant, positive stock components will mean large changes in international oceans governance. The “freedom of the seas hangover” must be ended to improve right exclusivity and end the free riding of foreign fleets on the sacrifices made by small scale fishers and recreational anglers. The single biggest hurdle besides the “freedom of the seas hangover” for a region wide solution will be the establishment of national quotas and sector sub-quotas. Allocations are difficult enough between sectors within a country. Fortunately, if trade is allowed between sectors and between countries the socially optimal allocation will be met in the marketplace. However, setting them incorrectly in the beginning will have negative social, fairness and equity implications.

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. The same holds for TURFs and particularly TURFS based on FADs. If it isn't possible for one vessel to exclude other vessels on the FAD for a given time period there will be conflict. 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.

The final design question is whether any assigned right are fully integrated or freely tradable across all sectors. 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. 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 industrial fleet bought the entire quota, it could impact the incomes of small scale and recreational fishermen. If it was determined that the artisanal sector needed to be protected, sales could be banned with quota only available for lease. Or only allow sale to the recreational sector so that they could buy up and retire billfish quota. The point is, there are many ways to structure the trade instrument to protect equity. There are precedents in commercial rights based programs for restrictions on trade for equity and other concerns.

These recommendations are design recommendations and not prescriptive directions on how institutions should be changed. There is no one solution for the Caribbean. Instead this document assembles solid directions to proceed tempered by general conditions found region wide. It will be very important to evaluate the existing communities on the ground to determine which of these approaches might work or if there is some better way forward. From the discussion below, existing communities may already embody a rights structure and that structure should be used if possible. If existing rights structures exist it may be possible to simply design a trade or compensation mechanism to further the goals of this project. There are two primary directions to go with rights based management for billfish in the Caribbean. The first would be a billfish harvest based right to billfish

mortality managed similarly to a pollution cap and trade. The second is some sort of TURF like access right to FADs that may or may not include industrial fleets. The assignment of that right could be a strong right to individuals or a weaker right assigned to a cooperative, a community or a corporation. Finally, the right should be assigned to address equity, fairness, livelihood and vulnerability concerns.

INTRODUCTION

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 long-line 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 Caribbean Billfish Project is a US\$1.95 million project component of the GEF-funded, World Bank implemented, Ocean Partnership for Sustainable Fisheries and Biodiversity Conservation Models for Innovation and Reform. The Ocean Partnership is part of a larger framework, the Common Oceans Program, a comprehensive GEF-funded initiative coordinated by FAO working with a variety of partners including governments, regional management bodies, civil society, the private sector, academia and industry to work towards ensuring the sustainable use and conservation of ABNJ biodiversity and ecosystem services.

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 3- year Caribbean Billfish Project consists of the following 4 components:

1. Generating value and conservation outcomes through tenure based management.
2. Strengthening regional billfish management and conservation planning.
3. A functional and responsive Consortium on Billfish Management and Conservation.
4. Business plans developed for pilot investments in sustainable management and conservation of billfish.

All fish have inherent wealth however that wealth is rarely recognized or incorporated into the fishery management process. Management failures arise because managers are largely ignorant of the concept of resource rent and economic efficiency. Often managers feel that efficiency and resource rent are too complicated for practical application to management problems (Cunningham *et al.*, 2009). Largely, managers have only focused on the biological system and conservation of fish instead of looking at the underlying incentives and motivations of society and the fishers themselves. Cunningham *et al.* (2009) advocate that the world should move towards WBFM. The focus of this desk study is largely one of examining how Caribbean nations can transition from current top down management regimes to wealth based regimes using rights based management techniques. This begins with a shift towards managing for wealth instead of the traditional focus of managing for harvests.

Tietze and Singh-Renton (2012) created a Strategic Action Plan for Large Pelagic Fisheries for the Caribbean Regional Fisheries Mechanism. That plan focused on the problems of unsustainable exploitation, degradation/modification of natural habitat and pollution and contamination. This desk study, funded by the World Bank, seeks to address those issues in billfish management while addressing Millennium Development Goals. While poverty is not a huge problem in the large pelagic fisheries examined in Tietze and Singh-Renton (2012) report, vulnerability is a large problem across the islands examined in their report. The outcomes of this report align well with the World Bank's Ocean Partnership Program (OPP) goals for this project. The OPP focuses on reclaiming values lost to overfishing, habitat destruction and pollution and returning that value to local communities. The improvement of triple bottom line outcomes in the Caribbean through the use of community and rights based management is the focus of this desk study. Specifically, this report details the motivating

factors for rights based management, approaches used in highly migratory species across many different sectors around the world, social issues and concerns with community and rights based management tools, details the challenges faced by rights based management and concludes with recommendations for moving forward using these approaches in the Caribbean to improve the management of commercial and recreational billfish fisheries.

MOTIVATING FACTORS FOR TENURE BASED APPROACHES

As much as 28.8 percent of the world's fisheries were overexploited, depleted or recovering and 61.3 percent are fully exploited in 2011 and this represents a downward trend since 1974 (FAO, 2014). Overexploited fisheries make little or no net economic contribution to local community and national economies (Cunningham *et al.*, 2009). If these economic rents can be captured it will raise people out of poverty and contribute to higher national GDPs. Much of the rent dissipation is driven by the open access, or common pool, fishery problem and weak national policies on fishing.

There is much pessimism regarding the sustainable management of straddling tuna and billfish stocks. With straddling stocks, the common pool resource problems are exacerbated by the fact that the stock is highly migratory. In addition, fishermen are highly mobile and they fish for a global market, exacerbating overfishing. As a result, this mobile nature pits multiple sovereign nations against each other in the resource allocation fight. If any one nation tries to conserve, others free ride on their sacrifices. As a result, on the global RFMO stage, members show an inability to cooperate and catches continue to rise. This section will discuss the theoretical underpinnings of the common pool fishery problem and the benefits of RBM.

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 (Wilén, 2006). The charged politics and adversarial decision making is particularly evident in the management of straddling stocks through RFMOs. As a result, marine ecosystems are in dire straits because the political process has become paralyzed while fishery value is destroyed. Wilén (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. The results are players that seek to maximize their share of the TAC, not aggregate economic value.

The divide is profound and relates to very different philosophies of human actions. Fishery scientists believe the failure is the result of "bad behavior" of the fisher's 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. Furthermore, fishery scientists believe the political process does not adequately incorporate science into management and feels the political process can be captured by industry or state interests that promote overexploitation. In this light, fishery scientists believe the only response is to ratchet regulations down even tighter.

On the other side of the ideological spectrum, economists believe the focus should be on the problem that causes the bad behavior, not the symptoms such as bycatch driven by the race to fish and overfishing itself. 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. In the Caribbean case, the race to fish for tuna results in billfish bycatch which reduces the value for local communities as those fish could be utilized in the much more valuable recreational fishery. 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 the national level. 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. General characterization of most national management is discordant. Nations use poorly directed policies fraught with unintended consequences. Often the resource is view 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 a common pool resource 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 common pool problem and not the root cause. Almost exclusively, these nations only focus on resource conservation at worst, or, at best, employment maximization (Cunningham *et al.*, 2009). MSY rarely makes the most economic sense from a resource rent maximization or wealth maximization standpoint. However, SSFs, as they transition to more modern technologies reduce employment while increasing fishing capacity. Combine that with a development focus of increasing value added in fishery products and it drives even higher rates of resource exploitation. Anything managers do to decrease exploitation and increase stocks rapidly evaporate under the common pool. Without secure access rights all conservation sacrifices are 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).

Insecure rights also increase 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). RBM approaches will enhance security for both SSFs and recreational fishing operations instead of allowing billfish to be caught as bycatch by fleets that are buying or leasing their rights likely far below the resource rents that could be generated under a WBFM approach.

Most economists now agree that the problem with fisheries management is not the result of bad behavior resulting from shortsighted commercial fishermen. Instead, the failure of fisheries management is based on the common pool resource problem combined with the institutional setting that has governed past management decisions. Wilen (2006) posits that profits are everywhere higher with secure access. Without secure access, management is a zero sum game. Overinvestment into fishing capacity and free riding, particularly in the international management of straddling stocks, dissipates any potential profits before, during and after rebuilding. Rights based management has a proven track record around the world. It realigns incentives such that they are compatible with stewardship and conservation. The capitalization of wealth into the actual, privately owned, share of the quota changes behavior and maximizes resources values now and into the future.

The common pool problem exacerbates poverty and vulnerability in small communities. Often in SIDS, SSFs are trapped in shared poverty (Ratner *et al.*, 2014). This happens when the population exceeds the local employment opportunities and the communities begin to share work. This is often the case when fishing is the employer of last resort. For many small scale fishers, fishing offers a way to supplement income or protein in bad times. It functions as a welfare system in some locations. It is very important to keep this in mind when designing management reform. Tietze and Singh-Renton (2012) show that while poverty is not a big problem for countries examined in their CRFM report, many households in the region are vulnerable. In Grenada 25.6 percent of households are vulnerable, 15.2 percent in Trinidad and Tobago, 10.8 percent in St. Vincent and the Grenadines and 7.4 percent in Barbados. The biggest issues are a lack of literacy, lack of access to basic services and little diversity in income. It will be very important in the project to focus on solutions that alleviate poverty by increasing diversity of income sources by taking a livelihood approach and thinking about compensation that improves access to basic services.

Why Tenure Based Management is Needed for Billfish

World Bank (2009) examined the potential value that could be gained by rationalizing commercial fisheries globally. In 2004 more than 75 percent of all stocks globally were under performing. Global landings have stagnated, and, in many fisheries, they are declining. 25 percent of all stocks were overexploited or were in recovery. As a result of stock declines, the world’s seafood industry has begun fishing down the food web. To top it all off, climate change is an additional stressor causing sea

temperature change and acidification. Currently there is massive excess fishing capacity that is driving some of this inefficiency and reducing the economic benefits that could be available.

Worldwide fishery production is approximately 160 million metric tons (tons), of which 53 percent is marine capture (FAO, 2014). Over the last 20 years growth in production has been driven by growth in aquaculture production. China is currently the largest fishery producer with 49 million tons, of which 32 million tons is from aquaculture. Developing nations are beginning to exploit their fisheries more intensively. In 1990, 50 percent of capture production came from developing countries while in 2005, two thirds of global production came from developing nations. A full 37 percent of all fish production enters international trade and a full 13 percent of all agricultural international trade is in seafood products. In 2006, the export value of all seafood was US\$86.4 billion, representing a tenfold increase since 1976.

World Bank (2009) continues by estimating the benefits lost by the current unsustainable fishing practices. They estimate that unsustainable fishing practices generate losses on the order of US\$50 billion annually and US\$2.2 trillion cumulatively over the last three decades. Their estimates are the difference between potential and actual benefits and exclude recreational fishing, marine tourism and losses from IUU fishing. They also exclude all sectors downstream from the harvester and exclude ecosystem services and protected species harmed in seafood production. In this case, because the bycatch problem is impacting the high value recreational fisheries, that value delta may be even higher.

Wilen (2005) estimates that mis-management of world fisheries costs nations US\$80 billion in rents annually. This estimate is higher than the World Bank (2009) estimate because Wilen assumes that more wealth generates even more wealth and that wealth is generated in two stages. First, after RBM is put in place under the current management structure and supply chain infrastructure, rents increase. Second, the supply structure and the management structure evolves generating a second wave of rents. The Australian bluefin tuna fishery is the perfect example. The original fishery was very traditional with fish being landed fresh and entering the supply chain immediately. When rationalized, it was estimated that rents would increase by US\$6.5 million (Cunningham *et al.*, 2009). After rationalization, the fishery evolved into a bluefin tuna ranching operation whereby the bluefin tuna were captured, moved to floating pens and fattened becoming a completely different, higher valued product. This second step, after the evolution of the fishery, generated even more revenue. These secondary gains are very hard to predict because it is difficult to know how security will change the underlying structure of the fishery.

Successful and complete rights based management ends the common pool problem. Under rights based management fishing incentives are changed such that the race to fish is ended and capacity shrinks. Ending the race to fish and reducing capacity makes it easier and cheaper to fish sustainably. Secure and transferable rights ensure that it is in the harvesters best interest to recover stocks. Dupont *et al.* (2005) showed that post ITQs in Canada's Scotia-Fundy multi-species groundfish mobile gear fishery that, while large vessels enjoyed more gains, all vessels saw an increase in prices. In the longer term, the ITQ encouraged exit, right sizing the fishery, with the more efficient operations remaining in the fishery.

RBM stands to offer unique benefits in straddling stock management. Once in place they have the ability to eliminate contentious political processes used now to decide allocations. Instead, the market dictates allocations. The IATTC is struggling with a similar bycatch issue that is reducing value in a pelagic fishery. The current allocation of yellowfin tuna and bigeye tuna to the PS gear in the IATTC is set by the PS fleet catching fish before they are large enough to be caught by the LL gear, draining fishery rents. The IATTC has tried longer and longer closures to try and change this allocation, to no avail. Closures are not incentive compatible. As closure become tighter, purse seine vessels fish harder and use more technological capacity to catch the same amount of fish as before the closure. Without incentive compatible management, the race to fish will always win out. Also, RBM can address new entrants by granting currently non-member coastal states a share of allocations and allowing potential DWFSs new members to buy in to the fishery.

Wilén (2006) develops the list of financial benefits of ending common pool management. Rights based fisheries increase fishing profits and that increased value is capitalized in the value of the catch share. The value in the fishery will go up through a number of potential pathways, not all of which apply in the bycatch case. Wilén talks of capacity reduction, but in the

Caribbean case, the goal is not rationalizing the DWFN fleets but capturing the value of billfish being lost to the recreational fisheries. Instead, in this case, RBM has the capability to monetize that value and incentivize the LL fleet to reduce their catch of billfish through markets and/or compensation and other rights based techniques. Reducing bycatch and billfish fishing effort will increase the recreational catches, increasing revenue; all other things equal. Increases in CPUE and reduction in competition for fish, due to less bycatch, reduces recreational and artisanal fishing costs, which increase profits further. The increase in fishery value and profits along with right security encourages resource productivity investment thereby increasing stewardship.

Wilén (2006) suggests an equation for the potential gains from RBM, but it refers strictly to full ITQs where the value accrues to the commercial fishers involved in the ITQ. In this unique case, the increased values will accrue to the recreational and potentially artisanal sectors. The potential value being realized by these sectors accrues through less bycatch in the DWFN fleet increasing CPUEs for both the artisanal and recreational fleets. Ideally it would be best if the artisanal fleet could also reduce their harvest and be compensated by the recreational fleet or the DWFN fleet.

From the Value and Impact Desk Study (Deliverable 1.1.1), the economic rent for the entire commercial billfish fishery was US\$7.5 million US dollars on total revenues of US\$27.3 million while the lowest recreational value of access presented in that document was US\$4.8 million dollars and the highest is US\$16.3 million across only three countries that reported recreational landings. This does not include the producer surplus that accrues to local charter captains engaged in taking tourists fishing. If those rents are included, the total recreational economic rent would be still higher. Those estimates are based on very optimistic release rates but only cover a small portion of the total recreational landings in the Caribbean. Looking at estimated billfish tournament spending in 2015, between US\$16.2 million and US\$78.0 million will be spent during tournaments in the region. While those are expenditures and not economic value, the economic value embodied by those tournaments alone may be more than the economic rent from commercial fishing, perhaps by a wide margin.

While the results in the document were developed for the region as a whole, some limited conclusions can be drawn from the country specific results. Table 1 displays the dockside revenue, commercial value, recreational expenditures and recreational value for the countries that reported recreational billfish landings. The value of the Barbados recreational fishery was US\$9.5 million US in 2013 and generated US\$2.8 million dollars in total expenditures. This value was generated by 4.7 metric tons of recreational landings in 2013. In contrast, the Barbados commercial fishery caught 54 metric tons of billfish. This generated US\$378,000 in landed revenue and US\$84,823 in value for the Barbadian people. Commercial value is several orders of magnitude lower in Barbados than recreational value. Across all countries examined in Table 1, recreational value far exceeds commercial value.

Table 1

Comparing Total Revenues, Economic Value and Expenditures for Select Caribbean Countries

Country	Commercial		Recreational Value	
	Revenue	Economic Value	Expenditures	Economic Value
Trinidad and Tobago	\$805 000	\$180 642	\$479 285	\$980 131
UK.Bermuda	\$21 000	\$4 712	\$689 834	\$5 864 621
Barbados	\$378 000	\$84 823	\$2 822 071	\$9 457 762
Totals	\$1 204 000	\$270 178	\$3 991 189	\$16 302 514

The value proposition can also be made by calculating rough marginal values for the commercial and recreational sectors. Current commercial marginal value, or economic rent per kilogram, was US\$1.73 as estimated in Deliverable 1.1.1: Impact and Value Desk Research. To compare this to the recreational values per kilogram, focus on the value of an additional harvested fish from Whitehead *et al.* (2013) of US\$2,579.10, the only such number found in the literature. That billfish would have to weigh more than 1,490 kilograms for it to be of lower value than the commercially caught fish. That is higher than the largest billfish of any species ever caught on a rod and reel. Even if Caribbean anglers value the next harvested billfish significantly less than North Carolina anglers, it is hard to imagine the Caribbean values being low enough to change that comparison. To put this another way, translating the North Carolina value from Whitehead *et al.* (2013) to a marginal value using an average size harvested blue marlin in the US blue marlin (205kgs) implies a marginal value per pound of US\$12.53/kg. That is over seven times higher than the commercial marginal value of US\$1.73/kg suggesting that the value of billfish harvest could be worth as much as seven times more than it is worth now if more recreational rent can be generated. The strongest conclusion from valuation desk study is there exists enough billfish value in the region to compensate the commercial sector for their loss of billfish harvest and still leave the recreational anglers better off, perhaps by a seven-fold margin.

The common pool regime dominates transboundary fishery management for a number of reasons. First the species sought are highly migratory making it very difficult to exclude other nations. It becomes even harder, under the current laws of the seas, to exclude on the high seas. Second, stocks are not easily observed or easily assessed. Assessment is a public good subject to free riding. Cohesion in RFMOS becomes stronger as scarcity and value increase, favoring the common pool (Allen *et al.*, 2010a). Finally, enforcement is very costly and under provided as it is a public good that other states can free ride upon.

DISCUSSION OF TENURE AND RIGHTS BASED APPROACHES

This discussion will focus on the basic types of rights based approaches. Generally, RBM can be separated into two broad categories; management rights and resource rights (Schlager and Ostrom 1992; Ostrom 2008). Management rights exist on a continuum from top down, government control to bottom up local control. Resource rights exist on a continuum from open access and no assignment of rights to strong, individual rights. They are both 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. This section will focus on the structure of these various rights and the positives and negatives of their use.

While the term RBM is used here interchangeably with tenure based rights, FAO has switched from referring to rights to using tenure. Tenure is a concept that incorporates both management rights and resource rights and respects traditional ways in place for small scale fisheries. Tenure has been defined by FAO (2011) as "...the relationship among people with respect to land and other natural resources. The rules of tenure determine which resources can be used by whom, how long for and under which conditions." This concept takes into account basic human rights needs of small scale fishers and perhaps presents a softer side to RBM than the how RBM has been used by industrialized nations in their industrial fisheries to date. While this document discusses management rights and resource rights as separate discreet concepts, this is solely done for ease of presentation. Looking at the entire spectrum of tenure, instead of focusing solely on resource rights, as much of the economics literature does and as most of the industrialized RBM experience has, will actually improve outcomes and avoid some of the social pitfalls that can occur focusing solely on resource rights.

Resource rights base regimes run the gamut from weak, attenuated rights to strong rights. 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 depended on and defended. Does not mean that 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 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)

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.

Management Rights

Often economists do not discuss management rights explicitly. Instead, it is viewed as a subset of all RBM that devolves management to the lowest level possible allowing communities or cooperatives to control their own fishery destinies. On the other hand, other economists and social scientists present community and co-management as a distinct form of rights different from resource based rights that focuses the right on the management regime rather than the resource.

Regardless of your opinion on the matter, community management involves at least assigning a weak right to a TAC. The community then makes decisions for the benefit of the community and hopefully conservation. Resource rights and co-management share their bottom up nature and a desire to incentivize the users to participate in management. Once the right has been assigned to the community, RBM may or may not be used within that management unit and, if it is used, the right may be either weak or strong. This type of management is most used across demersal species and often involves a TURF in their application. There is considerable overlap or resemblance to community based management and an AMO or a corporation or a cooperative that manages a block of quota or a fairly strong right for a group of people collectively. This discussion is included here as an extension of those discussions regarding the umbrella organization that administers the right as these exist on a continuum from individual rights to collective rights and from weak rights to strong rights. This section has been included in this document to provide a different point of view to the same problem of fisheries management failure. Reassuringly, the concepts, if not the language, are very similar and discuss very similar approaches.

Seijo *et al.* (2011) summarize governance and social issues in the Caribbean relevant to this study. They suggest that comprehensive fishery assessments are necessary region wide. In addition to assessments they call for building fishery management capacity including data collection. Overarching those infrastructure concerns is a need to adopt alternate management schemes that include social, economic and livelihood considerations. These new regimes should promote equity, use rights and participatory management. Seijo *et al.*, state that “Governance is about collective, aggregated and integrative processes that these actors explore together in solving problems and creating opportunities for society.” (Seijo *et al.*, p.404).

Many outside the field of economics criticize rights based management because of a perception that it promotes wealth at the expense of equity and fairness. Sociologists respond to these criticisms by talking about co and community management instead of rights based management. It is important to note that, while the language used by the two disciplines, sociology and economics, their concepts are very similar and for this report co and community management is included as a type of rights based management and this section delves into sociological approaches to addressing the equity and fairness issues that generate criticisms of rights based management. Change this up to examine the dichotomy between resource rights and management rights.

Seijo *et al.* (2011) discuss three major themes in reforming management in the Caribbean. The first is movement towards defining tenure rights or rights to access. This won't be discussed here as those issues mirror all the issues discussed above. Second, designers must focus on reducing high exclusion and transaction costs. Exclusion costs are of great concern for small scale fishers and for highly migratory species. The answer is to focus on existing organizations and community and tenure structures. Transaction costs most important to small scale and recreational fishermen are information costs and the ability to participate in a complex market (Seijo *et al.*, 2011). Of course, as discussed above, enforcement costs will be very high and difficult to reform.

Finally Seijo *et al.* (2011) discusses the development of effective institutions that are adaptable and allow for open, two-way communication. These institutions must be built from the bottom up and must be tailored to local conditions and local relationships and traditional access that is already in place. All of these things must be accomplished while structuring incentives to overcome the race to fish and guard against free riders.

Community and Co-Management

Jentoft *et al.* (2010) take a more sociological direction in talking about both the motivation and structure of co-management. Their discussion is motivated by a growing need to move towards EBFM and EBFM requires increased collaboration across government agencies and increased stakeholder participation. Co-management can enhance both principles as stakeholders should be involved in the management process by identifying problems, generating fishery knowledge, participate in regulation and be involved in monitoring and enforcement (Wiber *et al.*, 2004). Stakeholder involvement increases management legitimacy as their involvement is implied consent from the governed (Jentoft *et al.*, 2010; Lobe and Berkes 2004; Wiber *et al.*, 2009).

Co-management is a bottom-up system is sometimes the only feasible form of management in the developing world, particularly when central governments lack resources and infrastructure (Jentoft *et al.*, 2010). When it is correctly structured participation in the process engenders compliance (Wiber *et al.*, 2009). When management is devolved from central authorities it fights top-down management stereotypes that managers are distant, impersonal, insensitive and too bureaucratic (Jentoft *et al.*, 2010). Co-management tends to work best with communities when taking care of their own fisheries is deeply ingrained in the local culture (Nasuchon and Charles, 2010). Co-management is not without its critics. Some, just like in the discussion of the two philosophical camps above, feel that co-management is the fox guarding the hen house and that a strong, top down hand is a necessity. Without strong rights and enforcement, the gains from co-management are subject to free-riding. In poorly designed co-management cases, devolution of management only decreases the central planner's burden but does not enhance outcomes. It can be very difficult to devolve management when the country or community is very poor as food production overrides just about anything else (Nasuchon and Charles, 2010).

Jentoft *et al.* (2010) posits that, just as the economics discussion above, institutions matter for successful outcomes. Berger and Luckman (1967) define institutions as observed behavior patterns that persist over time and Scott (1995) expands on this definition with "Institutions consist of cognitive, normative and regulative structures and activities that provide stability and meaning to social behavior (p.33)." Traditional, top-down management typically only focuses on the regulative dimension whereas co-management brings in the cognitive and normative as well. Lobe and Berkes (2004) also use a lot of the same language as the economists and attribute the failure of common pool fishery resources to the inability to exclude other users from benefiting and a concept called subtractability whereby users are capable of subtracting benefits from other user. This has a direct corollary to the language from economic discussing rights above.

Jentoft *et al.* (2010) discuss property rights in an interesting light. While many sociologists decry the use of individual rights, these authors view centralization as often usurping traditional use rights. That is, there always was a property rights based approach in place before centralization and the governments ignored those rights. Fishery commercialization favored centralization, more formality in rights structures and a movement away from loose traditional rights (Giddens, 1984; Kooiman, 1993; Kosamu, 2014). This formalization reduced transaction costs for the industrialized fishers, but took rights from the traditional users. While they are quick to defend traditional rights, the authors view the movement towards formalized individual rights as a bad thing reducing management flexibility. They agree that open access is a bad thing, but moving towards strong rights could reduce ecological flexibility. While economists and sociologists may disagree on the terminology and the type of rights that are fair or equitable, they both share common ground in their dislike for top down management and its complete inability to halt fishery decline. Jentoff *et al.* (2010) concede that some type of property right is a must but feel the only equitable type of right is a communal right. Kosamu (2014) finds that the sustainability of small scale fishery management depends of the strength of social capital at the resource scale. Under situations with weak social capital, the level of government involvement mattered little and sustainability was not met. With strong social capital, Kosamu (2014) finds also that the government should be as hands-off as possible in small scale fishery management.

Nasuchon and Charles (2010) outline the keys to community management success. First, communication and adaptation a key which goes hand in hand with the axiom that there are no one-size-fits-all solutions (Costello *et al.*, 2010). Existing cooperatives offer excellent starting places as they are already functioning organization, can handle many infrastructure tasks and harvesting efficiency can be increased through cooperation, coordinating individual boats as a company would manages employees. The third key is aligning incentives as returns are maximized with the returns are paid to those making decisions. Economist see assigning property rights as the way to align incentives, but there are other paths. Aligning incentives to Nasuchon and Charles (2010) also means ending failed or flawed governance and circumventing corrupt governments that may lease fishing rights to DWFN at below market rates. Cooperation will fail unless users can agree to limits and enforcement. They also must make contributions to the public good by improving habitat, reducing harvest or contributing to management expenses. According to Nashuchon and Charles (2010) there have been many successes in co-management. Most of those success have involved TURFs across species with low mobility.

Co-management Examples

Currently in the Caribbean there is an ongoing pilot project examining co-management in FAD fisheries in the region under the Caribbean Fisheries Co-Management Project (CARIFICO). This effort was launched in May of 2013 and involves cooperation between CRFM, Japan International Cooperation Agency (JICA) and the fisheries divisions of Antigua and Barbuda, Dominica, Grenada, St. Kitts and Nevis, St. Lucia and St. Vincent and the Grenadines (Mikuni *et al.*, 2013, CRFM 2014). The goal of CARIFICO it to develop co-management pilots in the Caribbean and the master plan proposes to establish practical co-management models, promote participatory resource management in line with co-management outcomes and to formulate and strengthen regional sharing networks.

CARIFICO selected a FAD fishery in the Caribbean as a pilot project. Their goal was to use fishery cooperatives to facilitate the construction, use and sustainably manage FADs. The projected outputs include qualifications for FAD fisheries, best management practices for deploying, utilizing and maintain FADs, collect fishery information and develop a fishery co-management mechanism. St. Vincent and Grenadines has started a pilot in order to increase sustainability and improve profitability. The pilot is very much in its infancy.

JICA has assisted in the development of this pilot and is attempting to build off the Japanese experience with co-management (Mikuni, 2013). Japanese laws allow for co-management. Cooperatives manage fishing rights and only cooperative members can fish. Fishery management bodies support and oversee cooperatives. Governments pass subsidies to cooperatives for distribution, although, generally, fishery subsidies are currently frowned upon in fisheries management. Cooperatives supply fishing services and cooperative members must use those services. In many respects, they function as a vertically integrated corporation. Members of the cooperatives get a right to fish, access to government subsidies and bargaining power for inputs and outputs.

The goal with this specific pilot was to examine the application of the Japanese model to Barroualie in St. Vincent. Barroualie is one of the main fishing on the west coast of St. Vincent. In the region the Fishery Division has 40 out of 42 registered fishers as active and 49 out of 54 registered vessels as active. Locals however indicate that as many as 150 fishers are active (Mikuni, 2013). The fishers in the region use a wide variety of gears and target a wide variety of species from a variety of small scale vessels. There are two FADs in the area that were built and deployed under the MAGDELESA Project. One FAD is 3 miles offshore and the other is 5 miles offshore and both were deployed in March of 2012. Both FADs are marked with GPS beacons and can report in nearly real time. 18 fishermen and 14 vessels utilize the FADs to catch large pelagic species using trolling techniques. They also drop line to catch bait for trolling. The fishers on these FADS come from 5 different St. Vincent communities and on Grenadine community. These vessels have caught an increasing amount of blue marlin with 965 pounds caught in 2013 and 2,395 pounds caught in 2014 (Mikuni, 2013).

These fishers were surveyed and it was found that fishing FADs is more profitable as costs to fish are lower in both fuel and search time. Fishing is more consistent with the FADs. However there are some drawbacks. First, bait species have become target species and now it is difficult to find bait at FADs to use to catch the more desirable targets species. Also, some users are treating the FAD as a mooring location that will damage the FAD. The Fisheries Division is actively trying to promote FAD use and further develop the FAD fishery. They also want to improve data collection, strengthen cooperatives, update the vessel registry and build new fishing vessels. Individual ownership of FADs not encouraged and may indeed be frowned upon. No permission is needed to fish a FAD and there are no fees associated with fishing the FADs.

However, the cooperative in Barrooallie, the Barrooallie Fisheries Development Cooperative Society Limited, has low membership and lacks leadership. It is one of three main cooperatives in St. Vincent, but is really only involved in the organization of festivals that benefit local vendors (Mikuni, 2013). The cooperative has had trouble raising funds to rebuild the fuel dock and maintaining FADs. But running contrary to the success of this cooperative, a survey of local fishers found they would use a cooperative that provided services that included supplies, workshop space, catch marketing and fishery management. Region wide as survey of 937 fishers across 30 communities showed that 75 percent would be interested in co-management (Mikuni, 2013). In order for co-management to work, however, community cohesion must increase.

CARIFICO is still hoping for success (CRFM, 2014). They are seeking an active plan to improve FAD fishing and explore community/co-management. CARIFICO has recommended the development of fishing logbooks for FAD fisheries and St. Vincent and Grenadines are actively working on such a program. Awareness needs to be built before logbook implementation. They recommend starting small with logbooks in a single fishery or community and then gradually increase use. This is very much an ongoing effort, but one that may bear fruit for this project.

FAD fisheries are a major concern in the region and the focus of considerable investment dollars to improve fisher livelihoods. The Inter American Development Bank has currently invested US\$15 million in Haiti to improve harvest quality, improve conservation and improve commercialization of fishery products (Valles, 2015). The Haitian effort has already identified billfish sustainability as an issue of importance. Their overall focus is on description of current fishery, collecting baseline biological data, review of historic landings from FADs, develop management guidelines and plan the number of future FADs to deploy. They have identified weak institutional framework, lack of technical expertise, lack of basic infrastructure, lack of scientific data, lack of regulations and general environmental degradation as hurdles Haiti faces. The development of additional FADs is risky as most demersal and coastal fisheries are severely over-exploited and FAD development represents the opening of a new frontier to exploitation. The Valle (2015) report gives considerable detail regarding the FAD fishery in Haiti. Several fisher organizations are actually cohesive enough to fund the deployment of their own FADs. One conclusion that stands out from this report is the need for FAD fishers to explore other sources of income in order to decrease vulnerability and to avoid over exploitation of the stock. From this study, billfish mortality in Haiti is considerable with as many as 70 billfish landed per month in the South with blue marlin making up as much as 25 percent of the total harvest on FADs.

Resource Based Rights

Bycatch and Rights Based Approaches

The EPO tuna fisheries have several bycatch issues and provide a good example of the bycatch problem with billfish faced in the Caribbean. The LL fishery catches turtles. The PS fishery, because they set on schools of dolphins, continues to interact with dolphins. FAD fishing generates the most bycatch of any other PS technique (Gjertsen *et al.*, 2010). This technique catches juvenile bigeye tuna and yellowfin tuna and 15-25 percent of those fish are not of marketable size and are discarded. The small fish that are retained in the PS fishery receive much lower prices than if those same fish were allowed to grow and be harvested by the LL fishery (FFA, 2010). The literature on bycatch

reduction/management focuses on bycatch that is marketable and bycatch that isn't marketable. Protected species bycatch is not marketable, but some of the juvenile yellowfin tuna and bigeye tuna caught in the PS fishery is marketable. Policies to reduce or manage bycatch include time/area closures, gear restrictions and tradable bycatch quotas or other property rights techniques. The focus in this section is on the dynamics of marketable bycatch and rights based policies that can be used to address the bycatch of billfish in the Caribbean.

Solutions to address bycatch are grouped into two categories for the purpose of this report: command and control and rights based mechanisms. Command and control bycatch reduction mechanisms seek to equalize bycatch across vessels, while rights based controls seek to equalize the marginal cost of reducing bycatch. Therefore rights based controls reduce the cost of reducing bycatch.

Command and control bycatch reduction methods include fishery closures, time/area closures and gear restrictions. With fishery closures, hard TACs are set for both the target species and the bycatch species, and the entire fishery is shut down when either TAC is reached. Time/area closures are very similar to general fisheries closures and may be used when bycatch hotspots are identified during the season or used prophylactically for known bycatch hotspots. Gear restrictions require technology that reduces bycatch and can reduce harvest rates for target species at the same time (Haynie *et al.*, 2009). All command and control bycatch reduction controls increase fishing costs. All command and control bycatch reduction controls induce strategic behavior and free-riding and exacerbate the race to fish (Haynie *et al.*, 2009, Bisack and Sutinen, 2006, Gjertsen *et al.*, 2010). In the case of the Caribbean, some nations are not a party to ICCAT and therefore are not assigned a billfish bycatch TAC. This results in those countries free-riding on the sacrifices of those countries that have a TAC and fish within that TAC.

Under a common pool bycatch quota, if the target species is highly spatially correlated with bycatch, as is the case with the PS FAD fishery, an individual vessel may still choose to fish with high bycatch. This result is driven by the simple fact that avoidance of bycatch creates a non-excludable public good and others will free ride on his decision to fish with lower bycatch. Additionally, common pool bycatch quotas can create the race to fish for bycatch. When fishers know the bycatch TAC is close to being reached, they will fish areas with a high degree of target/bycatch correlation to try and catch as much of the target species as they can before the bycatch TAC shuts down the fishery (Haynie *et al.*, 2009). Abbott and Wilen (2006) list four additional areas where rents are dissipated under a common pool bycatch quota: wasted target quota, high discard costs or in this case foregone artisanal or recreational profits, shortened seasons and reduced product quality. As with the general common pool problem detailed above, bycatch is a human behavior problem, not a technological problem.

There is a fairly rich literature on command and control bycatch mitigation methods. The recent contributions to that literature have focused on ways to improve upon command and control techniques to increase efficiency and slow the race to fish. Gilman *et al.*, 2006 and Haynie *et al.*, 2009 both look at cooperative information sharing as a technique to reduce bycatch. In 2001, the north Atlantic swordfish LL fishery instituted a voluntary communication system across all members of the Blue Water Fishing Association to reduce turtle bycatch. The program formally ended in 2003, but, informally, still remains in use. During the same period, NMFS mandated the use of circle hooks to avoid dead turtle discards. During this time, there was heavy peer pressure in the fleet to keep from exceeding government turtle quotas and the threat was an already large time/area closure. Incidence of turtle bycatch went down in this fishery, but it is unclear how much of the reduction was due to cooperation and how much was due to mandatory gear changes (Gilman *et al.*, 2006).

Gilman *et al.* (2006) conclude that communication and cooperation can substantially reduce bycatch and provide economic benefits that outweigh operational costs. In the cases they examined, time/area closures increase fishing costs through increased search time and potential reductions in CPUE when high yield areas are closed. They temper this conclusion saying that the fishery must include strong incentives to reduce bycatch; that is the cost of exceeding the quota must be high and the quota set low enough. To that point, they conclude that for cooperation to work best, bycatch interactions must be relatively rare events. They also conclude that there must be adequate onboard observer coverage.

Additionally, cooperation works best with smaller numbers of players and, for large fleets, the cooperation must flow through a vessel association.

Haynie *et al.* (2009) take the Gilman *et al.* (2006) results further estimating a quantitative economic model of fisher location choice when constrained by a bycatch quota and aided by a formal bycatch information sharing mechanism. Their work focuses on the AKbottom trawl fishery that targets flatfish. The fleet operates under a two tiered TAC split between a target species TAC and a bycatch species TAC. The fishery closes when either TAC is reached. The fishery also uses time/area closures. This fishery has a very similar issues to the PS fishery in the Caribbean in that the list of prohibited species (bycatch) are all economically important species in other fisheries (salmon, halibut and others) like billfish is important to Caribbean SSFs and recreational fishermen. The important difference is that in this AK fishery, fish on the prohibited list cannot be landed and therefore have no economic value to the flatfish trawlers.

To address the catch of prohibited species and avoid costly closures, a private company, Sea State, aggregates observer data and generates spatially explicit bycatch rate information at least weekly (often much more frequently).¹ These estimates are used to identify bycatch hot spots in hopes that the harvesters will use the information to keep the fishery open longer. The program was instituted in response to early fishery closures. In 2001, 20 percent of the target species TAC was left in the ocean. There was widespread feeling in the fleet that the program was successful at reducing early closures.

All vessels exhibit a U-shaped avoidance function higher aversion rates in years where the bycatch quota binds. That is, they avoid bycatch early in the season, quit avoiding mid-season and go back to avoiding at the end of the season. Overall, the Haynie *et al.* (2009) results are consistent with Ostrom's (2000) work finding that the fleet cooperates conditionally with falling cooperation as the season progressed and the fleet got closer to the bycatch TAC. This phenomenon was most pronounced in the yellowfin sole fishery. This result also support the work of Isaac *et al.* (1984) suggesting that higher marginal rates of substitution for private goods versus public goods enhance cooperation. Also, they found that as group size increased, free riding increased; a result supported by Gilman *et al.* (2006). Their strongest conclusion is that information on bycatch is not enough to address the problem, even with moderate peer pressure. All harvesters avoid bycatch late in the season, but as the season progresses, all fishers reduce aversion. In the Pacific cod catcher processor fleet there is zero averting behavior. In the yellowfin sole case, because yellowfin sole is highly correlated with halibut naturally, there is evidence that the yellowfin sole boats are actually using the bycatch information from Sea State to fish in areas with high bycatch. Also, peer pressure and coercion is a very necessary component for success and they found that peer pressure may be stronger in the fisheries with longer seasons as the players wanted to keep the seasons long and avoid quick closures.

Haynie *et al.* (2009) also found that fishermen respond better to bycatch catch rate information than total bycatch quantity and that when fishing in high bycatch zones, information is more important to their choices. Provision of information cooperatively has no doubt reduced bycatch, more in Pacific cod than flatfish, but it is still an inefficient method to control bycatch. This fishery now has a full ITQ program and it will be interesting to see if this rationalization provides a more efficient solution. The authors suggest the best method to control halibut bycatch would be to require harvesters in this fishery to buy halibut quota on the open market.

Coming back to billfish bycatch in the Caribbean, the Haynie *et al.* (2009) results suggest that cooperative information sharing works least well when there is a high degree of spatial/temporal correlation in the catch of both the target and the bycatch. That may be exactly the case in the Caribbean tuna fishery. Further, even with a binding TAC on billfish and cooperative information sharing in the longline fishery, bycatch will not be reduced enough and the common pool problems will continue and overall value in this fishery for all sectors will still be lower than it could be.

¹ This fishery requires 100 percent observer coverage for boats over 125 feet long and sampled coverage (30 percent) below that threshold. Most boats are larger than 125 feet.

Bisack and Sutinen (2006) generate another result that suggesting that incentive methods are preferable to command and control methods to control bycatch using marine mammal bycatch in the New England drift gillnet fishery. Specifically, they use a simulation model to examine whether time/area closures or property rights are a more efficient way to reduce harbor porpoise bycatch. This fleet is composed of 546 mostly day boats that harvest 17 percent of the total groundfish harvest in the area. Current controls involve a total mortality cap, time/area closures and a requirement to install pingers on each net. They examine setting time/area closure to meet the cap or assigning tradable dolphin mortality shares. They found that ITQs offer more profitability due to lower costs. They found that rights based techniques increased profits 2-15 percent. They also found that total landings were lower under rights based regimes. Overall, rights based strategies increase profits over closures, reduce overall fishing effort, reduce landings and induce fewer closures.

Vaquita, a species of dolphin endemic to the Northern Gulf of California, is severely endangered by shrimp trawling and gill net fishing. A concerted effort to reduce dolphin mortality began in 2007 with a compensation plan to remove effort from the fishery (Barlow *et al.*, 2010). One million dollars was allocated to the program, but the funds were not effectively disbursed and nothing changed. The number of vessels allowed in the gillnet fishery was capped in 2007 and the number of vessels actually fishing then doubled (Barlow *et al.*, 2010). The government created two large reserves but did not enforce them and nothing changed. This is a classic example of top down rules that do not get the incentives correct and therefore have little success. Because there is no commercial value in vaquita, it is hard to convince fishermen to conserve. Fishing on the ocean is viewed as a right in the region, and because of a history of civil unrest and general attitude of ignoring the government in the region, regulations are simply ignored. Finally there are few economic alternatives in the region. In response to the failure of the 2007 regulations and reserves, researchers estimated the landed value from the panga fleet in the region (artisanal gillnetters)(Barlow *et al.*, 2010). They propose to buy out those fishers or pay them not to fish destructive gears. They propose that could be reinforced by a compensation plan to surrender their gillnet permit, there would have to be enforcement to eliminate the effort from those boats already fishing without a permit. While this plan has not be enacted, this is a type of rights based management because they are simply making gillnet fishing illegal and compensating the losers.

Property rights management has been criticized for creating discard problems through high-grading (Anderson 1994, Arnason 1994, Turner 1997), but only when smaller fish have less or no value or when the ITQ is placed on landings rather than total catch. Schou (2011) reports that the EU common fisheries policy is trialing a catch quota management system where the quota is on the catch, not the landings. This program is being enforced by observers, closed-circuit television and hydraulic sensors. So far, discards are down 2 percent in Denmark. Billfish are worth more in the recreational fishery and worth more than the target species in the PS fishery. If the Caribbean tuna fishery had 100 percent observer coverage, the Schou result suggests that any ITQ should be placed on catch, not just landings. Boyce (1996) finds that such an ITQ placed on catch and not landings can generate a static optimum as long as there are no non-market values for the bycatch. This result coupled with the others above suggests the potential first best solution to the Caribbean billfish bycatch problem is a fishery wide tradable quota for billfish placed on catch, not just harvest.

Abbott and Wilen (2006) use game theory to examine the dynamics of bycatch. Under a competitive equilibrium, the Caribbean PS fleet will fail to account for the externality they are causing in the artisanal and recreational fisheries. They state that, unrealistically, most of the work on bycatch has focused on the first best. In reality, compromise rules the day in fisheries management. Common pool bycatch quotas combined with limited participation and imperfectly selective gears allow firms to behave strategically, dissipating rents. They find that in small to medium sized fisheries, target species price changes have a huge impact on bycatch. With large numbers of participants and high target prices relative to discard costs, price changes have little impact on bycatch. Negative price shocks significantly large will always impact bycatch, regardless of the number of participants. Regarding technology, they find that gear designed to reduce bycatch, does indeed reduce bycatch as long as target escape is less than bycatch escape. Over some range, bycatch reduction technology increases the

catch of the target species because marginal bycatch costs fall. When starting with a very dirty technology, rents will rise but seasons will be shorter. However, technology changes are still inefficient as they do not allow the harvester to equate the marginal benefit of bycatch to its marginal cost. Often, the costs of new technology can swamp the potential rent increases. Also, increased rents may increase effort inducing the same level of bycatch in the longer term.

Abbott and Wilen (2006) then turn to formulating the optimal penalty to reduce bycatch. Instead of property rights, they formulated a Pigouvian bycatch tax set where the marginal benefit of increased harvest just equals the personal marginal cost, including the penalty, for a given season length. Such a tax would have to be tied to the volume of bycatch whether retained or discarded and be increasing in fishery participants. Pigouvian taxes are taxes tied to the level of bycatch produced. The extra cost for catching bycatch forces harvesters to change their behavior to avoid the tax. If they cannot avoid the tax, the tax revenues are used to compensate those being harmed by the bycatch. Inefficient gears have less of a penalty because they catch target species, and therefore bycatch, more slowly. While they recognize that property rights solutions would also generate the same result, taxes would generate the same result at a lower cost to the fisherman. That is not to say that societies cost would not be higher. To be efficient, the tax would have to be set correctly, revisited and adjusted periodically and would have to be monitored closely suggesting that tradable quotas may be the least cost mechanism for the regulator. In conclusion they reiterate that peer pressure and information sharing not enough to adequately address a common pool bycatch problem that is clearly subject to rent draining strategic behavior. Common pool quotas exacerbate the fundamental economic problem of the race to fish even when the bycatch TAC is set to meet biological goals.

There are a number of proposed rights based techniques that could be explored as listed in Gjersten *et al.* (2010), including property rights to bycatch, marginal taxes and non-marginal taxes. There is a precedent for using property rights in the Caribbean address bycatch from other RFMOs. Currently, the IATTC uses DMLs, established under the AIDCP, to address dolphin bycatch. This is a type of property rights management, albeit imperfect (Allen *et al.*, 2008), that shows promise for the use of incentive based techniques to address billfish bycatch. 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 have also 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).

None are as efficient as a simple quota for billfish that both industrial and SSF boats have to own to catch, not just land, billfish. Defining the quota as a general quota would get away from defining it as bycatch. Instead this is really an allocation problem between three sectors with a small discard problem. Values of for billfish are highest in the recreational fishery, particularly when catch and release fishing is becoming more and more widespread. On the other hand, billfish landed by the SSFs bring very low prices as do billfish landed by the industrial fleets if they are landed by the industrial fleets at all. Theoretically, with billfish more valuable in the recreational fishery, quota will be traded between the three fisheries and less billfish will be caught in the industrial fishery. The discussion below discusses how that value can be created and potential techniques to allow for compensation. However, there is very little experience with compensation schemes that include recreational fisheries and, from a theory perspective, many conditions regarding transactions costs and excludability must be met as discussed in greater detail below.

Segerson (2010) examines sea turtle bycatch through the lens of voluntary action focusing on, among other things, incentive payments, which can be a type of RBM. Segerson (2010) finds that incentive payments must be tied closely to the standard, either behavioral or performance standards. They must also be closely monitored. They work best as individual incentives as cooperation is challenging under group standards as free-riding can be a problem. Segerson states that some free-riding may be acceptable within the group and may not impact overall performance but does reduce efficiency. Group standards are more likely to be successful when the groups are small, homogeneous, monitoring

is high and the lag time between action and impact on the standard is short. These are all important points for any RBM approach.

Territorial Use Rights for Fishing (TURFs)

Instead of catch or bycatch, TURFs assign rights to a fishing area and individuals or communities are allocated the right to fish those areas. TURFs are typically used for demersal species or shellfish. TURFs are used in aquaculture and the TURF allows users a set number of aquaculture cages for shellfish in some cases. In other cases, the government or the community assess stocks within the TURF and limits are placed on the volume of harvest within a TURF. TURFs are not typically used for highly migratory species as they generally would need to cover too much area to allow for excludability; a very important right characteristic discussed above. There has been some discussion of their use to respond to the recruitment overfishing occurring in the Western Pacific discussed above, but there has been no use in practice.

The Japanese have a long history of TURF use. The majority of their inshore fisheries are managed under TURFs by cooperatives. Some of the cooperatives are further sub-divided into fishery management organizations. Generally, this is incentive compatible because a territorial use right is assigned and the lowest level of organization sets the rules and regulations. One particular co-management success is the sand eel fishery. Crisis in this fishery ushered in co-management (Makino 2010). Capacity shot up in the 60's and the 70's saw the fishery collapse. The existing cooperatives, recognizing the collapse, began to restrict their own fishing. The 80's ushered in an area based spawning closure and the 90's saw a season length shortened. Stocks have recovered and currently there are 200 operations with 700 vessels fishing under 12 cooperatives. These cooperatives host frequent meetings addressing the science and future management goals. Success of these cooperatives in bringing harvest into control was driven by strong existing community ties. As a result, very little enforcement has been needed besides peer pressure. The cooperative members also participate in data collection, research and general support of the assessment science (Makino 2010).

Chile also has experience with co-management using TURFs. The loco fishery was heavily overfished and the first response was to institute non-transferable ITQs (San Martin *et al.*, 2010). Low enforcement and unrestrained harvest led to failure of the program. The response was to assign a collective right to a cooperative or FMO. Under this structure there are many stakeholders including artisanal fishers, fishery authorities, science providers and economic development organizations. Artisanal fishers have been granted the exclusive right to fish in the first five miles from shore. This zone is broken into TURFs and there is limited entry in the TURF creation process. To apply for a TURF, a local cooperative or FMO initiates the process. It must be a registered FMO, must provide a biological survey of the area in question and must provide a management plan for approval (San Martin *et al.*, 2010). The performance of these TURFs has been mixed. All are depleted related to the base case and some are severely depleted. Most participants support the TURFs, but give their culture of collectivism there have been some issues related to rights based approaches. Exclusivity is a problem. No transparent rules and very limited enforcement. Technical support has been weak. Fishers do not participate in the science and there is no support for technological advances. There are no monitoring or data collection standards. There are no regional assessments only TURF level assessments to set TACs. Regional integration is very weak and there is no recognition of bio-connectivity in the assessments. There is poaching from closed areas. There is very little coordination between cooperatives or between cooperatives and the government. Some negative results have stemmed from a lack of flexibility in the design phase. Cost recovery was set on TURF sized not production which has created some perverse incentives. TURFs did not line up with historical use generating conflicts and poor compliance. Some TURFs were created too far from ports to make them financially viable and there have been resource conflicts with aquaculture. All things that could have been addressed with a more tailored design and not a one-size-fits-all approach.

The primary issue with using TURFs for highly migratory species is that, by definition, these species swim across boundaries. There is no boundary that could be drawn large enough to exclude free riders that wouldn't also involve crossing many sovereign nation's territorial seas. However, there may be a

place for an attenuated area based right that would enhance value in the region. Anecdotally we know that there are congestion problems that generate conflict around FADs. Commercial fishermen vie for access to these structures and compete for the same fish, reducing efficiency and value through congestion effects. Also, there can be great tension between recreational fishermen and commercial fishermen fishing these FADs for much the same reason. Commercial fishermen may think the recreational anglers have no right to be there and recreational anglers may hate seeing billfish harvested right in front of them. Or perhaps simple congestion between commercial and recreational users reduce value. In any case it may be possible to produce gains from trade by assigning tradeable rights to fish FADs. The recreational anglers, or even other commercial fishermen, could pay for exclusive access for a period of days allowing better catch rates and no conflict. While this might address local depletion and congestion externalities and improve fishery value, it is unlikely to generate a positive stock effect unless the area controlled by a FAD based TURF is also a core area for a billfish's life cycle and is a region of high commercial harvest.

The key to using a TURF in a billfish fishery is being able to reduce harvests in either a large enough area or encompassing an area of essential billfish habitat. Several studies show that closures in the Southwest Pacific have impacted recreational catch rates (Holdsworth *et al.*, 2003, Langley *et al.*, 2006). However the only publication to quantify the biological response to restricting the commercial harvest of billfish and the follow on increases in angler catch is Jensen *et al.* (2010). Their work shows that it is possible to positively impact billfish stocks using relatively small area closures. This paper demonstrates that even a commercial closure that doesn't cover the entire range of the species but covers a "Core Area" can increase stocks and improve recreational catch rates. Additionally, if a core area could be identified a right could be assigned to that area even if that area did not contain high FAD use. In the Mexico case in Appendix 1, de facto closures produced a stock effect with a clear value proposition. A TURF assigned to a core area could involve a tradeable day based right or could involve a buyout with an area closure, although that would be a weak right with high enforcement costs. This strategy is probably one that is not very feasible as any idea of a core area in the Caribbean would like still involve very large areas that would encompass multiple countries' territorial seas if it were to have a significant positive stock impact.

Recreational Rights Based Systems

In recent years there have been numerous scientific articles raising concerns about the sustainability of recreational fishing in some fisheries (Cox *et al.*, 2002, Coleman *et al.*, 2004). Many blame increasing effort or participation when the real problem is mortality. In this respect, the recreational problem is similar to the industrial and SSF problem. This is an important distinction because while effort is linked to mortality, angler motivations to fish exist on a continuum from harvest orientation to opportunity orientation (Chipman and Helfrich 1988; Fedler and Ditton 1994; Arlinghaus 2006; Chi 2006; and Johnston, Arlinghaus and Dieckmann 2010).

In the later case, these anglers feel that taking fish is secondary to the desire for opportunity and access.² Many recreational groups are motivated to increase participation and effort and their efforts are tied to improving and increasing opportunity and access (TRCP 2011). Second, the connection between effort and mortality is influenced by both anglers' preferences for keeping or releasing a particular species and how susceptible that species is to release mortality. For some species where there is no commercial component, where recreational anglers prefer to release their catch and where release mortality is low, stringent effort limits or access limits may never be necessary, even with an ever growing angling effort. In these fisheries, congestion or natural access constraints, such as parking spots at boat ramps, may provide all the limits needed to provide high value sustainable access as is the case with many freshwater fisheries. Billfish is one such species and increasingly so. The basic issue, then is to not control recreational mortality so much as enhancing recreational interactions and increasing the value in the fishery. Because of the nature of incentives, if the right is granted to billfish harvest, it will increase catch and release fishing with positive feedback for angling quality. If

² If anglers are motivated by harvest, there is a closer link between effort and mortality than if those same anglers are motivated by access and opportunity or possess a catch and release ethic.

the right is granted to billfish catch, not harvest but simply catching and releasing billfish, it may have the unintended consequence of reducing directed billfish effort.

As a result, high economic rents can be generated in the recreational fishery on very little and decreasing levels of mortality. The value proposition was detailed in Table 1 above. While rights based strategies in recreational fishing are completely untested, there has been some research into the use of this tool. One thing is clear, designed correctly, a rights based system tied to individual billfish catch (or harvest) that incorporated the recreational sector could offer a solution to both the allocation issue, that is allocating more billfish to the highest use, and to the distributional issues such as compensating SSF for their loss of billfish as a marketable species. However there are other, weaker rights that include TURFs or buyouts that maybe simpler, involve less transactions costs and those will be described as well. In this section, the research on recreational rights will be detailed as well as the history of rights used in other recreational pursuits.

Summary of Recreational Rights Based Proposals

Overall, very few rights based systems have been proposed in recreational fisheries and even fewer have been implemented (Kim *et al.*, 2009). This discussion will focus on three broad categories of programs; implemented programs and programs proposed by academics and programs proposed by recreational fishing organizations. Programs that have been implemented include many attenuated hunting and fishing rights, including salmon catch cards and Australian pink snapper, halibut charter sector catch shares in Alaska and Dungeness crab management in Washington. Academic proposals include day based rights, tag based rights, and AMOs. Only two programs have been proposed by recreational organizations.

Implemented Programs

This section will include a brief discussion of attenuated rights in hunting and fishing. These types of systems are quite common in big game hunting across the United States and, while less common, there are several fisheries examples (see Appendix 2). These rights are considered attenuated because they are typically not transferable or allocated using market techniques. But they do grant a limited right to the harvest of one or more animals or fish.

Attenuated Hunting and Fishing Tag Programs

Johnston *et al.*, (2007 and 2009) contains extensive discussions on the use of attenuated rights in hunting and fishing programs in the United States. They label these attenuated right because they are time limited, are non-renewable and offer limited or no transferability making them fairly weak rights when compared to Scott's 1988 criteria for property right. However, they have proven to work well in recreational only settings, even with high release mortality (hunting). For example, waterfowl and whitetail deer, just to name two iconic species, are very abundant across the entire United States.

Wildlife harvest tags are typically physical tags that must be affixed upon taking the animal. The goal of these programs is to limit harvest, distribute the right equitably, enhance monitoring and enforcement and provide data on the hunting experience. Some of these programs are very simple and some are quite complex. The complex systems limit harvest with lottery rationing. In some cases lottery rationing is equity enhanced by awarding preference points for last year's losers to increase their chances of being drawn next year. In some Western states, private landowners receive a set number of tags depending on the amount of habitat they own and the size of the overall herd. They can then sell those tags at market prices or terminate the right by harvesting the animals themselves (Kim *et al.*, 2009). In Eastern states a hunter buys a hunting license for a nominal fee from the state which comes with the right to harvest a number of animals. Also, it is fairly common, due to the scarcity of public land, for hunters to pay for the right to hunt on private land (Leal and Grewell, 1999). Some state use auctions as well, and, while straight up auctions are very rare, some states allow the purchase of unlimited lottery entries or hold a small portion of the tags and make them available for sale to the highest bidder. Kansas allocates deer harvest permits to resident landowners and land tenants/managers using a random draw lottery. Lottery winners owe the state a fixed fee, but they can sell that permit at market rates. In 2009, the market value of a deer harvest permit was

US\$574 indicating substantial rents exist for deer. The market in Kansas is becoming more fluid and transactions costs appear low (Kim *et al.*, 2009). Finally, Mexico has a successful program that sells the right to harvest a Weemsi desert bighorn sheep. The right is sold and the hunter can only hunt with a local guide who also provides meals and lodging for a fee. This program assigns a right to the small ranchers and farmers in the region and helps to conserve bighorn sheep once used for subsistence purposes to a high value recreational hunting target that has improved livelihoods and reduced vulnerability in these rural communities.³

Fish harvest tags are less prevalent and are used mostly to improve catch and effort data. Appendix 2, from Johnston *et al.* (2009), contains a list of all fish tag programs. All of these programs still rely on standard bag, size and seasonal restrictions. Most require that a tag be affixed to the fish to terminate the right, except in OR, WA, NC, MD and trout stamps. Trout stamps were left off the Johnston *et al.* (2009) list in Appendix 2. Many states that operate trout stocking programs require the purchase of an additional stamp to fish in trout waters. These trout endorsement programs are operated strictly for stocking cost recovery, but also represent an attenuated right. Additionally, VA has several trout waters that require a special access permit and the total number of permits is restricted. All states that administer recreational fishing tag programs typically over-issue the number of tags, but rarely are all tags filled. Across all fish tag programs only paddlefish and pink snapper are allocated using a lottery. All of these programs have shown some success in alleviating the common pool fishery problems such as runaway effort, eliminating the race to fish and generating longer seasons. Finally, these fish tag programs are generally well received by the angling public.

Halibut Charter IFQ

Commercial AK halibut has been under an IFQ since 1995. In 2001, the NPFMC passed a measure to include the charter sector in the IFQ program. The control dates for use in the allocation of rights included catch history from the 1998-2000 seasons and the IFQ was tied to the number of fish caught, not weight as the commercial IFQ was structured. The right was to be issued to the owner of the charter or the captain leasing the charter vessel and permit. The program was to retain the two fish daily bag limit and the four fish possession limit. Trades were limited such that charter IFQ holders could not sell quota to the commercial sector, however, commercial quota could be traded to the charter sector with pounds translated to numbers of fish using average weights.⁴ Under this program, there was to be no change to the management of the private recreational sector. Before a market could be developed, the NPFMC rescinded the program in 2005. Criddle (2009) feels that it died because of a severely flawed initial allocation of quota. The program took too long to implement while the industry was growing rapidly. Between the control date and the time to allocate quota, many new boats entered the fishery and were ineligible for an initial allocation of quota. With no provision for new entrants, new entrants lobbied to stop the program and were successful. Others feel that this plan was killed at the Secretary of Commerce level by fishing groups including the Recreational Fishing Alliance.⁵

The effort to bring catch shares to the for-hire sector is not dead, however. In 2007, the NPFMC instituted limited entry for the charter fleet and any vessel without a history in this fishery prior to 2005 will have to buy an existing limited entry permit to participate. In 2008 this reduced the number of charter vessels by 30 percent (Meyer 2010). Currently, small Alaska charters have sued the US Department of Commerce on the grounds that the limited entry program, that will put 327 fishing vessels out of business, is arbitrary and capricious.⁶ Those that are eligible for a limited entry permit are for the plan because of the huge potential windfall they can receive selling the permit for as much as US\$300 000 (see footnote 12). The suit was filed in Washington D.C. federal court as the charter captains feel the system is skewed towards commercial fishermen in Alaska and they wouldn't receive a fair trial. In October of 2008, the North Pacific Fishery Management Council proposed a change in

³ Program described at <http://bajabighornsheep.com/conservation/> Last accessed April 18, 2016.

⁴ While program never got off the ground and no trades occurred, it is likely that this sort of one way trade restriction would present a barrier to obtaining commercial quota.

⁵ Jeff Barger. Personal communication. Ocean Conservancy.

⁶ Craig Medred. Alaska Dispatch. <http://www.alaskadispatch.com/article/small-alaska-charters-sue-big-government-over-halibut>

how halibut are allocated between sectors. The plan is to finalize the “Catch Sharing Plan” in 2011 and implement it in 2012. The change sets a complex system of allocation triggers based on combined charter and longline TACs. These triggers also dictate a complex system of bag limits and size limits. The NPFMC motion also includes the provision for charter captains to lease quota from commercial fishermen to allow their patrons to harvest more fish than the bag limit, but only under limited conditions.

This “Catch Sharing Plan” was developed as an interim measure to address allocation conflicts and the NPFMC plans to develop a more long term solution. The current plan, while addressing some allocation issues, does not grant an attenuated right to charter captains but only allows the leasing of quota under certain conditions. This system is not incentive compatible. This measure does not allow the outright purchase of quota which keeps charter operators out of the full IFQ market and keeps charters under regulatory micro-management. When the commercial IFQ for halibut was established, commercial fishermen were granted a share based on catch history. Not having the ability to freely trade quota with commercial fishermen still leaves the charter industry at a disadvantage. Charters are still strapped with regulatory micro management and are forced to lease quota instead of receiving quota for free as the commercial sector did. Most charter operators see the new plan as “little more than a halibut grab by powerful commercial fishing interests” (see footnote 6), further bolstering recreational fears that rationalized commercial fishermen will use their secured wealth to reduce recreational allocations. There is some discussion of a permanent compensated transfer of quota to the charter sector to help alleviate some of these problems, but that is still an incentive blocking policy.

In 2014, a group of halibut charter operators put forward a proposal called Catch Accountability Through Compensated Halibut in response to the flawed set of triggers and leasing in the Catch Sharing Plan. The market under the existing plan has never really developed with less than 5 percent of the quota being leased by the charter fleet even though it would appear that the fleet would benefit from additional quota. Recent examinations by a group of consultants shows that the marginal economic benefits are higher on the charter side and that allocations would change hands if there were a mechanism. The CATCH plan proposes purchasing commercial quota using various fundraising schemes and allocating that quota to a charter cooperative that could manage that quota for the benefit of its members. The fundraiser would use a license stamp potentially and the funds raised would be used to purchase quota using a one time reverse auction. The consultants calculated that it would take a US\$20/day levy to purchase 500 000 pounds of halibut quota. Other funding options besides a state license levy would include passing the cost on to charter patrons or otherwise raising the money through a cooperative self-tax. They proposed the use of electronic logbooks, harvest tickets and the use of conservation buffers to manage accountability. The proposal is currently undergoing council review. For the charter side of recreational billfish management in the Caribbean, which is likely the highest effort sub-sector, this approach shows promise.

Canada, in the same fishery, has instituted a rights based system in the recreational halibut fishery in BC. Under a similar problem as described for AK, the recreational sector’s catch kept increasing while the commercial sector was rationalized under a rights based management regime. In 2002 the Canadian government set the recreational allocation at 12 percent, up from 8 percent, and allowed the recreational sector to purchase or lease quota. Within two years the recreational sector had increased its catch to the 12 percent limit, but has not really entered the market to purchase quota (Gislason, 2011). There are a number of reasons for this failure. First, there is no structure or legal entity that can act on behalf of the recreational angler. Second there is no structure for the disposition of the recreational right. That is there is no tag system or day based right. Both of these problems have increased the individual transactions cost high enough that no trade is occurring, outside of a limited number of trades with for-hire boats. Third, it is impossible for Canada to earmark license fees in the marine environment. As a result, there is no funding mechanism for the purchase or lease of quota on behalf of the private recreational angler. Instituting buffer sector management in this fishery would likely be beneficial (discussed below). One useful result from the BC experience is the finding that compensated allocation, or inter-sector trading, has to be on the table for recreational anglers to buy in to the system (Gislason 2011).

Western Australia Pink Snapper

This system is a success from a reduction of effort standpoint, but a huge failure from a recreational angler standpoint (Jackson *et al.*, 2011). Freycinet Estuary was divided up into three pieces and one area of the three fell under the tag system. To fish in this formerly popular area, the angler had to possess a tag and was allowed to apply for two tags through a lottery. At the beginning of the program, the government issued 1 400 tags which has since been reduced to 1050 tags at a cost of US\$10 Australian each. The program, however, has not been subscribed from the beginning and essentially everyone that applies receives a tag. In 2010, there were only 478 applicants and the government issued 944 tags. Recreational anglers simply have given up fishing in the area because the transactions costs of obtaining the tag is too high. Anglers felt two tags were not worth the trouble to obtain to fish in this remote area, when they could fish the two areas immediately adjacent without a tag. Also an angler would have to submit an application long before the drawing. Because the submission deadline was so long before the fishing season, many would forget they wanted the tags until they were on holiday and by then it was too late to apply for the lottery.⁷

From a biological standpoint, catch is below the TAC in all three areas, including the non-tag areas (Jackson *et al.* 2011). Compliance is excellent in the tag area with steady enforcement with a consistently low violation level. The tag is not used for reporting, however, and trade is not allowed. The program has very high administrative costs and the tag fee only covers a portion of those costs (Jackson *et al.*, 2011).

Washington State Dungeness Crab

The latest attenuated right was established by the state of Washington in their Puget Sound Dungeness crab fishery which became effective October 1, 2010.⁸ The Washington Dungeness crab fishery is broken in to coastal and Puget Sound management areas. The Puget Sound area is further broken in to six Puget Sound management regions that are broken into a series of areas and subareas for regulatory and catch reporting purposes. All recreational crabbers are required to hold a current Washington fishing license plus a US\$3 license endorsement to harvest crab. Every participant is required to carry and complete a catch record card which must be completed even if they do not harvest any crab. If they fail to report their previous year's harvest, they will be fined US\$10 which must be paid before they can obtain the subsequent year's crab endorsement. The new policy creates a right to Puget Sound Dungeness crab by granting priority to recreational harvest in the Puget Sound.

The coastal, non-Puget Sound fishery contains some recreational catch, but the majority of the harvest is commercial. The policy did nothing to change this portion of the fishery. However, the policy made a major change in the six Puget Sound management regions. It allocated all of the Dungeness crab in regions 4, 5 and 6 to the recreational fleet and gave catch priority to the recreational fleet in regions 1, 2 and 3. That is, the recreational crabbers have first harvest rights on the crab in these three regions, up to the tribal treaty obligations⁹, before the commercial sector is allowed any crab. The majority of the entire state fishery is coastal commercial harvest and this fishery, due to access and sea conditions, has very little recreational participation. Treaty interests are guaranteed 31.2 percent of the harvest with 13.4 percent in the coastal fishery and 17.8 percent in the Puget Sound fishery. This new policy states that the recreational sector, currently with 5.6 percent of the total state fishery, is free to grow unimpeded from this current share to 17.7 percent of the total fishery by harvesting what used to be the commercial Puget Sound allocation (12.1 percent).

The recreational allocation is projected to grow 2.5 percent but can continue to grow. This right is considered an attenuated right because it is not transferable nor fully excludable. It is partially excludable because the recreational crabbers can exclude commercial harvest simply by harvesting more themselves. It does, however, require the purchase of a Dungeness crab tag or endorsement and mandatory catch reporting. Each subarea in Puget Sound has its own size limits, bag limits and

⁷ Joachim Azzopardi. Recfishwest Australia. Personal communication.

⁸ Puget Sound Crab Fishery. Policy Number: C-3609. See also WAC 220-16-260.

⁹ Approximately 17.79 percent.

seasons. While the holder of a crab endorsement is not assigned a fishing area, crabbers are required to record each subarea they crabbed in and the number of crab they harvested in those subareas. Online reporting is allowed and a report must be completed even if no crab were caught on the trip.¹⁰ While it does not control effort or harvest directly, it creates a mechanism that could be used in the future if the current commercial allocation (12.1 percent) is exhausted through the use of TURFs tied to subareas. The CCA played a pivotal role in the creation of this policy and it fits very well with their stance on property rights and recreational priority which will be discussed below.

Academic Proposals

This class of proposed programs has come from the academic literature. In fact the first three proposed programs arose out of a Property and Environment Research Center workshop sponsored by the Environmental Defense Fund which was chronicled in the book edited by Leal and Maharaj (2009). The first two proposals, tag based systems and day bases systems, attack the issue at the asset unit level. The third proposal attacks the problem at the systems level with an eye towards a management system that reduces transactions cost. The AMO approach focuses on the overarching system of allocation, trading and management, but does not prescribe the asset unit that could be used. This dichotomy between approaches will be very important, particularly if phased in application from a weak right to a strong right in the future is desired. It is likely that a slow transition from a weak right to a strong right will be far more attractive to recreational anglers and angling groups than a direct transition to a full right.

Tag Based Right

Johnston *et al.* (2007) introduced tag based rights in response to the management failures in the GOM red snapper fishery. The challenges with tags as they define them include angler heterogeneity, many observation points that are not easily monitored and an angling population that is used to status quo management. Regarding heterogeneity, management faces the challenge of resident versus non-resident anglers and private anglers versus the for-hire sector. They suggest that the asset unit be tied to numbers of fish to reduce transactions cost and detail the potential advantages for a tag based right as applied to GOM fisheries. Because post release mortality is a problem in this fishery, tags would need to be in numbers to help reduce high grading. Additionally, numbers reduces transactions costs over tags based in pounds. It is hard to weigh fish on boats and, at the end of the season, anglers would be left with fractions of pounds that would be difficult to aggregate and potentially wasted. Appendix 3 summarizes those potential benefits in tabular format.

For starters, a tag based right would allow the GMFMC to better account for the hard TACs which they are currently unable to do. Tags have been used for this purpose for both hunting and fishing as described above. Tags can be tailored regionally to account for heterogeneity. It would however require a large number of tags across the entire GOM. Most hunting programs administer less than 25 000 tags. For red snapper, it would take somewhere between one and two million tags. This is a strong argument for the re-organization of the fishery into geographic blocks or TURFs with management devolved to the states or to an AMO. Tag based rights present the potential for longer seasons as anglers could choose when to terminate their tags and the season could be open year round. This is a huge potential benefit in the GOM red snapper fishery as the angling community has seen seasons as short as nine days in recent years.

Johnston *et al.*, 2007 offer several right allocation strategies. The tags could be allocated with a lottery with tag set asides for handicapped, retired or low income anglers if it was deemed necessary. They also suggest tag aggregation limits, much like exist for every commercial fishery catch share program in the US. The tags could also be allocated using the market and this method is the most efficient but also the most likely to disenfranchise anglers and angling groups. They suggest that multiple allocation tools would likely be the best strategy. They suggest that every license holder receive a certain number of tags or sell a base number of tags with an inexpensive red snapper endorsement. Additional tags could be purchased from a retailer, the state or an AMO. This idea works particularly

¹⁰ Reporting requirements: <http://wdfw.wa.gov/fishing/shellfish/crab/crc.html>

well with the state buffer sector system to be discussed in more depth below. Finally, very few wildlife programs allow transferability and those that do say no money can change hands during the transfer or only allow one transfer after the initial acquisition. Transferability is more efficient from a fishery benefits standpoint, but in the case of recreational anglers, transactions costs can be high. Transfers between individual anglers may not be desirable because of transactions costs, but transfers between sectors and the flexibility to allow anglers to buy more red snapper tags if they want more red snapper suggests that some sort of transfer should be allowed. My suggestion is that transfers between anglers not be allowed initially, but that an AMO or the state be authorized to sell additional tags and be empowered to act on behalf of the angling public to acquire more quota in the commercial market. Again this concept will be detailed more thoroughly in the AMO and state buffer sector sections below.

Rights based systems present both challenges and opportunities for monitoring and enforcement. All fish tag systems listed in Appendix 3 were created to enhance monitoring and if anglers were required to return unused tags or complete catch cards, it would potentially improve data collection and effort and catch estimates over the current Marine Recreational Information Program. Some state tag systems have had good luck with this type of data collection; others have not. For improved data collection, tag holders would be required to submit catch records from the previous year to obtain a license for the subsequent year. Some states have also started fining those that do not turn in their catch cards. For instance, Washington fines crab endorsement holders US\$10 for not submitting catch cards.

Enforcement would require that the tags must be physically attached to the fish immediately upon catch to terminate the right and enforcement officials would have to perform random checks. These random checks would likely need to be fairly frequent and would require additional funding and perhaps changes in laws to get law enforcement officers the jurisdiction to enforce these laws. On the extreme end, state fish and game officers or AMO officials would man checkpoints and require a 100 percent check-in of tagged fish, much like some wildlife programs. This would likely be too onerous for recreational anglers and very expensive given the disbursed nature of private effort and the large number of participants on any given day. However this strategy could be successful for charter and for-hire operators that return to the same dock every day or for areas where boat launch and docking facilities are not distributed geographically. For instance, there are large areas on the US West Coast where access to the ocean is only available from one or two marinas or small ports. Johnston *et al.* (2007) also suggest that the tag rights would have to be more durable than one year to induce stewardship. This doesn't necessarily mean that the individual tags would not have an expiration, but that the AMO or state would have to be granted a more durable right, like a long term proportion of the TAC. Additionally tagging programs have been used in wildlife to distribute educational materials, further improving stewardship.

Finally, tags can be used to generate revenue for management, monitoring and enforcement. It works for commercial fisheries and works in the wildlife and fish tag programs mentioned above. Johnston *et al.* (2007) also talks about full integration with commercial and for-hire sectors and they conclude that transactions costs would be too high for individual anglers to buy quota in a commercial market. However, some sort of integration would be needed to allow allocation to shift dynamically and outside of the paralyzed political allocation process (Wilens, 2006; Sutinen and Johnston, 2003). As mentioned above, if transactions costs are asymmetrical between parties in a fully integrated rights system it will prevent efficient outcomes. None of the other wildlife tag programs have anything to contribute to this debate because there are no commercial corollaries in those programs. They suggest that a third party would be needed to manage the acquisition of quota from other sectors. It would also have to be decided whether to allow the for-hire sector to aggregate and sell tags or to require that their patrons bring their own tags.

Day Based Right

Kim *et al.* (2009) proposed a day based right which is very similar to a tag based right in function, except the asset unit is a fishing day and that right would be terminated before leaving the dock. They suggest that the termination of the right could be done using the internet, telephone or the VHF radio on the boat. They posit that such an asset unit would be easy to understand and would present less transactions costs than a tag based right. They suggest that the right would not expire to prevent a race to use up days at the end of the year. The right would be good for the entire GOM and, if too many rights were being carried over from year to year less right could be issued in subsequent years to manage the carry over. Many of the details of this type of system are shared with a tag based system and generally follow the nine essential design questions developed by Kim *et al.* (2009) and detailed above.

It would be necessary to retain daily bag limits, which could be increased as stocks improve, to control total harvest. Additional size limits would still be needed to protect recruitment. Effort monitoring would be enhanced because each trip would have to be recorded electronically, however catch monitoring would still require MRIP style sampling or a catch card system. They briefly discuss allocation and recognize that it will be the most critical and controversial detail in the design. That goes for all rights regimes discussed here. A “correct” allocation, if executed poorly as in the halibut example above, will kill a program before it even has the chance to get off the ground. They are quick to point out that allocation using history, while popular for commercial rights based tools, would be impossible for individual recreational anglers. They recommend auctions. Auctions are transparent, efficient and generate revenue, but may be opposed due to equity and fairness issues. They suggest that a large numbers of auctions may need to be conducted in the first few years, but later in the system’s life, one to two auctions a year may be enough. I predict that auctions would be widely opposed by recreational angling groups for many reasons not the least of which is the fact that the commercial sector received their quota without any payment generating large windfall profits (Kim *et al.*, 2009; Bromley 2009). Recreational anglers will view having to buy quota through auctions as a terribly unfair double standard. I think recreational anglers would view a gratis allocation of recreational rights to a state or AMO as fair and on par with the commercial gratis allocation, even if the state or AMO eventually went on to sell endorsements and/or extraordinary access rights.

Finally, they recommend that there would have to be stiff fines for violations. They recommend that termination of the right be tied to boat registration numbers or another identifier that would have to be displayed prominently such that enforcement officials could determine daily eligibility quickly and at a distance. It would also be possible, but expensive, to require electronic monitoring. They recommend that anyone can buy them and resell the angling days allowing retail markets to aggregate and sell fishing days. They also recommend working up towards full integration of all sectors, by allowing limited inter-sectoral transfer at first. A conversion factor would have to be developed to convert days in to pounds, but one would also have to be developed to convert pounds in to numbers of fish for a numbers based tag system. They recommend that trade be restricted for the first five years, eventually completely removing sectoral allocations out of the political sphere.

Angling Management Organizations (AMOs)

AMOs were proposed first by Sutinen and Johnston (2003) and include management devolution, strengthened harvest rights and co-management, all important characteristics of rights. Their proposed system is more of an overarching administrative system than a fully specified right as the other two systems in this section above. In fact, at the bottom of their proposal individual anglers could be managed by tags, days, status quo management or any combination of techniques. The CATCH system described above is a type of AMO as defined by Sutinen and Johnston (2003).

Sutinen and Johnston have designed the AMO to conform to the seven principles of integrated management (p. 474, Box 1, 2003). They state that fully integrated recreational management is only beneficial if the benefits outweigh the costs. As this volume has discussed, these tools will be costly in terms of transactions costs and costs in political capital and integration must show big enough dividends or they will not be adopted. An integrated system must have a workable system for

allocating catches across sectors. For recreational anglers, the managers must be able to exert a high degree of control over fishing mortality. This same management system must be based on strong angling rights. The strength of rights were discussed at length above as were the benefits. Without strong angling rights in a mixed fishery, recreational anglers will continuously have their weak rights eroded by commercial fisheries with strong rights. Fisheries with commercial rights will argue that they have more at stake. This is currently happening now in red snapper. The Gulf of Mexico Reef Fish Shareholders' Alliance states that one of their goals is to "Develop a methodology for allocating (and reallocating) fish between the commercial and sport fisheries. We are already working with the Gulf Council to maintain the commercial share of the catch, and realize the negative impacts caused by reallocation away from well-managed IFQ fisheries to the poorly managed recreational sector."¹¹ This sentiment is a perfect example of that kind of pressure recreational fisheries with weak rights will face, particularly since one NMFS funded study suggests that red snapper allocations should move in the recreational direction.¹²

To ameliorate the transactions cost issue, Sutinen and Johnston (2003) suggest turning over management of the rights to recreational management organizations. As shown with community fisheries quotas in AK and now sector quotas in New England, the right is assigned to a group for management and the community assign the right to participants in their community or sector. This idea will be discussed further in the community section below. This allows recreational fishery management to be decentralized with limited management authority devolved to local organizations. In fisheries management, centralization and federalization have shown to breed contempt and distrust. This centralized authority is incapable of accounting for angler heterogeneity. This type of devolved management is successful because it draws on local social networks for compliance and stewardship, and it has proven to work with state level wildlife and fisheries management. Sutinen and Johnston (2003) believe that cost recovery should be applied to recreational fishery management because it will strengthen accountability and improve management performance. With a rights based system, enforcement and monitoring costs will go up and it is only fair that the angler pays their share.

As applied to GOM red snapper, current management addresses their first three principles. They propose AMOs to respond to the remaining four principles. They view AMOs as a non-governmental organization comprised of groups of anglers. The fishing rights are assigned to the AMO and individuals own tradable shares in the AMO in a similar fashion to a corporation. The AMO has the authority to implement measures to optimize socioeconomic objectives. The AMO would be responsible for managing the TAC set by the GMFMC and would be penalized for exceeding their share of the TAC using a temporary or permanent reduction in share. Their idea is that devolved management would be less costly to the angler and to society. The organization would have to be a non-profit, financially independent and financially sustainable.

To address equity concerns, each AMO must be founded on providing equal opportunity to all. Having a larger administrative entity than the individual angler will reduce quota trade transactions costs. Additional AMO rights and duties would include an exclusive right to a share of the TAC. They would also be vested with enforcement authority. Finally, they would be empowered to manage the TAC and develop appropriate controls. While not foreseen by these authors, these controls do not necessarily have to be market based and one of the clear benefits of AMO is that it would allow the institution of an attenuated right and devolved management that, at least initially, could look a lot like current management to the average recreational angler. As they evolve and grow, they could incorporate more rights based tools as needed.

The AMO would be operated as a limited liability company, limited partnership or corporation with publicly traded shares. Share owners don't own quota, but own a share in a corporation that does own quota. Catch could be allocated to members using auctioned spatial rights, license sales, fee based tournaments and lotteries for catch rights. Their charter could include a provision of quota to current

¹¹ <http://shareholdersalliance.org/membership/>

¹² Griffin, W.L., R. T. Woodward and H.N. Kim. 2009. Bioeconomic Analysis of the Red Snapper Rebuilding Plan and Transferable Rights Policies in the Gulf of Mexico. Grant ending report. Grant No. NA17ff2873. August 27, 2009. 249p.

anglers or not. They envision both voting and non-voting members with voting members being AMO shareholders. Membership must be open to all. Sutinen and Johnston do not spend much time on what types of management measures that could be used except to say that input controls should be avoided and that management measures that are designed to exclude certain users are out of bounds. I disagree with this point. For example, the use of chemicals or explosives to harvest fish should clearly be excluded as should anglers that only want to use those techniques. Clearly there are good reasons to exclude certain types of users, but the point is that is a potentially slippery slope. Access to the fishery could be granted any number of ways. From traditional management to tags or some incentive compatible mechanism, it would be up to the AMO to decide. If an incentive compatible structure was selected for use within the AMO as a overall structure, they suggest using numbers of fish in a tag system. They also suggest that the right assigned to the AMO be as durable as the commercial right in the same fishery, but the AMO is free to choose how durable the right they assign to members can be.

Sutinen and Johnston (2003) reiterate that rights are stronger with trading and that overall efficiency and therefore benefits are greater under trading. They suggest that the AMO should be allowed to trade with other AMOs and other sectors. They caution that unrestricted trading could concentrate shares geographically, which could induce localized depletion. Therefore some limits on trading might be warranted, particularly in the beginning including limits on aggregation within a region and limits on the amount that could be sold or bought from other sectors.

These organizations would be funded by purchases of shares in the AMO by members and by the sale of fishing access rights. Sutinen and Johnston (2003) suggest that significant funds could be generated by leasing “exceptional” rights to for-hire agents, tournaments or to commercial fishermen. They also mention funding these AMOs through levies on fuel and tackle.

They suggest that to manage localized depletion, the quota should be spatially delineated and that AMOs be established based on this delineation. This would work very well for reef fish, which have very high site fidelity, but potentially poorly for migratory fish. Spatial delineation can make enforcement easier, particularly if rights holders are required to display a flag or a decal that indicates their right. It could potentially make stock assessment more difficult as the TAC would have to be set based on the stock in the spatial delineation.

Sutinen and Johnston (2003) identify the issues that will have to be addressed in implementation. They recognize that this is a new idea that may not be well received by the recreational community. They suggest the following process: set spatial TACs; create an AMO for each TAC; and then the AMO issues shares to those it deems eligible. The allocation of individual shares is the most difficult and contentious part of the design. The total number of rights has to be determined and assigned. Fairness and equity must be part of the allocation process or you risk alienating your members and damning the AMO to failure. They suggest three options for allocation; set shares equal to the number of participants, anglers can nominate themselves for ownership or set a fixed number of shares allocated via lottery.

They suggest that there is an optimum AMO size, both in terms of membership and allocated catches: too large and it becomes difficult to manage, too small and they won't be financially sustainable. Eventually, the optimal size will arise out of the market, but they believe that AMOs should at first err on the side of being too large. To reach optimum size, AMOs should be allowed to split and or merge as long as it does not violate any excess shares rules established elsewhere. They suggest that some sort of phase-in process be used to ease the transition. The entire process would need to be monitored and audited by an outside authority. This outside authority would insure that each AMO was properly organized, chartered and capable of developing and implementing its own management policies. This start-up phase would involve substantial transaction costs. Much work would have to be done to lay the groundwork for the establishment of such an organization. They suggest establishing a transition authority for two years to build an infrastructure through a collaborative process. They suggest using government funding for this initial phase.

Recreational Organization Proposals

There have been very few rights based proposals by recreational organizations. Groups like the Recreational Fishing Alliance, Fishing Rights Alliance and many other smaller, angling rights organizations are strictly anti rights based management, even for commercial fisheries, and therefore have never proposed any rights based management. Officially, they are opposed to recreational catch shares and would instead endorse the terrestrial wildlife management model whereby all important recreational fish are made gamefish and entrusted to the management of the state. Essentially this is a form of attenuated property right and one they have been very effective advocating at the state level. Many state, particularly in the GOM region have made many species, either outright or defacto through gear bans, 100 percent recreational species. All gamefish designations were driven largely by CCA lobbying efforts.

Dr. Russell Nelson, of Nelson Resources Consulting, Inc., proposed a tag based system for red snapper at the April meeting of the GMFMC in 2009 (Nelson 2009). His six page proposal advocates a numbers- based tag system whereby tags are distributed in lots of 10 or 100 via annual auctions. They would be freely transferable and anyone could buy them. His plan discusses aggregation caps, but does not set any. The tags would also be required of commercial fishermen and the tag would have to be placed in a caught fish immediately and remain with the fish until it was consumed for enforcement purposes. Auction proceeds were estimated to be between US\$3 and US\$15 million dollars and the funds would be used to “support state of the art population estimates using genetic technology that would eliminate the need to use MRFSS in assessments” (p.4). He recommends eliminating minimum size limits to reduce discards and believes that a numbers-based tag would encourage anglers to target larger fish that would result in reduction in fishing mortality. Anglers would be allowed to catch more than two fish per trip so they would be able to take fewer trips for the same amount of meat, reducing fuel costs. He posits that reductions in fuel costs alone would pay for tags. By counting tags sold, it would provide an accurate and controllable means of staying within the TAC. His proposal got no traction at the council.

While the focus of this report is on private recreational anglers, the for-hire sector is likely to see the first recreational catch share program. One is currently proposed under the CATCH system described above and one is currently being scoped in the GMFMC for the for-hire sector of the red snapper fishery. As suspected for the recreational sector it is proving most tractable to split the for-hire sector off from the private recreational sector and provide them their own allocation. This would allow for-hire captains the most flexibility and would allow patrons potentially to have the flexibility to catch as many red snapper as they wanted limited only by the quota holding of the for-hire vessel. However, there has been extreme to resistance to sector separation across anglers and angling groups in the GOM. Private angling groups and the National Association of Charterboat Owners oppose sector separation for two reasons. First, they feel it will split their support base. That is, they believe it is easier to influence the council process as a unified block. If the sectors are separated they feel that there will now be three sectors fighting against one another. Second, sector separation is a necessary condition for allowing the for-hire sector to participate in a catch share program. It is felt that resisting sector separation will stave off for-hire catch shares. Private angling groups are particularly concerned about for-hire catch shares because they are afraid the for-hire sector, which is now a part of the recreational political base, will ally itself with commercial interests post separation and institution of catch shares in the for-hire sector. It is more tractable in the for-hire sector because they are monitored more closely, they are fewer in number and many see it as a way to offer better trips to clients. It is likely that if a for-hire program is successful, it will influence the adoption of one across private recreational anglers. It will also increase the pressure on the private sector to obtain rights because the for-hire sector will join with the rationalized commercial sector in calling for private recreational management reform as we have seen in red snapper and AK halibut.

Summary of RBM Types

Table 2 summarizes both the management rights and the types of resource rights discussed here. Again, management rights are not mutually exclusive with resource rights while each resource right is mutually exclusive with the next. That is, the management of the resource under management rights

may continue to be the more typical command and control or could involve resource based rights. Conversely, strong individual rights, for example, could be managed under a co-management rights or could be managed under the more typical command and control. All the resource rights systems in the US are managed under the umbrella of typical command and control management whereas most fisheries in Japan are managed using a community governance structure with a TURF type resource management structure.

Table 2 represents a vast oversimplification of the issue. Tenure based management is very complex and is actually better represented on four dimensional continuum between top down, command and control on one extreme of the management right dimension and co-management on the other extreme. For the resource right continuum, one extreme is weak, collective rights and the other is strong, individual rights. There are many pluses and minuses to each place on that continuum. The major focus of this project is to move in a more incentive compatible direction recognizing that it is impossible to be prescriptive without examining and involving the local communities in the design of a management system that seeks to improve livelihoods and conserve billfish.

Table 2

Summary of RBM Types

Type	Governance Mechanism	Strength	Summary
Management Right	Community Management	Weak-Strong	Right assigned to governance, not resource. Not mutually exclusive with any resource based structures below. Addresses many social negatives of strong, individual resource rights. Should be adapted from current tenure arrangements. Strength depends on how right is managed at the resource level and the strength of social capital. Strong social capital enhances success.
	Co-Management	Weak-Strong	
Resource Right	Individual Transferable Quota on Billfish Harvest	Very Strong	Reduces capacity quickly. Generates wealth quickly. Transfers wealth efficiently. Handles allocation in the market. Fewer vessels = less employment. Requires intensive monitoring and infrastructure needs are great. Requires changes to international agreements. Transactions costs likely high for recreational and small scale sectors.
	ITQ on Bycatch	Very Strong	
	Day Based Right	Less Strong	Easier to monitor, easier to enforce, easier to understand, perhaps less transactions cost, quickly transfers value. Not linked directly so stock impacts harder to achieve. Directly linked to effort. Effort allocation handled in market.
	TURF	Weak - Strong	Easier to monitor and enforce, particularly if historical tenure is based on place. Low infrastructure cost if based on historic tenure If social capital in community is strong, enforcement will be easier. Strength depends on the fish stocks association to structure/place, if stock is tightly associated with structure and all important structure can be included in right, it can have strong rights characteristics and strong stock impacts. Low transactions cost.

Transboundary Stocks and Legal Issues with RBM

Creating a rights based regime will require balancing complex benefits and costs across non-cooperating states (Allen *et al.*, 2010a). Coalitions could involve single members or groups of members. Distribution of benefits will be extremely important and will constrain both the total benefits and the ability to change to a rights based regime. Often, it takes catastrophe to usher in such drastic institutional change (Libecap, 1989). If benefits are more uncertain than costs, change will not occur. In the case of individual country quotas, state sovereignty and geographic strategy issues will be the biggest challenge to rights based management. That is, the allocation of quota will prove to be a large hurdle with very little legal precedent. Also, if the change is not viewed as fair and equitable, change will not occur. This section will address the concept of rights in transboundary stocks in general, allocation of those rights in practice and general design issues and challenges for the application of rights in any fishery.

Rights and Transboundary Stocks

There are several legal challenges facing a change to rights based management in the Caribbean. UNFSA and UNCLOS require consensus, provide provisions for members to opt out and require that new entrants be allowed to enter fisheries. Under these agreements, creating a level playing field will require considerable cooperation that will prove extremely challenging. Enforcement will likely be a significant challenge because of the weak and untested property rights on the high seas.

The legality of allocations to individual fishers by RFMOs has not been fully tested (Allen *et al.*, 2008). Clearly individual nations can and there are examples from the Australian bluefin tuna fishery, Chinese Taipei bigeye tuna fishery and Pacific halibut where both parties, Canada and the US, have individual ITQs within their states. Serdy (2008) concludes that any mechanism would need to be consistent with the tuna legal framework in Articles 64 and 116-119 of UNCLOS. Under international law, questions of property rights are to be regulated by states under domestic legal systems. This may be a hurdle, but may change with precedents set by the Kyoto Protocol and emissions trading. Freedom of fishing on the high seas is a positive right under UNCLOS article 116 and is the item Munro (2007) suggests will be the biggest impediment to well specified private rights. As state previously, only current members are bound by international laws, opening the door for free riding. As a result, even if assignment and trading of individual ITQs were proven legal, this would present a major roadblock for a successful property rights program.

Catch and effort limits are negative limitations and not positive rights (Serdy, 2008). Therefore quota cannot be traded because the limiting duty is owed to every other member, not just the quota seller. This may not be a major problem as other members can agree to waive their rights to hold the buying members to its original quota and commission can approve these types of transactions as evidenced by ICCAT quota swapping and IATTC ad-hoc capacity quota trades. The CCSBT did a thorough examination and found no fundamental obstacle to trade and New Zealand concluded the same in a separate legal opinion.

For the IATTC to allow capacity trading it required a significant administrative infrastructure. This infrastructure included a rigorous accounting system and the 2002 resolution was not sufficient to allow for formal trading. To allow for formal trading, the IATTC must decide whether capacity can be carried over or banked. It must also decide how to handle the capacity of non-members, particularly for coastal states that haven't joined. It must also deal with non-commercial uses for capacity that are not currently included (Serdy, 2008). These types of arrangements must be agreed to by all and that has its own challenges identified above.

Perhaps the most challenging aspect, particularly in light of the freedom of the seas doctrine, non-members must also agree (Serdy, 2008; Munro, 2007). Article 8(4) of UNFSA does offer a glimmer of hope; states must either join or cooperate with IATTC or refrain from fishing. Within this vein, the IATTC must secure recognition that new entrants cannot disregard non-discriminatory trading schemes and must purchase quota to participate in the fishery (Serdy, 2008). This would necessarily

mean allocating quota to coastal state non-members so they could either participate or lease quota to capture rents due to them resulting from the productivity contributed within their EEZs.

Joseph *et al.* (2010) identify a dichotomy between the haves and have not's that exacerbates management issues in this RFMO. They label the DWFS as the haves and the coastal states the have not's. The DWFSs arrived in the region with the most fishing capacity first and the RFMOs first action was a total quota, creating the race to fish. Most allocations within RFMOs are set using catch history which also favors the haves (Berkes, 2006) The haves, with all the capacity, are winning that race still. The haves prefer the common pool regime because they have the capacity advantage to win the race to fish. The coastal states, on the other hand, have much less capacity. Initially they only had a three mile coastal jurisdiction, but now have a 200 mile EEZ. In general, they prefer conservation and what to gain more control over the resource. The conflict between these two groups has made agreement on conservation impossible in many RFMOs. As a result there has been virtually unrestricted growth and overfishing across international tuna fisheries.

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 the Caribbean. While Allen *et al.* (2010) state the "time has past for unlimited entry into tuna fisheries" (p.65), limiting entry may be one of the toughest hurdles facing the institution of rights based management in international tuna fisheries. Limited entry is a prerequisite for the institution of rights based regimes, and yet, as discussed above, international laws require that new entrants be allowed until the stock is fully exploited. In addition, because of DWFS, limited entry in even just the Caribbean would require a worldwide vessel register (Allen, 2010).

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.

Expanding his examination to include straddling stocks, Munro (2007) identifies three differences between transboundary and straddling stocks. First, straddling stocks naturally involve more players making coalitional bargaining a must. Second, international law requires that new entrants be allowed as the UNFSA clearly states that nations cannot be denied entry without just cause. This induces implicit free-riding. That is, as the WECAFC successfully rebuilds the stocks, any nation can come along looking for a proportional share. If accepted into the WECAFC the new member is free-riding on the charter members' sacrifices. Third and finally, is what Munro calls the "freedom of the seas hangover (2007 p.435)." A vessel fishing inside another country's EEZ fishing without permission is fishing illegally. That coastal state has clear property rights and can take strong action against that vessel. On the other hand, a non- WECAFC member fishing on the high seas in the Caribbean in a manner inconsistent with WECAFC rules is participating in unregulated fishing. All WECAFC members would agree that this is wrong, but what can be done? Property rights are not strong and any

potential enforcement measures are equally weak. This “freedom of the seas hangover” is an explicit invitation to free-riding.

Therein lies the rub. If the Caribbean regional management body does not allow entry and implicit free riding, those seeking entry are likely to become unregulated fishers. The key is to allow new entrants with the right amount of investment. If the offer to new entrants is too good, the regional management body risks undermining their management by encouraging implicit free-riding. If the offer is not good enough, the new entrants will turn to explicit free-riding. Pintassilgo (2003) supports this result that if unregulated fishing is not controlled, the grand coalition will collapse.¹³

Pintassilgo and Lindroos (2008) also agree with Munro (2007) that the grand coalition cannot be stable when the number of players is greater than two. As long as free-riding is possible, it will be difficult the rights based regime to be successful. In the case of the Caribbean, it is essential to success that the legal regime prevent non-cooperators from accessing the resource. To this end, Munro recommends ending the “freedom of the seas hangover” by establishing property rights in the Caribbean 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. It is likely that this type of proposal would meet stiff resistance from DWFSs. Allen *et al.* (2008) says 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.

Allocation and RFMOS

At the heart of any rights based management tool is allocation of the stock across one or more sectors. If region wide solution is pursued, the largest challenge will be the allocation of quotas and sub quotas across sovereign nations. However, in order to examine the realm of possibilities, allocation processes across all RFMOs are examined here. The use of the term “rights” within this section does not necessarily mean strong property rights. Instead, the use of “rights” conforms to the usage of that term in the UNFSA.

Allocations are made constantly within RFMOs. The vast majority of the time they are implicit allocations based on CMMs and explicit allocations are rare. This is problem because implicit allocations rarely consider all facets of efficient allocation and can have disproportionate impacts on developing coastal States and SIDS. CMMs that lock harvest/effort/capacity at some historical level often favour those that have been in the fishery longer. In most cases, the DWFNs have been there the longest. This tends to enhance the have/have-not divide with the have’s being the DWFNs and developing States as the have-nots.

For those tuna RFMOs that make explicit allocations very few have a quantitative formula. The WCPFC VDS is one of the few that uses a formula that is based on EEZ area and history, and it only covers a sub-allocation within the RFMO. All tuna RFMOs have qualitative guidelines that deal with equity, fairness and developing State and SIDS aspirations. These guidelines are difficult if not impossible to quantify, and RFMOs are obligated only to consider them.

The lack of explicit allocations directly impacts the distribution of costs and benefits of tuna fishing (Allen *et al.*, 2010). It impacts employment, income and the wealth and sovereignty of States. As a

¹³ The main assumption in cooperative games is that the grand coalition will form as the group that supports the game solution.

result, allocation is difficult and contentious. Existing allocation mechanisms, or lack thereof, in the five regional tuna RFMOs have all failed to prevent overcapacity and overexploitation (Grafton *et al.*, 2010). Across all RFMOs the two most common criteria are historic catches and coastal State access.

Stable cooperative agreements can only emerge when no state is worse off from acting cooperatively than acting independently and this result comes out of the game theory literature and practical experience in the allocation process (Munro, 2007; Munro, 2006; Munro *et al.*, 2004). Different States or groups of States have different goals in any given negotiation (Willock and Cartwright, 2006). Often, the side payment necessary to achieve agreement are generated by increasing allocations and/or the TAC beyond sustainable limits. These “paper fish” exacerbate the overcapacity and overharvest conditions found across most shared stocks managed by RFMOs.

The pressure to over allocate is also driven by pressure from domestic industries and national fleets concerned about the loss of revenues (Hoel and Kvalik, 2006). Further, the challenge of incorporating new entrants and meeting the aspirations of developing States, adds to the challenge of reaching agreement on allocations. Perceived inequities lead to cheating existing allocation (Lodge *et al.*, 2007). This section is designed to outline current difficulties, current allocation practices at ICCAT and to examine potential directions to establish country specific allocations of tradable billfish quotas.

Globally there are 42 RFMOs all facing issues with allocation. ICCAT and CCSBT are the only tuna RFMOs that explicitly allocate quantities directly to countries. In both cases, the allocations are quantity based and not proportional. RFMOs are in the business of regulating or restricting access and harvest of resources shared across national jurisdictions. These regulations and restrictions imply an allocation decision. Two conditions make allocations both possible and necessary; limited or scarce resources and a community that has a stake in those resources (Franck, 1995).

Allocation strategies take several basic forms. Olympic, the most common allocation strategy, involves setting an RFMO wide TAC for a given species and every State races to catch as much of that TAC as possible. Country shares, as the name implies, assigns a portion of the TAC to each party to the RFMO. These country shares can be quantity based or can be made proportional to the TAC. Quantity or weight based shares are the most common and but the least flexible. If some exogenous shock requires a reduction in the TAC, it can open the door to a complete renegotiation of the allocation which many times results in over allocation in the face of science that says TACs should be reduced. Proportional shares, however, grant States a percentage share of the TAC. In the event that the TAC needs to be rapidly adjusted, the adjustment is passed to the States without renegotiation based on their proportion. Less common than either Olympic or country shares are property rights systems and fishing corporations (Crothers and Nelson, 2006; Allen *et al.*, 2010).

While explicit and implicit allocations are being made by RFMOs, they have become the most difficult and contentious aspect of international fisheries management. In many cases, allocation mechanisms are criticized by members and non-members as inequitable and non-transparent (Palmer, 2010; Van Dyke, 2010). To be successful allocations must be objective, transparent, predictable, reasonable and fair. The majority of all allocation decisions are made on the basis of catch history which often exacerbates the race to fish (Van Dyke, 2010). While relatively few formal allocation analyses have been conducted, the vast majority of those studies use economic criteria. Economics has a difficult time measuring and accounting for equity concerns and yet equity has arisen as important criteria in all explicit allocation particularly from the point of view of developing States. However, the concept of equity is poorly defined. The legal norms for equity have-not been examined and there is no objective, legal definition of equity. It is also challenging to incorporate because it is difficult, if not impossible, to quantify.

Explicit allocations evolved out of a convergence of technology and the need to reduce international overexploitation of fish stocks. Allocations arose out of a need to eliminate inefficient and rent draining competition for shared fish stocks. The race to fish promotes inequity with the haves (DWFNs/developed nations) out-competing the have-nots (local developing States) in an Olympic style fishery (Allen *et al.*, 2010). Formal allocations to States have been sought to allow States to

maintain sovereignty and address the inequities between the haves and have-nots in the RFMO process. However, it has been shown that allocations alone are not enough to address the common pool problem.

Early in the debate regarding formal allocations there were concerns that State allocations could lead to localized depletion (Crutchfield, 1968). Additionally Crutchfield pointed out that fixed, weight based allocations would need constant revisions due to both endogenous and exogenous factors and he urged the use of proportional allocation. Even early in the process, equity arose as a major concern. This equity debate has focused on new entrants and the rights of developing States. These developing States often produce much of the productivity within their territorial seas that DWFNs harvest. Early in this process it was recognized that allocation was important and needed, but legal mandates and allocation criteria did not exist. To a large degree, 43 years later, they still do not exist.

While proportional allocation is better for sustainability, currently all allocation systems in RFMOs are quantity based. That said, both NAFO and NEAFC operate with informal proportional shares where tonnages are allowed to vary each year, but relative State shares remain the same. Currently these quantity based allocations are denominated in tonnes (most common) or effort levels, typically the number of vessels (Cox, 2009). Quantity based allocations confuse the allocation decision with other CMMs, particularly the setting of the TAC. This conflation results in tradeoffs on individual allocations, entry to the fishery and the setting of the TACS that drives the allocation of paper fish.

Most allocations are set annually although the IOTC has plans for multi-year allocations. There are some multi-year TACs and allocations under some rebuilding plans and NAFO has a multi-year plan for Greenland halibut (Cox, 2009). While allocations are set annually, in practice allocations tend to change very little from year to year. While identified below as a potential benefit in allocation strategies, allowing quota transfers is very rare. ICCAT does not allow sales of quota, but some transfers do occur between States. CCSBT has considered transfers and has allowed some transfers of bluefin tuna quota to Japan.

Regarding new entrants, three broad approaches have emerged. The first is closure to new entrants. Long established N. American RFMOs (NEAFC and NAFO) are completely closed to new entrants across fully allocated fisheries. They do however allow new entrants in new fisheries that are not full allocated. Second, new entrants are admitted without reduction in current allocations, potentially creating unsustainable harvests. Korea (2001) and Chinese Taipei (2002) were added to the CCSBT with existing members maintaining their existing quota. However they now have a 900t set aside for non-contracting parties and 800t was offered to Indonesia to encourage them to quit fishing illegally.

In another example, the number of parties to ICCAT has doubled since 1995 and most old members' allocations have-not changed. In the IATTC, new entrants are exempted from the fleet capacity limits, which is their only allocation mechanism. The third and final approach is to discourage new entrants and restrict allocations to existing members (Cox, 2009). This relates to the Catch 22 provision in Article VII of UNCLOS. Under that article, any State can accede to the convention, but membership can only be open while the acceding State is engaged in research or harvesting within the convention area. The catch is that only members are allowed to harvest. Unfortunately, allowing new entrants without decreasing current allocation increases capacity and allows free-riding (Van Dyke, 2010).

A common allocation criterion is compliance. The CCSBT and NAFO will deduct identified quota overruns from the next year's allocation. Additionally, sanctions and penalties have been used to punish offending vessels. CCAMLR puts offending vessels on a black list. IATTC suspends offenders from the vessel registry. CCSBT has reduced State quotas and ICCAT applies quota penalties.

While some RFMOs have allocation guidelines/criteria (detailed below), it is difficult to assess if those guidelines have had any impact on allocations (Palmer, 2010). Most RFMOs that have criteria have not consistently engaged in any formal allocation process. Of all 42 RFMOs, only NAFO, NEAFC, ICCAT and CCSBT manage the majority of their stocks with TACs and State allocations. Even across those RFMOs, some allocations for some species have broken down, faced stringent

objections from participants or are currently being ignored. The IATTC has used national effort limits that have been set too high and have only recently adopted CMMs for bigeye tuna to include a TAE/TAC and, for a limited number of States, a specific country allocation. CCAMLR has not adopted State allocated TACs and CMMs that contain an implicit allocation have been rejected by contracting parties. IOTC and WCPFC have only limited effort and catch to existing levels or to levels from some referent period.

Economic Perspective

Many economists view every regulatory decision as an allocation decision. There is considerable depth in the economic literature on allocation.¹⁴ Much of this work is now driven by game theory. From this literature, stable outcomes can only be reached when no State is made worse off by cooperating. Additionally, the mechanism generally needs to be self-enforcing as there is no third party enforcement. There are a number of key findings from this literature.

First, initial allocations must be seen as fair and equitable. In the absence of tradable allocations, if one party feels cheated, they can defect and break the cooperative agreement. Effective enforcement is a requirement in these agreements as the incentive to cheat before the other coalition members cheat is very high. Existence of an equitable allocation is therefore a necessary but not sufficient condition to insure enforceability (Cox, 2009). If the allocation is not supported by adequate MCS, there will be limited incentive to comply with allocation. There can be strong incentives for cooperation via side payments because optimal management will maximize cooperative surplus. Currently side payments, in the form of paper fish, are frequently used to insure agreement on both explicit and implicit allocations.

The higher the surplus is from cooperating over not cooperating, the higher the penalty should be for breaking cooperation. If potential cooperative surpluses are high, it increases the ability to use side payments to achieve cooperation in the first place. To be clear, maximizing surplus may mean that management will prefer one State or group of States over others because those States hold higher values for quota. Without managing to those states that hold the highest values, adequate side payments may not be possible. Generally this is the justification for the necessity of side payments as other participants that have lower values for quota may view this type of management as inequitable and must therefore be compensated in order to cooperate.

In general, the more players there are in the allocation debate the more difficult it will be to reach a stable cooperative agreement. Enforcement and accountability become more difficult to achieve. Consensus becomes harder to obtain. Munro (2007) talks of the importance of sub-coalitions that can effectively reduce the negotiating costs by reducing the number of different parties at the negotiating table. This is exacerbated in most tuna fisheries because the species are highly migratory leading to a large number of potential participants. New entrant claims add to this problem. Allocation agreements must be responsive and flexible to internal and external shocks to keep cooperation, which argues strongly for proportional allocations. This point holds for any allocation shift, even outside of the RFMO problem.

New entrants are a threat to keeping stable cooperation as new entrants free ride on the sacrifices made by current participants. Munro (2007) talks about ending the freedom of the seas doctrine established in UNCLOS. To keep cooperation, allocation set asides should be used to address new entrants and that these set asides should only come from proportional reductions in current participant allocations. Without proportional reductions, sustainability is threatened which may threaten the cooperation. Finally, Munro (2007) says that new entrants should not be allowed if the stock is in trouble.

This is the essence of the paper fish effect. TACs are set too high to be sustainable. TACs are set not based on science but offered as the side payments needed to reach agreement across RFMO members. This results in “paper” TACs that do not bind on anyone and do not promote sustainability, often

¹⁴ This section will contain a brief summary. For considerably more depth, the reader is direct to FAO (2002), Munro *et al.* (2004), Munro (2006) and Hannesson (2007) for specific fishery applications.

against the scientific advice developed by the RFMO itself. In some cases, evidence of this over allocation has been used to lock out new entrants (Palmer, 2010). If new entrants are allowed, their allocations are often created by increasing the TAC further instead of reducing the TAC of current participants.

Quota Trading in ICCAT

The first discussion of tradability arose in 1968 (Palmer 2010). Tradability is seen as one component of an RBM system that can also add flexibility to an allocation system even if not coupled with a strong RBM system. RFMOs are reluctant to adopt RBM for a number of reasons. Exclusivity and excludability are viewed as antithetical to the freedom of the seas doctrine from UNCLOS, however UNFSA improves on exclusivity. If coupled with strong rights, tradability can end overcapacity and is the most flexible allocation system if quota shares are proportional. It is also viewed as the most elegant way to include new entrants, but new entrants would be required to buy their way in to the fishery by acquiring quota. This has actually been criticized for being unfair and inequitable to developing countries and particularly SIDS. Here is a sampling of current trading practices across RFMOs.

ICCAT has explicitly discussed tradability in an ad-hoc allocation working group and there has been widespread dislike of selling or trading quota. 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 with a TAC allocation under paragraph 6 may make a one-time transfer within a fishing year of up to 15 percent of its TAC allocation to other CPCs with TAC allocations, consistent with domestic obligations and conservations 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 percent of the allocation.”

which 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.

In summary, across all RFMOs that have discussed the topic, quota trading for money is looked at disdainfully while quota trading for flexibility is appreciated (Palmer, 2010). This is certainly reflected in the ICCAT approach. Many RFMO participants resist trade on equity grounds feeling that focusing on maximizing benefits through trade will overlook non-economic objectives. Many feel that trade will generate big fights domestically if quota trading reduces the local industry. For example, under trading for money, a country may be better off leasing or selling its quota from a benefit maximizing perspective. However, leasing or selling the quota may reduce employment and cause domestic pressure not to trade. Additionally, unless an entire RBM system is instituted based on strong individual rights, trading may not pass the incentives to conserve resources back to the individual fisher.

International Fora Focusing on Allocation

Kobe I, held in 2007, concluded that tuna capacity was too high globally and that catches were not being set at sustainable levels. MCS needs to be improved and made more comprehensive. Additionally, developing coastal states, and particularly small islands, need help developing their

fisheries but at the same time RFMOs need to address overharvest, overcapacity and allocation of stocks. This led to Kobe II in 2009 that called for reinforcing the mandates for the five tuna RFMOs, addressing the shortcomings of individual RFMOs at the global level and adopting a course of action. Specifically regarding capacity, Kobe II set forth some capacity goals. These goals include two that specifically mentioned allocation including that allocations should be fair, transparent and equitable and that allocations should not constrain access to, development of and benefits from tuna fisheries by developing coastal States in particular SIDS. Kobe III's focus was substantially on allocation (Grimaud, 2010). Kobe III found that allocation methods are not consistent and demonstrate symptoms of the classic common pool problem (Gibbons-Fly, 2010). The participants in Kobe III pointed to the Bellagio Conference outcomes including that allocation rules should be clear, easily understood and applied equally across all participants through the range of stocks.

The Second Joint Tuna RFMO meeting in San Sebastian, Spain in 2009 recognized that allocation is a fundamental priority and should strive for policies that are fair, transparent and equitable also recognizing that capacity is too high. However, meeting participants were reluctant to include such language in their proceedings. The FFA in particular objected because they had been abused by similar provisions in the past. One FFA member was quoted:

“...However, Chair, on immediate action 1.a, FFA members are concerned that we are taking a considerable risk in agreeing to this text (on allocation). In the past, FFA members have been severely impacted upon by abuse of very similar provisions. We echo the sentiments of our colleague from Tuvalu. FFA members will not stand for any attempts to use this to threaten our sovereign rights or development aspirations. Any such abuse we believe will seriously jeopardize the future of the Kobe process. FFA members have moved from our initial position in the spirit of good faith and cooperation. We would urge in the strongest sense possible for all participants to implement it through RFMO processes likewise.”

Due to these objections, the convener's report instead agreed to an international workshop on international RFMO management of tuna focusing on allocation and development aspirations of SIDS. Participants suggest further examination of moving towards rights based allocation in all tuna RFMOs, moratoria on new entrants, examination of allocation criteria, developing and defining transferability criteria and establishing a link between capacity and allocation. The primary question arising from this discussion was what are the most appropriate allocation methods and how can they be implemented? That is still very much an open question. So while agreement could not be reached even on basic statements regarding allocation, the topic is still a high priority. Against previous trends, there is beginning to be interest in quota transferability.

The Bellagio Framework 2010 concluded that reducing capacity will require new approaches that will include rights based management (Bellagio Conference, 2010). They blame overcapacity on the common pool problem that drives the races to fish. They list ways to control capacity including limited entry, buybacks and RBM. This is important because RBM can also be used to address allocations and addressing allocations is one of the primary drivers of considering RBM in addition to capacity reduction benefits.

The Framework listed several challenges in shifting to RBM. Some nations will need to adjust their domestic legal frameworks to incorporate right security. New entrants will require adjustments to the allocation process and everybody with a real interest in the fishery should be able to participate in the allocation decisions regardless of whether the RFMO is inclusive or exclusive. To that end, allocations must; benefit all participants, be perceived as fair and equitable for all participants and reflect both history and the position of developing countries and coastal states. The Framework also recognized that allocation in excess of optimal levels may be needed to achieve consensus, but that this approach is inefficient, reduces long term benefits and may reduce sustainability of the fishery. Compensation or cash/technology side payments are preferable to over-allocation as found in the game theory results presented above. While it may seem like side payments reward those overfishing quota or exceeding

capacity limits or simply lobbying for unsustainable TACs, side payments are preferable to allowing fish to continue to be overallocated to appease the goals of different sovereign nations. The Framework also stated that allocation should be transferable. Transferability increased economic efficiency, provides flexibility (particularly if allocations are proportional and not in quantities) and creates a mechanism to incorporate new entrants. The Framework was clear to point out that if full transferability is not desirable, sub-groups should be allowed to trade such that one State cannot shut down trade for everyone. They were clear to point out that trades should also only occur between willing buyers and willing sellers and that each RFMO would have to establish rules that fit their particular fisheries.

The Framework also suggests that transitional rights or as they term them “sample project” be initiated soon. They suggest that two or more States that are party to an RFMO could each develop individual catch quotas and allow and encourage international trade of that quota. Trade would be short term, not permanent, so as not to create the impression of any State increasing allocations. As another transitional right, they suggest creating individual transferable bycatch limits, highlighting bigeye tuna in PS fisheries again across a small number of initial participants. Allocated bigeye tuna limits could be traded within that State or across States eventually. Interestingly, the Framework states that transferable allocations can be used or retired. They also discussed the use of a tuna corporation that could manage the quota for the fishery as laid out in Allen *et al.* (2010). Transferability, as it grows from these transitional rights, must be able to accommodate coastal State rights and development aspirations.

More specifically regarding developing States, the Framework states that RFMOs should examine assigning time limited rights to current users that expire and revert to developing users. Another way to address developing State aspirations is to levy a landings tax on current quota holders that will be used to fund the purchase of quota on behalf of developing States. Finally, high seas rights could be allocated to developing coastal States and then rented, leased or fished by the developing State.

The Bellagio 2011 Framework laid out 5 key allocation points (Bellagio Conference, 2011). First, RFMOs must clearly define and bind the rights to be allocated. These rights must be based on a sustainable TAC and the asset unit must be defined carefully (tonnes, days at sea, etc.). Any agreement will be undermined if any party can increase catch unilaterally. Any arrangement must bar free riding by new entrants and entry and allocation must be closely linked. Any allocation agreement must start with limited entry as well. They also suggest that proportional allocations are the best and most flexible.

Second, the RFMO must agree on who the rights are allocated to and establish transferability mechanisms. RFMOs must decide whether RFMO will allocate to States or directly to individual fishers. There is no fixed answer to this question they felt, but clear definition is critical. Again in this section they highlighted trading as a way to improve flexibility and suggested that the duration of the right should be at least annual and perhaps even more durable.

Third, RFMOs should develop a mechanism to accommodate coastal States that have rights to increased participation in these fisheries. They conclude therefore that historic catches cannot be the only criteria for allocation, as coastal States have the right to participate and grow their participation as their economy grows. In fully exploited fisheries, coastal States rights to expand must come from reductions from other members.

Fourth, each RFMO must set up a mechanism for effective MCS as accountability is the key to maintaining cooperation. RFMO governance requiring consensus makes it difficult to maintain compliance by meting out sanctions. Allocations must account for the absence of central authority and therefore must be self-enforcing mechanisms to induce voluntary cooperation.

Finally, fifth, the 2011 Bellagio Framework lists maintaining transparency as the last key allocation point. The allocation process must be transparent at all stages. This means that participants must have a high level of confidence in the process and feel that other members are accountable and will fish

within their allocation. Finally, allocations must be perceived as equitable. Participants in the Bellagio conference thought it important to point out that while allocation will be very challenging, there are no insurmountable impediments.

Allocation Legal Framework

RFMOs are governed by the UNCLOS and the UNFSA. Article 63(2) and article 64 of UNCLOS require the cooperation between coastal and non-coastal nations to ensure conservation. In the case of highly migratory species, RFMOs must promote optimum utilization within and beyond EEZs. Article 87 includes the freedom to fish doctrine that says that all States have the freedom to fish on the high seas. This is not an absolute right, but one tempered by other treaty obligations. This includes RFMO regulations aimed at members and non-members that focus on conservation.

The UNFSA strengthened the power of RFMOs as the primary arbiter of CMMs. Article 8 includes a duty to cooperate and only cooperating members and non-members can have access. Any nation with a “real interest” must be allowed to become a member. “Real interest” has never been defined and has become a real sticking point in RFMO management (Cox, 2009). Real interest is not necessarily limited to fishing history. It may also include general interest in common good of conservation and management (Molenaar, 2000; MRAG, 2006). Further complicating this issue is that UNFSA ignores any explicit link between this idea of “real interest” and allocation (Cox, 2009).

UNFSA does define RFMO functions and one of those functions is to agree on allocations, TACs and fishing effort (Article 10(b)). Beyond that, however, neither UNCLOS nor UNFSA speak directly to the allocation process. Looking at Box 1 it is clear that the UNFSA conferences were dominated by the have/have-not divide and delegates never raised allocation because it was felt that it would only aggravate this divide (Palmer, 2010).

But it is clear from other language that allocations must account for and be compatible with other principles and provisions of UNFSA (Cox, 2009). The relevant provisions are in Box 1. These provisions are aimed at new entrant and developing State issues. However, nothing in UNFSA gives developing States a prima facie right to an allocation of high seas opportunities (Lodge *et al.*, 2007). UNCLOS does explicitly give preference to developing nations and landlocked or geographically disadvantaged nations (Grafton *et al.*, 2010). The provisions in Article 11 state that allocations must be tempered by stock status and current effort. This same article is interpreted to limit entry if a stock is fully exploited (Grafton *et al.*, 2010). It is also clear from Box 1 that UNFSA fell short of providing a strong legal framework with regards to allocation and a search for a framework is ongoing. And perhaps that is the right choice as many feel that due to regional and stock heterogeneity the task of developing a strong legal framework is best left to the RFMO.

Box 1**Key Provisions of UNFSA Relating to Allocation**

Article 7: Calls for compatibility of CMMs between coastal States and non-coastal States in RFMOs. This implies that RFMOs should account for coastal EEZ catches, but cannot impinge sovereignty under UNCLOS as long as those rights are exercised in accordance with UNCLOS.

Article 11: Develops a long list of criteria that should be used to determine nature and extent of rights for new members including:

1. Stock status
2. Level of current effort
3. Interests, fishing patterns and fishing practice of new and existing members
4. Respective contributions of new and existing members to conservation and mgmt
5. Needs of coastal fishing communities which are dependent on fishing for the stock
6. Needs of coastal states whose economies are dependent on exploiting living marine resources
7. Interests of developing States where the stock occur in their EEZ

Article 24, 25, 26: Special requirements for developing states relating to:

1. Vulnerability of states dependent on seafood protein for food security
2. Avoid adverse impacts on subsistence, small-scale and artisanal fishers, women fishworkers, and indigenous
3. Conservation and management do not provide a disproportionate burden on developing states
4. Provide capacity building to developing States to enable them to participate in the high seas and facilitate participation in RFMOs. Capacity building to include:
 - a. Financial assistance
 - b. Human resource development
 - c. Technical assistance
 - d. Technology transfer

Allocation is a duty left to the RFMOs tempered by UNCLOS and UNFSA. Those two treaties offer guidance but also create impediments to good governance (Rayfuse, 2007). UNCLOS established the freedom to fish concept basically making it difficult, if not impossible, to limit entry. UNFSA lent some strength to conservation allowing limited entry for fully utilized stocks. However, only the signatories to the UNFSA matter and the treaty doesn't bind third party or non-party States. That is, those that have-not ratified UNFSA do not have to abide by it and therefore cannot be required to report catches.

The upshot of the interplay between UNCLOS and UNFSA is that RFMOs have no legal standing to enforce allocations, or anything else for that matter, against non-members. This is essentially the reason that IUU cannot be effectively addressed and why it continues largely unabated. Rayfuse feels that IUU is the issue at the root of allocation (2007). Only those with a "real interest" in the fishery may become an RFMO member, further confounding the problem. It is unclear what constitutes a "real interest" and, through the freedom to fish doctrine, this cannot be used to bar new entrants. This contributes to IUU fishing. Cooperating non-member status was created to encourage compliance and eventual membership. This technique, however, may instead result in further discrimination against developing State non-members as they are held to higher standards than members (Rayfuse, 2007). Rayfuse goes on to say that property rights are not currently recognized by international law and therefore is impossible to allocate fish but can allocate fishing opportunities. Serdy (2008) disagrees.

In practice, TACs and the issue of allocation did not arise until EEZs were created with UNCLOS. UNCLOS created a spatial and jurisdictional approach to the allocation of ocean resources under the new EEZs and it was believed this would solve the problems of the common pool fisheries resources. It fundamentally changed how RFMOs did business and each RFMO responded differently. The

creation of EEZs shut down some RFMOs and expanded others. In the northeast Atlantic, the high seas areas shrank weakening the NEAFC as most of the commercially important stocks were now within State jurisdiction. In ICCAT, the new EEZs did not trigger a new convention because the old convention defined the entire Atlantic as their jurisdiction. Within ICCAT, no distinction is made between coastal States and DWFNs and this was driven by their interpretation of UNCLOS with respect to highly migratory species. ICCAT feels that coastal States have no jurisdictional claim over highly migratory species within EEZs; a view supported by the USA initially, but was reversed by the 1996 Magnuson reauthorization (Palmer, 2010). To this date there is still no official interpretation of how rights of coastal States and ICCAT jurisdiction interact, generating considerable conflict.

Currently, allocation discussion at the RFMO level centers generally around the needs of coastal States, developing States and SIDS. Two issues continuously rise to the top in discussion of allocations at the RFMO level. First, negotiating parties are reluctant to address participatory rights. All language is very neutral and lacks any strong compliance criteria. In addition, many States, particularly those with currently large shares, have no interest in opening a full debate on allocation. Second, negotiating states have difficulty defining the word equitable and what that means for allocations.

Allocation in Practice at ICCAT

ICCAT has undergone substantial changes due to pressure from coastal States that are also developing States. These States felt there was a lack of recognition of the sovereignty of their EEZs and little recognition of their development needs and aspirations. In 1997 the issue came to a head with the allocation process for swordfish. Negotiations were contentious and only settled in a closed door meeting of delegation heads. Many left unsatisfied feeling the process was unfair. As a result, Brazil and other developing States succeeded in establishing a working group to analyze allocation criteria generally. This generated non-binding Resolution 2001-5 regarding allocation criteria. Debate was contentious and centered on whether it should apply to all stocks or just to currently unallocated stocks, settling on all stocks with gradual implementation to avoid negative economic consequences. Many developing nations joined ICCAT because of the guideline's explicit recognition of developing nation's rights in their own EEZs. In practice, those hopes turned out to be overly optimistic (Palmer, 2010). Southern SWO and Eastern and Mediterranean bluefin tuna negotiations collapsed over allocation criteria. That collapse proved so acrimonious that they failed to roll over previous CMMs. Finally agreement was reached in 2004 for both swordfish and bigeye tuna, but the TAC was set higher than the scientific advice to reach agreement.

ICCAT was established in 1966 and 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 yellowfin tuna in 1971, but decided it was too difficult mainly due to lack of data and assessment capability. Many argued that ICCAT couldn't set a TAC without hard State allocations and many said both TACs and allocations were unacceptable. For bluefin tuna, the topic of allocation did not arise until 1982. Agreement on TACs and allocation for bluefin tuna was difficult and had to be reached in a 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 swordfish, Eastern and Mediterranean bluefin tuna and North Atlantic albacore. 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 is 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, 2011). 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 3 years and are not transferable, except temporarily and with prior approval. This three year time frame is ICCAT's attempt at flexibility. The allocations are not proportional, but are in tonnes. Oddly, non-use of an allocation can result in the loss of that allocation.

From Box 2, 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 capacity and ensures that levels of fishing effort are commensurate with the ICCAT objective of achieving and maintaining MSY."¹⁵ 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, 2006). For instance, in 2002 Mexico was allocated 25t of swordfish in recognition of its aspirations. The 2002 swordfish rebuilding plan included allocations to the traditional parties plus Morocco, Mexico, Barbados, Venezuela, Trinidad/Tobago, UK, France, China and Chinese Taipei in recognition of existing fisheries or aspirations. For Eastern Atlantic and Mediterranean bluefin tuna, 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 bluefin tuna TAC was significantly higher than the scientifically established TAC by allocating paper fish to new entrants.

This experience with swordfish and bluefin tuna is unfortunately similar to other stocks. Bigeye was allocated in 2004, but allocations were not set in stone. It was the result of a negotiated process but based mostly on recent historical catches and not restrictive. South Atlantic albacore is still an Olympic fishery. N. Atlantic albacore 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 has begun moving towards proportional allocations with West Atlantic bluefin tuna. First the allocations were expressed in tonnes, however changes in TACs since that initial allocation have been made proportionally and in 1994 Japan's proportion was lowered and US and Canada's proportion set relative to 1991 participation. Japan's proportion is to increase back up to its original proportion when the TAC is set above 2 660 tonnes. A few new entrants have expressed claims and have received small allocations in tonnes. The current recommendation on the table involves a two step process. List the allocation reductions in tonnes across UK, France, Mexico, USA bycatch and Canada bycatch. Distribute the remainder proportionally based on TAC level triggers.

¹⁵ ICCAT Recommendation 2001-25

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).

Box 2

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:

1. Be a Contracting or Cooperating Non-Contracting Party, Entity or Fishing Entity.
2. 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.

Box 2**ICCAT Allocation Criteria** *Continued...*

- 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.

Source : ICCAT Recommendation 2001-25.

Allocation Discussion

Allocation will be the biggest hurdle for reducing the catch and bycatch of billfish in the Caribbean if some sort of strong right to billfish harvest is desired. Proper allocation of the billfish TAC to individual country or even sectors could create incentives for sound business decisions (Crothers and Nelson, 2006). It can provide for development aspirations and can increase economic efficiency and rents in a fishery. If rights are assigned to the countries or, better still, the artisanal fishers themselves, they can address fairness and equity concerns by capturing those rents in that sector. However it is an incredibly difficult and contentious process that no RFMO has gotten 100 percent correct yet.

TACs and allocation have become an important and fundamental CMM. UNCLOS explicitly recognizes TACs and UNFSA reinforces TACs and adds allocation as a matter of RFMO responsibility. Most RFMOs agree that allocation is important. However, RFMOs are coming to realize that allocation alone does not produce efficiency, particularly when RFMOs are allocating paper fish. Allocation simply passes incentive to be efficient down to the States protecting their sovereignty. That is the issue in the Caribbean. It will be necessary to create country TACs for billfish if the choice is to move towards a strong, tradable individual catch or bycatch right.

Cox (2009) lists a number of options for improvement. First, RFMOs and the stocks they manage are heterogeneous and therefore will require different quantitative allocation regimes. Flexibility is a must and proportional allocations are one tool to increase flexibility as is trade or transferability. Cox (2009) suggests that RFMOs need to gain a broader understanding of economic efficiency as that knowledge can greatly enhance the quantification of allocation.

The focus on equity had taken the debate away from economic efficiency and biological and economic sustainability. Improving economic efficiency has the potential to make cooperation stronger, particularly if there is a way to capture additional rents and use them for side payments. Trade can improve efficiency, but it is a necessary but not a sufficient condition for maximizing economic efficiency. To reach maximum efficiency with trade would require stronger rights and, from the discussion here, reaching agreement in RFMOs is challenging. However, trade could be used to improve the allocation issue without necessarily passing the incentive through a strong right all the way to the individual fisher. There will be arguments against trade because it may be viewed as exacerbating the have/have-not divide. It would be essential to insure that the developing nations were allocated sufficient initial rights and be allowed to participate in the market. Allocating the quota to the artisanal fleets may be a way to address equity questions. If the entire right could be allocated to the have-nots and leased or sold to the haves, it could go a long way to insure equity and fairness.

One solution is a two-tier structure (Chand, 2003). A proportion of the quota would be allocated to founders on a permanent basis while the remainder is classified as flexible. This second portion could be distributed to members or non-member via auction and the proceeds used to fund the administration and management of the RFMO or distributed as a dividend to members (Tronsden *et al.*, 2003). New entrants could enter by purchasing quota at auction. The base share may alleviate developing nation concerns regarding excessive share, particularly if base share trades are restricted or banned. Pontecorvo and Schrank (2001) proposed a similar structure that would see the members fishing under a very conservative TAC with any stock surplus auctioned off as an extraordinary right.

Others have suggested a third party to manage the quota either through the RFMO, a producer organization or a corporation (Cox, 2009; Allen *et al.*, 2010). This structure has the potential to reduce market transactions costs and potentially reduce political influence. If the third party is allocated a special portion of the quota, it can use that to buffer poor reporting or lease it to current participants or new members to fund its operations. Tradable rights require strong enforcement of penalties to work, which may be an impediment for RBM, unless sufficient cost recovery can be collected to fund the MCS. This is similar to the buffer sector approach discussed above under recreational rights systems.

Currently, history dominates allocations in practice, but using history has its limitations. It is convenient because history is easy to quantify. However, because these RFMOs have been built and funded on the back of historical participants it is difficult to move away fro

m history politically. International water use, pollution and fish allocations have a two level structure. First is the allocation between States at the multi-lateral level and, second, between participants within each State. These steps are linked, but there is a large domestic pressure to defend history; both for economic reasons and sovereignty reasons. History can also create perverse incentives as countries are willing to delay negotiations and fish for allocation.

One way to move beyond the qualitative lists that have grown so popular would be to develop weights for each criteria, but that process would also be contentious and subject to political capture. The Parris and Lee (2009) work is a perfect example. All of their scenarios had the objective of developing a formula that would benefit the FFA and PNA the most. Caddy (1996) proposed a multi-objective decision making framework that separates tasks to avoid political capture. First, an independent review panel would quantify the criteria and, second, the weightings would be developed by negotiation. Those that see the value in market based solutions see free trade of secure quota rights as the solution to the allocation problem. That solution carries its own set of challenges as seen in the first part of this project.

Another suggestion is to remove allocation from the setting of CMMs as they are often one in the same process. Allocation should be explicit and proportional for flexibility. With proportionality, allocations do not have to be renegotiated every time the TAC changes or some exogenous shock hits the fishery. TACs should be set independently and transparently before allocation is addressed.

Allocations should be reviewed independently. Currently no RFMO does this. ICCAT has allocation review panels for certain stocks, but these panels are subject to political capture. Again, however, members would have to agree on a review process which is subject to capture in itself. All RFMOs have a dispute resolution process that could potentially be used for this independent review. This could, however, create perverse incentives to influence the TAC through an allocation dispute.

New entrants pose a huge challenge for allocations, particularly concerning equity and coastal States and SIDS. The UNFSA does allow denying entry for full exploited stocks, but this could cause problems if the new entrant was a coastal State whose EEZ supports stock productivity. There are several solutions to this problem. First, over allocate the stock with the understanding that it will be brought down in the future. This option is unattractive because once a right is given it is difficult to then take it back as current RFMO management shows. Second, accommodate new entrants under the existing TAC. However, without side payments, it is virtually impossible to make everybody better off.

Quota trading is likely the best solution. A portion of the quota could be set aside and held for new entrants. If this quota could be leased until new entrants arrived, it could fund acquiring additional quota, fund enhanced monitoring or be used to subsidize participation by SIDS. It would be difficult for current participants to swallow giving up quota that, at best, they could lease back. If the quota is not fished in the interim, it generates a potential free-rider problem that could create the incentive for current participants to never let new entrants join in. Some EU national programs require the annual surrender of a portion of the quota that is specifically held for young fishers.

Grafton *et al.* (2010) set forth what an incentive compatible allocation program would look like. First it would recognize incentives and would involve RBM. They recommend proportionally allocating to the States and not all the way down to the individual. They feel system would have to be fully allocated so the UNFSA could be used to deny entry. Country allocations should be tradable and trades may be the side payments needed to reach successful agreement. To prevent free riding, penalties would have to include temporary reductions, permanent reductions or revocation. If trade was free, developing States were allocated an equitable share of the quota and transaction costs kept low, it would matter little what the initial allocation was as the market would take care of responding to stock issues and exogenous events. That said, it would be important to promote consensus and maintain coalitions by providing a mechanism to incorporate equity and fairness.

RBM Design/Implementation Challenges

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 countries selected for inclusion in the business cases. The biggest design issue this project faces is address the allocation of the bycatch quota. Many feel the current billfish quotas are too high to begin with and setting any cap to trade against would have to be set lower than the current billfish TACs. This is an allocation issue and allocation issues are very contentious withing RFMOs as discussed at length above. 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 level. Beyond the allocation issue, RBM faces many challenges that will also be discussed. One of those challenges is that institutional change can have negative consequences, but those must be balanced agains the need to address the common pool problem (Coulthard, 2011). The remainder of this section will dissuss these larger criticisms of rights based systems.

Conflict is expected between allocations to coastal state fleets versus DWFS. Additionally, the have/have not argument from above will factor strongly. Not all members have local tuna industries, but the EEZs' of these members is 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. Such an evaluation would require the use of bioeconomic models requiring data that is not currently available. Bioeconomic models link stock conditions to harvest behavior. Their outputs include profits. Inasmuch as those models can be constructed to output profits, the profits foregone of any allocation shift can be calculated. A side payment equal to the foregone profits should be acceptable to a country at the allocation negotiating table. At the very least the forgone profit from the model would be a good starting point for negotiating side payments. This is strictly referring to the initial allocations. If trade was allowed between sovereign nations the marketplace would sort out these allocations at the social optimal level.

Ridgeway and Schmidt (2010) list several pre-requisites 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 right 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 their own conditions. Until the individual cooperators are selected, going any further would be foolish. It is important to keep in mind that markets tend to aggregate and consolidate the industry. They also tend to drastically re-distribute income. These outcomes can be very desired or they came be shocking and unwanted or unwarranted.

Rights based management has been criticized for distributional concerns (Cope, 1997 and Degnbol *et al.*, 2006). Both McCay *et al.*, (1996) and Palsson 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. McCay (1995) has also bemoaned the loss of social capital and traditional ways of life resulting from the consolidation of fishing capacity. Consolidation is less of a concern in the Caribbean but if SSFs are not somehow compensated in a rights based solution, there will be negative distributional consequences from moving toward WECAFC wide quota for billfish.

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 Palsson and Helgason, 1995), however it is a little spurious 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 come out pre crew share in this fishery.

Cunningham *et al.* (2009) brings the focus on to 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 and 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). This project would be wise to use this rapid assessment technique for country selection and baseline development so that performance of these business cases could be evaluated.

Governance reform is an important point (Cunningham *et al.*, 2009). This project would do well to take governance into consideration when selecting countries as major reform is certainly outside the scope of these business cases. The selection process should focus on legal regimes, fiscal measures, organizational arrangements, management mechanism and other fishery management infrastructure (Cunningham *et al.*, 2009). For instance, a country with strong fishery fiscal infrastructure, a strong association of recreational fishermen and an existing fishery information system would be far preferable to one that did not have those characteristics. Regarding fiscal measures, wealth in the private sector in developing countries tends to be reinvested within that country, however, in the developing world private sector wealth created may be wasted or invested offshore, particularly in tourism sectors. This means the gap between private and societal benefits may be much larger in developing countries. If keeping wealth local is a goal of this project, it will be important to examine these fiscal characteristics 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. Define the fishery management units is also important. It is insufficient to simply identify industrial/small scale/recreational sectors. The project must drill down to communities, professional organizations or cooperatives. Design should focus out of the box of traditional ITQs and examine corporate or communal organizational structures to keep transaction costs manageable (Cunningham *et al.*, 2009). Rights based regimes increase transaction costs. Transaction cost increase with the heterogeneity of participants and with skewed distributions of potential gains (Libecap, 1989; Baland and Platteau, 1996 and Barrett, 2003). The Caribbean is a very heterogeneous place and transactions costs are expected to be high. 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 patches have exogenously determined timed dependent harvest rates, fishers will compete with these patches reducing rents. FAD fisheries are exactly this sort of fishery and the use of FADs are on the rise in the region. 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 SSF can be really tough. They often do not follow regulations, 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 them out of the rights based system so they are faced with the changes and rationalization that markets and rights can bring. The design must be holistic as small boats can cause as much damage as trawlers. This is becoming a problem for billfish in the Caribbean as the use of FADs to attract and harvest billfish is increasing rapidly in some regions. If not include, they will free ride on the increasing CPUEs and drain any rent created.

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 longline fleet. The recreational fishery is a higher value fishery, but harvests and profits may not stay local. 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. Smith *et al.* (2009) offers a list of potential problems with ITQs. First they may not be suited for international stocks. They do not necessarily address bycatch unless specifically designed to do so. They do not address habitat destruction. They can create incentives to high-grade. They can lead to overfishing of non-quota fisheries. In the same way that rights are particularly well suited for recreational fisheries, they are not particularly well suited to small scale fisheries or data poor species. They can create fleet consolidation, loss of employment and social disruptions. They can concentrate wealth which may be a feature or a bug depending on your point of view. However these detractions can be addressed by dealing with design properly.

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 the aggressive use of WTO compliant trade measure 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 and 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 loser 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 that focus.

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. Ignoring the livelihood portfolio has resulted in forced evictions, child labor, forced labor, detention without trial, among other human rights violations (Ratner *et al.*, 2014).

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, maybe 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 difficult due to scale. Berkes (2006) concludes that regional TACs are necessary among other things. ICCAT is

constrained by weak bottom-up linkages and is dominated by “big science” and powerful developed nations (Berkes, 2006). Defining issues at the highest ecological level, as ICCAT often does, tends to hurt SIDS. SIDS see ICCAT as insensitive to their needs and unresponsive to their issues (Berkes, 2006). This result advocates for a bottom up cap and trade type system that allows SIDS and recreational fishermen to have the flexibility and power to address this bycatch problem.

Solutions to the subtractability problem, or what economist call excludability, require monitoring authority, sanctioning authority and the authority to resolve conflicts. ICCAT represents a classical asymmetric relationship; science and regulation filter down, with no bottom up feedback and the mismatch is driven by scale issues (Berkes, 2006). In the case of ICCAT and the Caribbean the disputes typically 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 the Caribbean will involve a two-step process with the rule formulators operating at the ICCAT 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 overharvest of billfish by DWFNs and, in some cases, artisanal fishers in the case of some of the rapidly expanding FAD fisheries, may provide the catalyst to move towards co-management.

RECOMMENDATIONS

Regulators can attempt to control mortality through top down command and control techniques or through actions that take fisher incentives into account. Regulations that take incentives into account are called incentive compatible regulations and are designed to maximize economic value by inducing fishers to truthfully reveal their preferences elicited by the policy device. Incentive compatible tools include rights based regimes, taxes or royalties or community based management. Regulations that do not take into account incentives are destined to fail and the bycatch of billfish in the Caribbean is an example of this type of failure as billfish resources are overexploited in the industrial fishery and value is being lost in the recreational fishery. Current, top down management policies block the natural behavior and preferences of commercial harvesters, SSFs and recreational anglers such that their normal behavior subverts the goal of the mechanism.

Looking at the six dimensions of rights presented above, it will be very difficult, if not impossible, to achieve all of those characteristics when the playing field includes recreational anglers, small scale fishers and transboundary stocks. However, even attenuated rights offer two major benefits. First, even attenuated rights could grant sectors far more flexibility in how they fish and the quality of fishing. Second, even with only partial integration between commercial and recreational sectors, rights can remove allocation decisions from the political process, increasing efficiency. Both will increase benefits for nations in the region. If the sectors are fully integrated, the market will take care of allocation between commercial and recreational anglers. That is, if sectors are allowed to trade quota or access rights across sectors, the market will establish the socially optimum level of billfish mortality. It is important to frame rights based management as a continuum from a strong individual right to an attenuated right assigned to a cooperative or collective. 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. The only 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 and it has been a success.

Hanna (2009) lists a series of conditions necessary for management change in recreational fisheries. All seven do not have to be met, but the more that are met the easier the change will occur. These are likewise true for commercial fisheries reform. First, fish stocks must be in trouble and the sector must really feel that scarcity. Second, transactions costs of new management must not be too high. This includes cost of initial allocations, set up, operation, conflict management, enforcement, accountability and user costs. The highest transactions costs will come from enforcement and accountability and these costs may well prove insurmountable in some fisheries. Third, the process must be driven by the affected interests. This has been born out in commercial fisheries in a big way. There must be a sector champion and this person or persons must be an insider. Fourth, users must participate in the process. The decisions must be fully representative, transparent and based on consistent expectations. Fifth, management must fully support and recognize that the devolution of management will reduce management costs.

Sixth, enforcement and accountability must be sufficient. For an integrated allocation system to work, commercial quota holders must feel that one pound of mortality on the commercial side equals one pound of mortality on the recreational side. If the differential is too great, trading will cease. If trading cease, market allocation and compensation generation will stop and these are the primary goals of this project. Same goes for tradable FAD days. If a recreational fishermen finds a small scale fishermen on the FAD he has leased, he will feel his money was wasted and will quit leasing FADs. Finally, the change must be viewed as equitable and fair. This may very well be one of the biggest hurdles as small scale fishermen and recreational fishermen alike are very wary of rights based strategies. Fairness concerns include making rights available for all regardless of income and making initial allocation to the sector for free.

Kim *et al.* (2009) developed nine critical rights based management design criteria. First, the definition and measurement scale of the asset unit must be defined carefully.¹⁶ 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 release mortality. For instance, if the asset unit is defined as a tag based on numbers of fish, it will induce higher mortality than a tag based on pounds of fish due to the likelihood of high-grading smaller fish under a tag based on numbers. The reason for this is simple. If a tag is based on numbers of fish, the tag has more value if a larger fish is retained, if commercial fishermen or anglers value larger fish over smaller fish. Unless the law is that all caught fish must be retained, or a catch based right instead of a harvest based right, fishermen will release small fish in favor of a larger fish, all other things equal, under a numbers based tag. Under a pound based right, the value of the right does not necessarily change based on the size of the fish, although it is possible.

Kim *et al.* (2009) propose three asset units: tags for numbers of fish, tags for pounds of fish, and fishing days. Tags must be affixed immediately to the fish (terminating right), but this could induce high grading to terminate the right on only the big fish. Tags for numbers of fish would work well for charter boats with observers. Tags are viewed as having high monitoring and enforcement costs and high transaction costs. To the second point, individual fishers would have to know in advance how many tags to buy, and they may under buy. Charter boats and DWFs, on the other hand, could keep a stock of tags on hand. Fish in pounds reduce high-grading potential, but don't eliminate it. It would be difficult to terminate weight based recreational right because it is hard to weigh fish at sea and it would be difficult to deal with small bits of leftover pounds for recreational anglers and for small scale fishermen that do not catch much billfish. Transactions costs are viewed to be just as high as tags based on numbers.

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. Because TURFs are an assignment to an area, these issues can be alleviated. 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. On the other hand, hunting rights in the US expire annually, and while the commercial right is based on a percentage of the TAC held in perpetuity, quota cannot be rolled over to the subsequent year.

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. The same holds for TURFs and particularly TURFS based on FADs. If it isn't possible for one vessel to exclude other vessels on the FAD for a given time period there will be conflict. With the rationalization of the fishery, the value of the right will increase, increasing the incentive to cheat. 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 US recreational community and many small scale fisher organizations are so against rights based management (Bromley, 2009). It is also a virtually impossible

¹⁶ An asset is a single item of ownership having exchange value. Asset is a common term in the assignment of property rights as in order to assign a right, what is being assigned must be defined.

technique to use for individual recreational anglers because they have no official history; no logbooks, no official landing record at the seafood dealer which may also be the case for small scale fishers in this region. This system is also very inefficient, but the prospect of a windfall payoff to commercial fishermen was one of the most important carrots dangled to buy commercial fisherman participation in these programs (Bromely, 2009). There may be fairness, equity or livelihood concerns that can be addressed by allocating these valuable assets to the most vulnerable sector(s).

All other US public resources that are allocated to private businesses are allocated by auction or lease, thereby allowing the resource rent, or at least a portion of the resource rent, to be captured by the public when the resources are allocated or transferred to private ownership. 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 this case, the entire bycatch quota, or a majority of it, could be assigned to the small scale sector to enhance their incomes.

The final design question is whether these rights are fully integrated or freely tradable across all sectors. 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 all the quota, it could impact the incomes of artisanal and recreational fishermen. If it was determined that the artisanal sector needed to be protected, sales could be banned with quota only available for lease. Or only allow sale to the recreational sector so that they could buy up and retire billfish quota. 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.

Taxes and royalties were not discussed at length in this document. They essentially have the same impact as rights based management, but there is little empirical evidence of their use in the real world (Ward *et al.*, 2004). Taxes and royalties are not used in the real world for a number of reasons. First, setting the optimal tax would be subject to a political process and therefore subject to capture.¹⁷ Second, the optimal tax or royalty would likely be very high and face stiff resistance from the recreational sector. The first best policy would be a tax on mortality in pounds or in numbers of fish. If the tax is set high enough, it would reduce mortality. However, enforcement would be difficult and the transactions costs would be very high. Second best would be a tax on effort, which would be less efficient at reducing mortality but would involve less transactions costs as the tax could be collected before the trip began. This would also make enforcement easier than a tax on mortality, but only marginally so. Overall, a tax or a royalty would face all the same hurdles as all the rights based regimes discussed below without any of the potential allocation benefits that can accrue with rights based regimes. Additionally, setting the tax will be challenging and divisive. Ideally it would need to be set dynamically and updated regularly to achieve its goals. In the few cases where it has been attempted in commercial fisheries the process has been subject to political capture and has not been successful in reducing mortality (Ward *et al.*, 2004).

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 likely that the DWFN will resist any

¹⁷ Political or regulatory capture occurs when a state regulatory agency created to act in the public interest instead advances the commercial or special interests that dominate the industry or sector it is charged with regulating. Regulatory capture is a form of government failure, as it can act as an encouragement for large firms to produce negative externalities.
http://en.wikipedia.org/wiki/Regulatory_capture

attempt to take back the billfish value for the SIDS. As a result, 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, weakens the power of the community. It is difficult but necessary to balance these issues. Enforcement and particularly complete enforcement is difficult, if not impossible, to attain. Fishers are the first link the compliance chain, so if they buy into the community system, enforcement will work. If not, compliance will be weak at best.

Jentoft *et al.* (2010) outline four questions to help shape who is qualified to participate and represent their community. The first involves 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 participating places on their lives should be taken into consideration. Finally, designers must define the system that organizes participation.

Allison and Ellis (2001) advocate for taking a livelihoods approach when designing new community institutions. 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.

McCay and Jentoft (1998) caution that design requires a deep knowledge of the community. This means it is very important to select the community before going too far down the design path and why this document only briefly addresses potential designs. Often, property rights are already embedded within the existing social and political relationships and those should be recognized and codified in the new institution. Coulthard (2011) posits that 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. Often in SIDS, SSFs are trapped in shared poverty (Ratner *et al.*, 2014). This happens when the population exceeds the 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.

These recommendations are by no means the only possible options in the Caribbean but simply solid directions to proceed tempered by general conditions found region wide. It will be very important to evaluate the existing communities on the ground to determine which of these approaches might work or if there is some better way forward. From the discussion above, existing communities may already embody a rights structure and that structure should be used if possible. If existing rights structures exist it may be possible to simply design a trade or compensation mechanism to further the goals of this project. There are two primary directions to go with RBM for billfish in the Caribbean. The first would be a billfish harvest based right to billfish mortality managed similarly to a pollution cap and trade. The second is some sort of TURF like access right to FADs that may or may not include DWFNs. The assignment of that right could be a strong right to individuals or a weaker right assigned to an AMO, a cooperative, a community or a corporation. Finally, the right should be assigned to address equity, fairness, livelihood and vulnerability concerns. These recommendations are should be taken very generally and not as bounds on the direction this project should proceed. The biggest, overarching recommendation from this desk study is that any management shift should begin from the bottom up and should be participatory in nature. Any change in management structure is doomed to fail if the stakeholders are not included in the design of the system.

From the discussion above, the first best solution or maximizing value, reducing fishing capacity and enhancing sustainability would be an individual transferable quota to a proportion of the billfish TAC. However this sort of solution requires the most infrastructure and has the highest transaction costs. If not designed correctly, it may also disadvantage small scale fishers and actually work against

improving livelihoods and decreasing vulnerability. On the other end of the continuum, a FAD based right assigned to cooperatives or AMOs would be in the realm of the second best. The cons of this strategy include not fully minimizing capacity or maximizing value. The positives include reduced transactions costs, perhaps better equity and fairness outcomes and fewer players at the table. A TURF assigned to FADs potentially avoids the contentious and perhaps not legally supported action at the RMFO level as well.

Catch Based Rights

This business case option involves the assignment of an individual right or community right to a share of a TAC. It is therefore predicated on having an establishing TAC. The right can be based on a proportional amount of that TAC or to a set number of pounds. Proportions are recommended so that when TACs change, allocations or shares automatically change. If the allocation is to a set number of pounds, every time the TAC changes it opens the door to contentious allocation fights. Allocation can be in weight or that weight can be converted to tags for individual fish. Tag may be easier to monitor, but may also result in the targeting of larger fish and the discard of smaller fish as a larger fish has relatively more value per tag.

Monitoring and enforcement may be the most expensive for individually assigned rights to a TAC. Each fish must be landed at a controlled or official location and reported and tracked as quickly as is feasible. If a country already has a pre-existing system of reporting to official dealers, this monitoring and enforcement requirement may not be too much of a burden. However, if such a system does not exist, it could be very expensive to institute. Additionally if the small scale fishermen are organized into cooperatives that are vertically integrated through the dealer and marketing segments, it may be possible to add quota tracking relatively cheaply.

Generally, however, individual quotas are criticized for recreational and small scale fishers as transactions costs are assumed high for the reasons discussed above. Those costs can be ameliorated somewhat by switching to tags and perhaps completely by assigning the quota to an angling management organization, a corporation, a cooperative or a community. The community could then manage that catch quota in a way that suited them best. They could manage it weakly as a collective quota with very little change to their current operation, or they could assign a strong individual right. Transactions costs would be reduced as only one entity, or some small number entities, would be responsible for participating in the market place, reducing transactions costs. If transactions costs are too high, it will keep a market from developing and will prevent the transfer of value from the recreational or DWF sectors to the small scale sector.

Additionally, assigning the majority, if not all, of the catch quota to the small scale sector would address equity, fairness and livelihood concerns by keeping the value in small scale fisher hands. Further, restricting trades to lease only would prevent the recreational or DWF sectors from purchasing all the quota and perhaps ending the small scale fishers' ability to harvest any fish. This is unlikely as the small scale fishers could release most of their billfish catches alive if they used circle hooks and practiced good fish handling.

Allen *et al.* (2010) list the potential rights based options in their report. The first and most efficient would be a universal ITQ. This type of management assigns individual vessels a fraction of the total TAC. As with other universal ITQs it would reduce overcapacity, increase rents and maximize asset values. This could also be viewed as the least equitable without constraints on who can own quota as it is possible that distant water fleets or recreational fleets would buy the entire quota. However, since billfish in some countries do not make up a larger portion of total harvest, allowing the purchase of quota by fleets other than the small scale fleet should have very small impacts on that sector. That is in countries will relatively low landings by the small scale fleet, those fishers may chose to take cash payments to not catch billfish at all and would still be able to fish for other pelagics. Alternatively, the sale of quota shares could be banned and DWFs and recreational fleets would be required to lease quota annually. A universal ITQ also requires a heavy MCS and data collection burden. This type of system would generate higher costs, but all rights based regimes require better monitoring. If central

landing requirements, or better still licensed dealer requirements for first landing, do not exist, MCS is likely the most expensive for this type of right. Additionally, cost sharing could cover all or some of these increased costs.

Allen *et al.* (2010) proposes such a system for purse seine bycatch in the yellowfin tuna and bigeye tuna fisheries in the Eastern Pacific Ocean. They call for country allocations set as a fraction of the TAC. This system would only work if the TAC is set low enough and if each nation agrees to abide by the TAC. After assignment to each country, it would be up to the country to decide how the quota was allocated, which could include allowing the country to assign rights within the country and allow trading. This type of system would require separate quotas for each stock and, in the Caribbean case would require separate quotas by sectors (DWFN, small scale and recreational) to address the rent drain associated with commercial gear catching billfish. If the all or most of the quota were assigned to the small scale sector, it would protect the development aspirations of the SIDs by keeping the value of those billfish in the local states.

If the system was imposed region wide, it would require far more coordination and cost. All nations fishing in the WECAFC region would be required to have a billfish quota and the system would have to be agreed upon by ICCAT, CRFM and OPESCA. In all likelihood, it would require a new RMFO for the region. While ICCAT members currently have billfish quotas, non-members do not. Therefore it would require non-members to agree to country level quotas. It would also require that a WECAFC region wide quota be developed. It would also require a mechanism for rents to return to member nations through share auctions, cost recovery or quota rental charges. Finally, as seen above, there may be legal challenges to this type of management of a straddling stock. While this type of region wide quota maybe the only way to have a significant positive impact on this highly migratory stock, this level of region wide change is far beyond the scope of this already ambitious project.

Another possible option suggested by Allen *et al.* (2010) includes the IATTC forming a corporation owned by all owners, internalizing transactions costs. The goal would be to separate property rights from management and harvesting with shareholdings proportional to ownership interest. The corporation, as any corporation, would be managed to maximize shareholder value. The articles of incorporation could be encumbered to protect distributional and equity issues by requiring landings in certain countries and by limiting allocations of harvest to member vessels. The duties of the corporation would include, stock management, collection and distribution of resource rents, generate and allocate annual catch shares, allocate management costs, maintain catch records, balance catches against quotas and apply penalties for bad actors. This does not preclude the cap and trade option, but acts as a way to manage that system in this case. This is very similar to the concept of an AMO or community quota discussed above. This can be viewed more as the umbrella over the system that reduces transactions costs by consolidating the market players into a smaller group.

Corporate rights address many of the negatives of individually assigned rights. It is flexible and can capture full ownership incentives. It can reduce capacity and increase rents and provide for structured sharing of those rents. It provides a clear role for members and allows sovereign nations to hold on to their power. On the downside, it is a regime that would be subject to agency capture, but the corporate structure may provide more transparency than the current system. Finally, this regime has not been tested in the courts and may face similar challenges as an individually assigned quota.

While virtually untested for use in recreational fisheries, Arnason (2009) states that rights based regimes will rationalize recreational effort and increase benefits as they have for commercial fisheries. He goes on to say that the most benefit will be obtained with a fully integrated right that includes all fishery sectors, but tempers that with the statement that transaction costs and enforcement costs must be similar across all sectors. Corporations, communities or AMOs can help ameliorate those problems. In this case, a right assigned to the recreational fishery has the primary purpose of reducing conflict, increasing quality and transferring wealth to small scale fishers.

Next, it has to be decided who is eligible to own the right. If the right is granted to individuals, it is conveniently similar to the current regulatory environment, reducing transactions costs. Individual

based rights, however, make the initial allocation and enforcement more difficult and perhaps more expensive. It has also been proposed that the right be allocated to an independent third party such as an AMO, a corporation, an existing cooperative or a community. These organizations would own the right and would choose how to manage that right. This method could reduce enforcement costs because it could be audited as a whole instead of relying on individual enforcement. Regarding the stock itself, an AMO is also more likely to call for, and perhaps finance (as is the case in some commercial rights based fisheries) better stock assessments. This concept is very similar to the current sector management scheme in New England or community quotas in Alaska.

Should trades of the right be monitored? There is a precedent for monitoring in commercial fishing. It will add to transactions cost, but if trades are electronically tracked, the additional cost will be minimal. Physical tags or permits make tracking easier, but care would have to be taken to avoid counterfeit instruments.

Should owners of the right be allowed to buy and sell the asset unit to make a profit? Open markets are the most efficient, but open trade can have equity implications and increase barriers to implementation. Selling rights freely to the highest bidder also raises excessive share concerns. Recreational groups have big concerns over “corporatization” or aggregation of quota in too few, particularly wealthy, hands. They are very motivated by populist-type arguments and do not want the wealthy to lock out the little guy by purchasing “too much” quota. Kansas deer hunting tags can be sold at a profit, but the tag can only change hands once (Johnston *et al.*, 2007), but otherwise speculation is rare in hunting rights programs.

Nasuchon and Charles (2010) discuss the role of cooperatives when ITQs are also in use. If stocks are homogenous, ITQs can be efficient without a cooperative. However if stocks are heterogeneous, ITQs managed by a cooperative may be more efficient. The heterogeneity can stem from the spatial density of the stocks, distance to ports, temporal variations in value and short fishing seasons. Without the cooperative in these situations harvesters may participate in the race to fish again. However, actions taken by the cooperative are public goods and therefore subject to free-riding. Heterogeneity drives transactions costs as well. In fisheries with high heterogeneity, AMOs, cooperatives or corporations may be necessary to reduce transactions costs.

TURF Type Rights

Many of the same design characteristics and recommendations from the above catch rights apply to the design of TURFs. Typically, TURFs are a weaker right unless the rights within a TURF are assigned to individuals as shares of the TAC within the TURF. If this project uses FADs as a TURF, the right is considerably weaker as excludability can only be enforced on the FAD itself. As soon as the fish swims off that FAD, it is subject to caught on other FADs or in the open ocean. As a result, a TURF on FADs is unlikely to have a positive stock impact unless all FADs in the region are protected, core areas are included in the FAD management area and there is no billfish harvest allowed off FADs, which is unlikely in this case. As a result, TURFs assigned to FADs are best suited for reducing congestion and conflict that happens between commercial fishermen and between commercial and recreational fishermen. It may be possible to improve stock conditions as well if side payments or FAD improvements can be utilized to convince FAD fishermen to use circle hooks when using bait and/or to release all billfish alive.

Figure 1 displays the cumulative harvests of Atlantic white marlin and blue marlin in the WECAFC area (FAO, 2015). The darker red the cell, the higher the harvests. From this figure, several areas of high harvests emerge. If these areas correspond with areas of importance for stock spawning or other areas important to the billfish life cycle, it may prove beneficial to focus on countries in that region. However, blue marlin and white marlin are generally more mobile than striped marlin in the Baja region of Mexico. Further research on billfish regional movements and billfish life cycles will be needed before deciding if core area management could be successful in the region.

Nelson Ehrhardt’s and Mark Fitchett’s presentation at the recent meeting in Panama showed that the majority of reported billfish harvest in the region corresponded with habitat compressed areas.¹⁸ Their habitat compressed areas correspond with the areas of heaviest harvest in Figure 1 just north of Venezuela. Figure 2 displays their areas of habitat compressed area and areas of high billfish habitat use. Those large red ellipses correspond with some of the harvest hotspots. With additional tagging work it may be possible to identify the importance of these areas to billfish and use that information to form a core area where the pilots and future business cases could be directed.

FIGURE 1
Cumulative Atlantic white marlin and blue marlin harvests since 1950 in the WECAFC Area

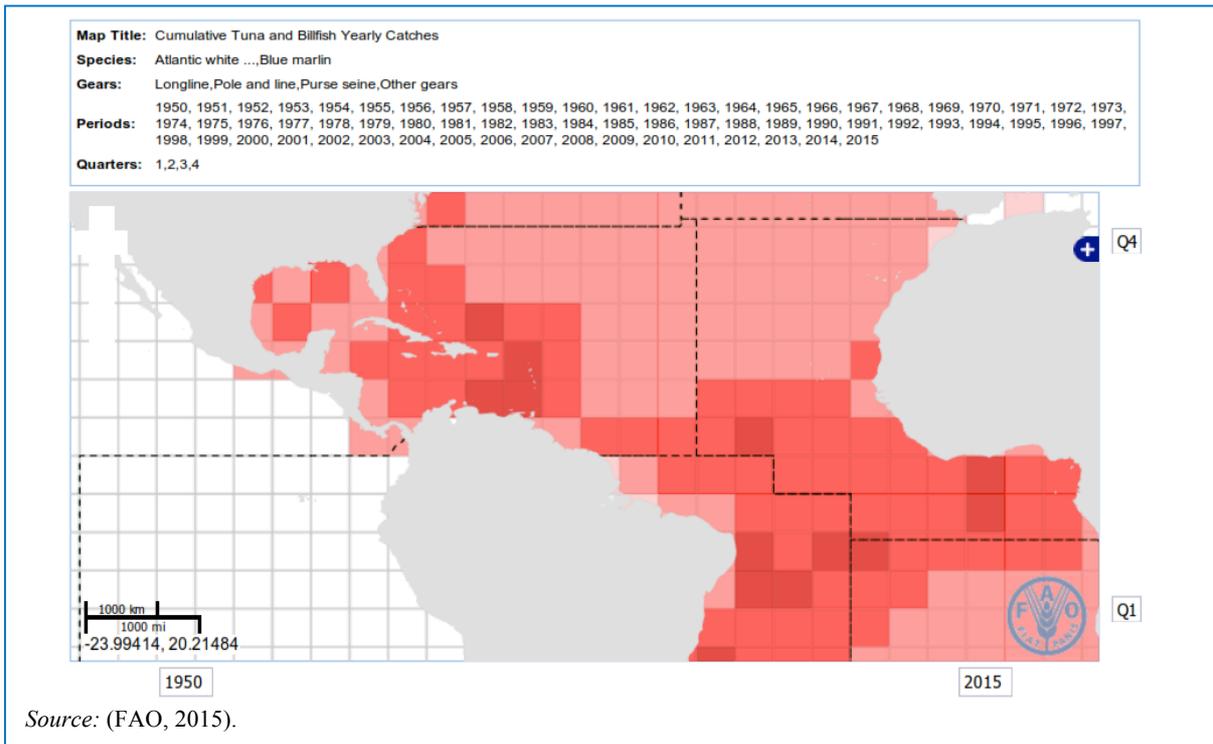
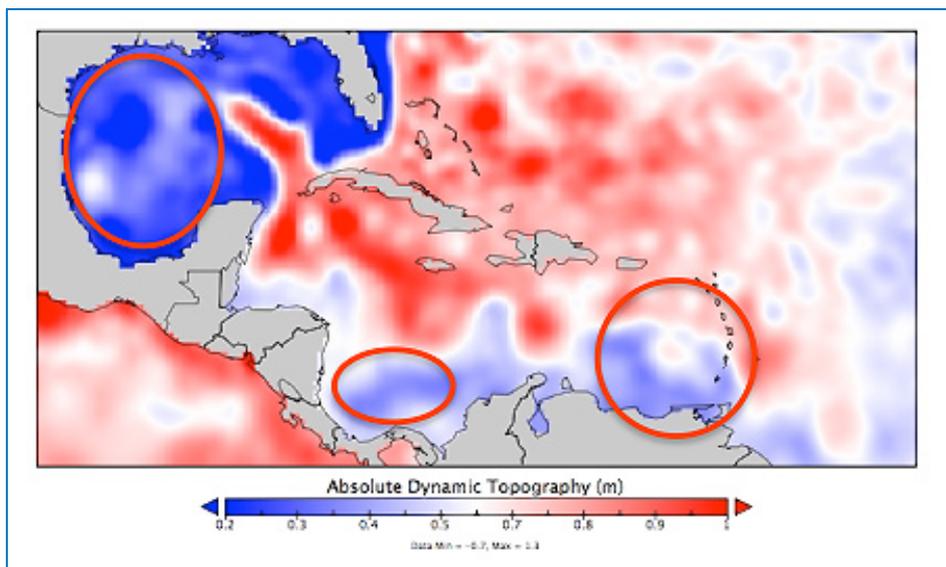


FIGURE 2
Sea Surface Height and Hotspots of Billfish Habitat Use in the Caribbean



¹⁸ Ehrhardt, N. Personal Communication November 9, 2015.

This approach is attractive for a number of reasons. First, congestion and conflict is very high in some regions and that congestion and conflict is rent reducing. Second, it is unlikely that a region wide solution can be orchestrated in the very short time frame this project has for implementation, and a FAD solution could be successful within the EEZ of one country. As discussed above, RFMO level individual or community rights are extremely difficult, if not impossible for legal reasons, to adopt at this time.

Finally, anecdotally, rights to FADs already exists and trades are occurring between the recreational sector and the commercial sector in this region. As discussed at length above, it is important to examine existing rights based structure embodied in current use. For example, there is anecdotal information that recreational anglers will pay cash and trade non billfish catch for the exclusive right to fish over FADs over a agreed upon period of time in the Dominican Republic. In other locations, recreational fishermen have built and installed anchored FADs with the understanding from the local community that they have first rights to fish that FAD when they fish but the small scale fishers in the community can utilize the FAD at other times as long as they release all billfish alive.

Additionally, if a core area could be established, a TURF could be established to that area and rights assigned to community members either loosely or individually. However, little time will be focused here on that approach as the potential core areas identified currently cross multiple EEZs. There is zero experience and no proposals that address this type of TURF.

A TURF on FADs would be a day based right with recreational fishermen or commercial fishermen able to purchase days of fishing on that FAD. Enforcement costs could be high with on water enforcement or could be relatively low if all vessels were required to have VMS, even rudimentary locators, so that position could be determined remotely. The administration and enforcement would require a “transaction center” that would monitor VMS and record and track trades. It may be necessary to couple this type of monitoring with hail-in/hail-out provisions. In this regard, monitoring and enforcement could be far less expensive than an individual or community catch based quota.

Perhaps the most contentious issue facing a TURF based on FADs would be a requirement to register FADs in the program. Also, without limited entry on new FADs, this type of action could lead to the proliferation of FADs as people would place FADs to keep from having to lease FAD days.

Allocation of rights would have some challenges. Ideally, assignment of rights would need to follow current use. However without records on that use, it would be difficult to assign those rights. If existing cooperatives or communities can establish exclusive usage patterns, it would be important to assign rights to those FADs to those users collectively. Overall, it would be best to allocate FAD rights to small scale users collectively. If cooperatives or communities could not be identified and usage patterns could not be quantified, the right could be assigned to the state on behalf of small scale fishermen. The “transaction center” could be a government role with leased day proceeds being distributed to small scale fishermen as cash payments or used for infrastructure or education improvements.

If limited entry is not instituted it presents an interesting opportunity for right assignment. If it is believed that more FADs are a good thing, which is not universally agreed, the right should be assigned to those that built the FAD. This would produce the “optimal” number of FADs because the entire cost would be internalized to the FAD owner. As long as adequate regulations regarding FAD quality existed, it should put the right incentives in place to generate the right number of quality FADs. One requirement would also be to follow the current best management practices being developed for FADs.

One bonus of this type of system is that it could also be used to manage congestion and conflict within the commercial fishermen. If every fisherman was assigned a set number of days, those fishermen could reserve their days on FADs. If those days were given away for no cost, there would be no income issues and it should minimize equity concerns. Without a price, however, incentives are not passed through to the individual fishermen. If congestion and conflict is not a current problem because

commercial fishermen have developed agreements or community norms to avoid conflict, this would not be a concern.

Again, all of the discussion above regarding allocation and right assignment holds for this type of right. Overall, this type of right should be easier to enforce than a strong individual right, particularly when there is a strong existing community or cooperative or in the absence of any standardized catch reporting or on water or dockside enforcement. Additionally, it lowers transactions costs relative individual catch rights and may only involve minimal transaction costs for small scale fishermen with most of the need to interact with the market tied to recreational fishermen. This, of course, is predicated on having a recreational fishery that fishes predominantly on FADs.

The only mechanism in a FAD based TURF that would have a positive sustainability impact would be a moratorium on new FADs. Without such moratorium a FAD policy that included recreational compensation plan could actually increase FAD deployments. Individuals or organizations seeing enhanced revenue from leasing FADs would have an incentive to build and deploy more FADs. Additionally, the new income from FAD leases might also encourage re-investment in FADs. FADs do not improve habitat and increase stocks but simply aggregate pelagic fish making them easier to harvest. Increases in FADs would have a negative impact on stocks. Increases in FADs would have a negative impact on congestion and conflict. At the very least a FAD based TURF should include registration of FADs, even existing FADs, and a moratorium on new FADs. If decreasing FAD numbers were a desired outcome, there could also be provision for a policy of no replacement of FADs as they went out of service or were otherwise lost.

Weak Incentives to Reduce Billfish Harvest

At the recent 2nd Regional Billfish Workshop held in conjunction with the 68th annual Gulf and Caribbean Fisheries Institute meeting in Panama several proposals were made that could be, at best, described as weak rights but more appropriately described as non market based attempts to change incentives and retain more value for the billfish in the region.¹⁹ There is a lot of concern that this effort is a top down one driven by out of region interests. There is a lot of concern that rights based management is not appropriate for small scale fisheries, although their general concerns are really aimed at individual tradable quotas with the goal of capacity reduction. Instead, those concerned have discussed other ways forward that are briefly discussed here. Most of the suggestions focused on having recreational anglers contribute to fisheries capacity building and/or livelihood outputs through formal and informal arrangement without assigning formal rights. Some also suggested fairly standard input controls, output controls or educational campaigns.

Several in attendance felt that by encouraging fishermen to target other species and improving harvest quality and therefore access to foreign markets small scale fishermen could be encouraged to move away from billfish harvest. One participant suggested that if recreational fishers or the World Bank could train small scale fishermen to catch blackfin tuna and handle the catch better, the fish could be sold to an untapped sushi grade blackfin tuna market in the US. It was discussed that could be coupled with limitations on billfish harvest or outright bans of billfish harvest. While a suggestion regarding the ban on the export of billfish met with little resistance at the meeting, most billfish is kept for local consumption anyway. It was unclear how the funds would be raised for this capacity investment or any continued compensation scheme to transfer recreational value to small scale fishermen. It is important to point out that capacity investment activities, such as this, have a habit of increasing exploitation if there was no market or other incentive feedback mechanism to control growth in this new blackfin tuna fishery. It must also be noted that blackfin tuna is another recreational target species.

However, these types of proposals do bear closer scrutiny. If such an effort could be constructed by first instituting limited entry in the fleet with a simultaneous ban on billfish landings, it could have the desired income and sustainability impacts, but still would not involve the assignment of rights or the

¹⁹ November 9-13, 2015. http://www.gcfi.org/Conferences/68th/Panama_en.html

institution of the types of incentives necessary to have the feedback effects rights and a market can provide. This proposal represents the classic investment in fishing capacity tried in previous , failed attempts at economic development through fisheries investment. However, this type of market capacity building could be a way recreational fishers compensate small scale fishers for the loss of billfish, but that compensation needs to be tied to tangible changes in billfish harvest.

Also, this sort of proposal goes against others that expressed concerns about protein security. Several commented that taking away billfish would cause small scale fishers to purchase protein from imported sources exacerbating poverty and impacting resilience. Building supply chain capacity to increase exports would also reduce the amount of fish protein that stayed locally. This policy approach would require examining whether the increase in foreign exchange from selling higher end seafood products would offset the need to purchase imported protein, a loss of foreign exchange.

Finally, an information campaign describing the negative health impacts from consuming billfish was suggested. Billfish, being upper level predators, bio-accumulate many harmful pollutants. By discouraging consumption for health reasons, it could improve the compliance with any ban or other limitation on billfish harvest. A campaign of this sort would also pay dividends in any governance shift and it should actually be made part of any communications strategy moving forward. It bears noting that any of these fishery capacity building suggestions in this section could also be part of the compensation package used in the development of any of the other rights based strategies discussed above.

Infrastructure Needs

This section contains a brief discussion on infrastructure needs going forward. The document above contains much more depth on this topic but it is summarized here. In general, MCS investment will have to increase, perhaps significantly depending on the path selected. Individual right tend to require the highest MCS. There has to be mandatory catch reporting requirements that typically require limiting and licensing dockside seafood purchasers or requiring the monitoring of catch by third parties that might include the government or a cooperative. That data needs to be kept in real time and tied to the individual harvester, or the cooperative if the cooperative holds the quota. Often individual quota regimes require observer coverage particularly when discards have the potential to be a large part of mortality. All in all, individual quotas can be very expensive, particularly if little or no catch reporting already exists.

If a FAD based TURF direction is taken, right enforcement could be accomplished with VMS. This would require monitoring the VMS and that entity would be responsible for managing fishing rights on FADs and resolving disputes. If strong relationships already existed in the region, it might be possible for the vessel leasing the day right to enforce his own right by reporting vessels fishing his leased time. As long as a mechanism existed to report and fine or otherwise sanction the offending boat, it could be a very low cost MCS system. It would be a good idea to work towards strong catch monitoring for recreational and commercial sectors under a FAD based right, but it would not be necessary to achieve reductions in congestion and conflict. Fishery capacity investments involved with this project should prioritize better catch reporting. The second highest priority would be to register all vessels and or FADs and put in place some sort of limited entry.

Better reporting on mortality is desperately needed; both landings that enter trade and dead discards, which may make up a significant portion of DWFN mortality. Typically, discard data is self-reported, if reported at all. That is unlikely to change unless all sectors are required to carry observers or electronic monitoring, and, even then, observer coverage would have to be quite high. Real time monitoring will not be possible without 100 percent check-in after each trip for any of these fleets. 100 percent monitoring is also completely impossible from a practical standpoint and would likely increase transactions costs too high for a rights based regime to be successful. It may be possible to improve enforcement and data collection in individual fisheries with catch cards or targeted panels surveys, but those also increase costs.

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APPENDICES

APPENDIX 1: RESEARCH IN SUPPORT OF CORE AREA MANAGEMENT

Commercial billfish mortality in Mexico began falling as the result of de facto billfish fishing closures. In 1976, Mexico claimed a 200 mile EEZ and began enforcing the EZZ against Japanese longliners in 1977 (Squires and Au 1990). At the time, Japanese longline catches were 30-50 percent of all striped marlin catch globally, which had a huge impact on the striped marlin stock. In 1980, joint venture Mexican longline boats began fishing, which created a three year de facto closure. This small closure may have had an impact as there was a slight rise in striped marlin CPUE, but CPUEs in the area swing with sea surface temperatures. In 1984 and 1985, the Mexican government withheld longline permits creating another de facto closure. Then in 1990, Mexican longline vessels were prohibited from targeting billfish, and, while they are still allowed to sell billfish, there remains only a little bycatch in the tuna/shark longline fishery. In 1998, Mexico began closing areas to commercial longlining formally.

Baja has a unique concentration of striped marlin with higher recreational and commercial catch rates than anywhere in the world (Jensen et al 2010). Squire and Au (1990) showed that temporary closures resulted in rapid stripe marlin recoveries. Genetic research has shown limited exchange with other regions (McDowell and Graves 2008). Striped marlin are the target of one of the most valuable recreational fishery in the Baja region of Mexico (Ditton and Stoll 2003). These factors combined suggest that perhaps the waters off Baja are a “core area” for the species.

Science has shown that fish with higher movement rates benefit less from reserves, in general (Gerber et al. 2003 and Walters et al. 2007). The effects of reserves on billfish related to the assumption regarding the rates and drivers of movement (Martell et al. 2005). Pop up tags deployed in the Baja region show relatively restricted movements of striped marlins (Domeier 2006). This suggests that reserves could be effective in the Caribbean region if a “core area” could be found for one or more species of billfish. If such a core area existed, this study shows that by eliminating, or greatly reducing, billfish mortality in that area, the stock would increase and recreational catches could improve. It would not be necessary to close all fisheries, but only those with heavy commercial mortality of billfish

Jensen et al. (2010) used data for the recreational fishery going back to the 1930s. Release rates in the region were 75 percent and survival rates in at 75 percent (Domeier et al. 2003). This translates into a 50 percent mortality for every recreationally caught fish and that estimate is used in their model. For the commercial sector they use Japanese longline CPUE from 1963 to 1998 in five minute by five minute cells. Catch rates for this fleet are typically 20 times higher than elsewhere in the North Pacific (ISC 2006). Recreational CPUE comes from the US billfish survey conducted by the NMFS Southwest Fishery Science Center which has estimated annual catch and effort since 1969 (Squire 1987). The Jensen et al. (2010) modeling effort used the “Baja California” and “Mazatlan” reporting areas combined.

Jensen et al. (2010) used stock reduction analysis to estimate abundance trends and population dynamic parameter for the period from 1953 to 2002. This is not a complete population model but a model conditioned on catch. They modeled catchable billfish from the vulnerable individuals in the model under three modeling scenarios; observation error only, 25 percent process error and 50 percent process error. The authors analyzed a four year closure, a two year closure and a 100 percent recreational release policy. They used lure only recreational release survival rates with 10 percent mortality under the 100 percent recreational release policy. This is likely optimistic according to Domeier et al. (2003). The four year closure increased the number of vulnerable billfish between 12 percent and 22 percent based on the error assumptions. The two year closure increased the number of vulnerable individuals from between 6 percent and 12 percent depending on the error scenarios. The 100 percent recreational release policy generated between 2.8 percent and 7.5 percent more vulnerable individuals. Under all model results the observation error results only produced the highest change in vulnerability. These results suggest that a closure is more effective, even when the entire range of

white marlin cannot be closed, than mandating 100 percent recreational release. Additionally, recruitment is slightly better under all scenarios suggesting there will be stock growth. This result runs counter to claim that reserves don't work for highly migratory species.

Some of the recovery in the region is not explained by the model and may be driven by weather or other climatic factors. There are caveats. The catch data is uncertain. Artisanal panga fleet catches striped marlin but landings are not reported. Additionally, industrial longliners may have become more resistant to providing data and may be under reporting striped marlin harvest. It is important to point out that tag recoveries have shown that this stock does not move as much as other striped marlin stocks as 90 percent of 306 tag recaptures have occurred within 1,000 kilometers. It is important to point out that mixing rates and spatial distribution of temporary migrants matter for closures to work. The authors suggest that management and conservation efforts should focus more locally. Their modeling strategy does not need stock structure and all stock structures showed rapid increases in abundance resulting from closures.

Several caveats are warranted regarding the use of this study to transfer benefits to the Caribbean. First, blue marlin and white marlin are likely far more mobile and it is likely unrealistic to think that protecting a small area in the Caribbean would produce similar gains for billfish in the Caribbean. Besides the relative mobility of these species, as mentioned above, many of these countries have very small EEZs because of their close proximity. In the Mexico example above, the entire core area was within the Mexico EEZ. As a result, even if a core area for blue and white marlin could be found in the Caribbean, it still may involve agreements between multiple sovereign nations for harvest reductions to be meaningful and produce stock gains. Again, this result is presented as more of a proof of concept. Spatial distribution and movement data is lacking for billfish species in the Caribbean. With better data on movement and habitat use, it may be possible to find a "core area."

APPENDIX 2

TAG PROGRAMS USED IN FISHERIES

Program Location	Species	Tag Type (attached vs. catch cards)	Allocation Method	Cost of Tags for Adult Residents	Tags Create a Limit on Individual/ Total Catch	Number of Tags/Tags Over-subscribed (yes/no)	Mandatory Harvest Reporting
Shark Bay, Western Australia	Pink snapper	Attach	Lottery	AUS\$10	Yes/yes	1 400 (2006)/yes	No
Missouri River, South Dakota	Paddlefish	Attach	Lottery	US\$5	Yes/yes	275 archery, 1 400 snagging (2006)/yes	No
Ireland	Salmon and sea trout	Attach	With license	Free with licens	Yes/no	Not limited, approximately 25 000 /year/no	Yes
Newfoundland	Cod	Attach	With license	Free with license	Yes/no	Not limited, approximately 135 000 /year/no	Yes
Florida	Tarpon	Attach	Purchase	US\$51.50	No/yes (but not binding)	Cap of 2500, 300-400 sold/year/no	Yes
North Carolina and Maryland	Bluefin tuna, white and blue marlin, sailfish, swordfish	Attach (acquired upon landing)	Provided at designated landing spots	Free	No/no	Not limited, approximately 2000-3000/year/no	n.a., tag acquired only when used
Washington	Salmon, steelhead, halibut, sturgeon	Record on card	Purchase in addition to license	First card free with license, US \$10 plus dealer fee for additional cards	Yes/no	Not limited, approximately 650 000 /year/no	Yes
Oregon	Salmon, steelhead, halibut, sturgeon	Record on card	Purchase in addition to license	US\$21.50	Yes/no	Not limited, 208 452 (2005)/no	No

APPENDIX 3

MANAGEMENT FEATURES OF HARVEST TAGS VS. CURRENT MANAGEMENT IN THE GULF OF MEXICO RECREATIONAL FISHERIES

Issue	Features of Current Management	Features of Harvest Tags
Hard Harvest Limits	<ul style="list-style-type: none"> No effective harvest limits imposed; quotas are “soft” or do not exist. 	<ul style="list-style-type: none"> Allows hard harvest limits to be imposed.
	<ul style="list-style-type: none"> Trends towards more restrictive management. 	<ul style="list-style-type: none"> Would require large number of tags, and complex administration.
		<ul style="list-style-type: none"> Number of tags issued should account for potential release mortality.
Season Length	<ul style="list-style-type: none"> Trends towards shorter seasons related to ineffective harvest control. 	<ul style="list-style-type: none"> Can allow for longer seasons compared to non-rights based management, promoting angler satisfaction.
Rights Allocation	<ul style="list-style-type: none"> Harvest open to all anglers subject to license, bag, size, season and other limits. 	<ul style="list-style-type: none"> Requires establishment of mechanisms for allocation of harvest tags.
	<ul style="list-style-type: none"> Rights “allocation” generally not a concern, as management is not rights-based. 	<ul style="list-style-type: none"> Allocation can be complicated by large numbers of anglers; heterogeneous groups; resident vs. non-resident distinctions.
	<ul style="list-style-type: none"> Waiting period or pre-planning rarely required to fish. 	<ul style="list-style-type: none"> Short-term rights can ameliorate some allocation concerns or controversy associated with durable rights.
		<ul style="list-style-type: none"> Allocation can be controversial; allocation methods for scarce tags include lotteries (with preference and/or bonus points) and auctions.
		<ul style="list-style-type: none"> Examples of various successful allocation modes in existing programs.
		<ul style="list-style-type: none"> May involve money cost, effort, or waiting periods to obtain tags; might require pre-planning to target certain species.
Monitoring, Enforcement and Compliance	<ul style="list-style-type: none"> Faces common challenges associated with monitoring, enforcement, and compliance with regulations in large scale recreational fisheries. 	<ul style="list-style-type: none"> Monitoring and enforcement still a challenge, but ameliorated by attributes of harvest tags (ease of observability at check points, etc.)
		<ul style="list-style-type: none"> Requires mechanisms for monitoring tags and harvest.
		<ul style="list-style-type: none"> Can increase voluntary compliance and self-policing among anglers.
		<ul style="list-style-type: none"> Angler education and information materials often required.
Data Collection	<ul style="list-style-type: none"> Recent assessments identify significant limitations with current methods of obtaining data for recreational fisheries, including those in GOM. 	<ul style="list-style-type: none"> Tags can provide data on some or all aspects of recreational fishing.
		<ul style="list-style-type: none"> Wide array of reporting and data gathering mechanisms in current tag programs provides lessons for developing methods for GOM fisheries.
		<ul style="list-style-type: none"> Reporting compliance varies with incentives provided by program.
Revenue Generation	<ul style="list-style-type: none"> Current management mechanisms such as bag and size limits provide no 	<ul style="list-style-type: none"> Revenues from the sale or auction of harvest tags can be used to support management,

Issue	Features of Current Management	Features of Harvest Tags
	mechanism for cost recovery or revenue generation.	education, data collection, and other efforts.
Sector Integration	<ul style="list-style-type: none"> • Private and for-hire sub-sectors face same bag, size and season limits. Regulations rarely suit groups equally. 	<ul style="list-style-type: none"> • Revenues must be viewed within the context of program cost. • Many models for integration of management for private and for-hire groups using harvest tag programs.
	<ul style="list-style-type: none"> • Commercial and recreational sector not integrated under current management. 	<ul style="list-style-type: none"> • Possibility of rights transfer between recreational and commercial sectors; practical mechanisms for integration are not well developed.

This document provides the findings and recommendations from a desk study carried out in support of the Caribbean Billfish Project. It includes an analysis of the motivating factors for rights based approaches in order to address the common pool fishery problems which dissipate rents. Human action depends on the fisheries management approaches followed. The study recognizes that it is a challenge to apply rights based approaches in the developing world. The author states that the answer is to secure rights to the fishery to end the race to fish and to put proper incentives in place to increase wealth and sustainability. The document also describes the characteristics of strong rights and several rights based approaches in commercial and recreational fisheries for billfish.



ISBN 978-92-5-109393-1 ISSN 2070-6065



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I6071E/1/09.16