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Angling management organizations: integrating the recreational sector into fishery management

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Abstract

This paper examines ways to reduce conflicts and improve the sustainability and value of marine recreational fisheries by fully integrating the recreational sector into the management of fisheries. One possibility involves a novel approach, here called *angling management organizations* (AMOs), which combines three of the more pervasive and promising trends in fishery management worldwide—management devolution, strengthened harvest rights, and co-management. AMOs are community-based organizations that are designed to conform to seven basic principles of integrated fishery management, which are described below. AMOs are loosely related to rights-based producer organizations in commercial fisheries, and are expected to strengthen resource stewardship, reduce enforcement and monitoring costs, alleviate management conflicts, and produce greater long-term net economic benefits in recreational fisheries. The other organizational structures considered here, including the management status quo, do not conform to all seven principles and are not expected to be as effective as AMOs.

Keywords: Fisheries management; Recreational fisheries; Rights-based fisheries; Co-management; Community-based management

1. Introduction

Recreational fishing is one of the more popular pastimes in many countries. In the United States, an estimated 34 million anglers 16 years old and older—16% of the population—fished an average of 16 days each in 2001 in both fresh and marine waters [1].[1] Over one-quarter of all recreational fishing occurs in marine waters. In 2000, nine million recreational saltwater anglers made 75 million fishing trips to the Atlantic, Gulf and Pacific coasts, and caught an estimated 429 million fish [2]. Australia has a large recreational and charter fishing sector, in which over one-quarter of the population participate [3]. In New Zealand, there are 400,000 marine recreational anglers out of a population of 3.7 million [4], and estimated recreational catches make up about 35% of the national total reported catch [5].

According to the Marine Recreational Fishing Statistics Survey [2], marine recreational fishing has been growing in most coastal areas of the United States. Marine recreational fishing activity (number of fishing trips per year) increased by over 20% from 1996 to 2000. Nearly a third of this growth occurred in the Gulf of Mexico (GOM) region, followed closely by the Mid-Atlantic region (at just over a fourth), and the South Atlantic region (about one-fifth). The dramatic rise in marine recreational fishing activity has exacerbated conflicts with commercial fishers and depletion of fish stocks. Such conflicts and resource depletion are threatening the future of recreational fisheries in the US as well as in other countries.

This paper examines ways to rescue this future by reducing conflicts and improving the sustainability and value of marine recreational fisheries. We explore options for fully integrating the recreational sector into the management of fisheries. Among these is a novel approach, here called *angling management organizations* (AMOs), which combines three of the more pervasive and promising trends in fishery management worldwide—management devolution, strengthened harvest

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[1] This compares to some 13 million people who are estimated to have hunted an average of 18 days during the same year.

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rights, and co-management. AMOs are community-based organizations that are designed to conform to seven basic principles of integrated fishery management, which are described below. The other organizational structures considered here, including the management status quo, do not conform to all seven principles and are not expected to be as effective as AMOs.

The discussion proceeds as follows. After reviewing recent trends and limitations in recreational fishery management, for which we use the Gulf of Mexico Red Snapper as a case in point, we develop seven principles for the integration of the recreational sector into a comprehensive fishery management program. Based on these principles, we then present a novel, practical option for recreational fishery management: the AMO. This option, loosely related to rights-based producer organizations in commercial fisheries, is designed to strengthen resource stewardship, reduce enforcement and monitoring costs, alleviate management conflicts, and produce greater long-term net economic benefits in recreational fisheries. In addition, we examine five alternatives to AMOs, including the status quo.

2. Issues: conflicts and depletion

The expansion of fishing effort by both recreational and commercial sectors during the 1990s placed fish stocks under pressure in several US fisheries [6], and contributed to increasing conflict between the two sectors. According to the National Marine Fisheries Service [6], the stocks of three of the 10 most popular recreational marine species are not healthy. Overfishing is occurring and stocks are overfished in the cases of red drum (South Atlantic and GOM) and scup (Mid-Atlantic). Overfishing is occurring for summer flounder (Mid-Atlantic), but the stock is not yet overfished. The bluefish stock in the Atlantic is overfished, but overfishing is not occurring.

Conflicts and disputes between the recreational and commercial fishing sectors often center on such factors as the use of different management measures to manage the recreational and commercial sectors, and the explicit or de facto open-ended reallocation of harvest from the commercial sector to the recreational sector, or vice versa [7–9].[2] In addition to conflicts with commercial fishers, the effects of a growing recreational sector have included (1) localized stock depletion in specific geographical areas favored by recreational anglers; (2) overcrowding of productive grounds and declining catches; (3) a potential race-to-fish in the recreational sector; and (4) conflicts between competing recreational user groups.

The sustainability and long-term social value of recreational fisheries are further threatened by on-going trends in management. A recent report by the National Academy of Public Administration concludes that the federal fishery management system has 'increasingly struggled under the burdens of conservation, environmental protection, overexploitation, and increased statutory and policy mandates' [10, p. ix]. Moreover, in the US, the growth of litigation has diverted resources away from the basic tasks of fisheries management.[3]

The system that produces fishery management regulations is cumbersome and inflexible,[4] with a tendency to enact regulations that fishers view as overly complex and inappropriate for their fishery. For example, the federal council system tends to establish common rules for fishing activity over very large spatial scales. While this approach is partially justified on the basis of biological considerations, the use of the same broad spatial scale for establishing management rules threatens the ability of management to optimize socioeconomic objectives. In general, the broader the spatial scale, the more diverse the interests of the fishers, and the greater the difficulty to design rules of fishing that are optimal for all, since acceptable compromises and consensus on common rules are difficult to achieve. These problems are not unique to the US. Many countries have encountered similar difficulties, and have concluded that heavy government involvement in fishery management is burdensome, inflexible, and ultimately ineffective [12].

Other notable trends with potential implications for recreational fisheries management include economic and demographic change, increased use of market mechanisms in fisheries, and the application of rights-based approaches to commercial fisheries management. These and other changes place increasing pressure on existing recreational management regimes [13].

[2] For example, the commercial sector may be subject to a hard or binding TAC, in which the commercial fishery is closed when the quota is met, and any overages are subtracted from future seasons' commercial harvest. In contrast, the recreational sector may be subject to a 'target' TAC, in which violation results in neither closure of the fishery nor explicit deduction from the following year's recreational TAC. Rather, overages in the recreational sector are deducted from the next season's *total* TAC. This management practice imposes an indirect penalty on the commercial sector because the commercial sector receives a percentage of the total TAC, which is reduced by the overages by the recreational sector.

[3] Kammer [11] asserts that 'litigation is hamstringing NMFS. Before 1997 NMFS had 16 open cases [and grew to] over 110 in 2000'. In addition, 'The costs of increased litigation are not funded—this diverts scarce staff and other resources into court cases'.

[4] According to Kammer [11], the National Marine Fisheries Service is the fourth largest regulatory regime in government—behind the Environmental Protection Agency, the Federal Aviation Administration, and the Federal Communications Commission. There is no uniformity in creation of regulatory records across the eight NMFS regions; and each regulatory decision endures eleven levels of review within NOAA.

3. An example: the Gulf of Mexico Red Snapper Fishery

The GOM red snapper serves as a good example of a mixed recreational–commercial fishery that is poorly served by existing management arrangements. It illustrates an archetype in which management has not adequately addressed three primary issues: (1) fishery overexploitation, (2) increasing commercial-recreational conflicts, and (3) heterogeneity in the recreational fishery.

Red snapper is an important component of the large multi-species reef fish fishery in the GOM. It is one of the primary reef fish targeted by both commercial and recreational fishing sectors. Red snapper also is subject to significant incidental catch by commercial shrimp trawls. As a result of combined directed and incidental harvest, GOM red snapper stocks have been placed under substantial and long-term fishing pressure. The stock is currently classified as both overfished and subject to overfishing [6].

Red snapper harvests are currently far below their historical highs, but have remained relatively stable over the previous decade. Recent years have witnessed red snapper mortality increasing in the recreational sector, remaining relatively constant in the commercial sector, and remaining constant in the shrimp by-catch sector [14]. Fig. 1 illustrates commercial and recreational harvests from 1990–2000, along with the commercial and recreational TACs set by the Gulf of Mexico Fisheries Management Council (GMFMC). While commercial harvests in general correspond with the TAC, recreational harvests have often exceeded the official TAC, often by significant margins. While the estimated stock of legal harvest-size red snapper has increased in recent years, the total population shows no evidence of increase and may have diminished [14].

Fig. 2 illustrates the number of days in which the commercial and recreational red snapper fisheries were officially open. As shown by Fig. 2, both fishery sectors reveal a pattern in which open days have diminished over time, even as the total harvest has remained relatively constant. Recent regulatory amendments reveal a trend towards smaller bag limits and increasing minimum length [15]. As in most marine recreational fisheries, the GMFMC sets management regulations over a wide spatial scale. For example, the recreational season for red snapper in the GOM, which runs from April 21 through October 31, applies throughout the Gulf, with no local or regional variation. The particular dates of the open season, however, may not provide optimal benefits to anglers in all geographic areas.

The magnitude of the GOM recreational red snapper fishery and performance of existing management indicates that significant economic gains may be realized through management arrangements that successfully integrate the recreational sector into overall fishery

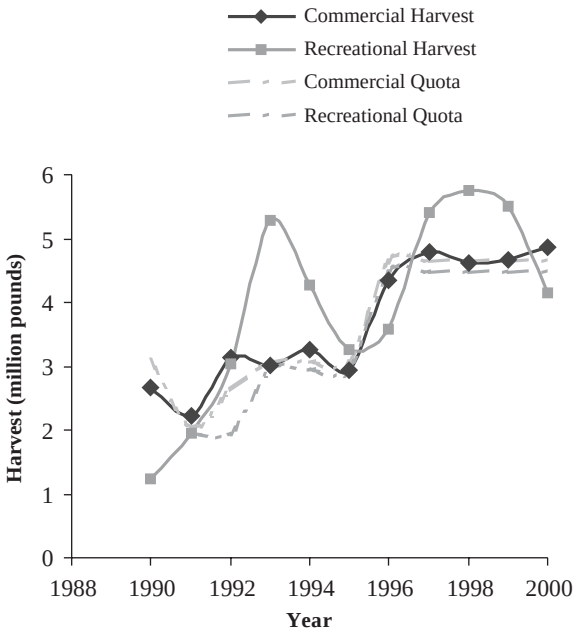

Fig. 1. Gulf of Mexico Red Snapper Harvest and TAC—recreational and commercial sectors (from [14,15]).

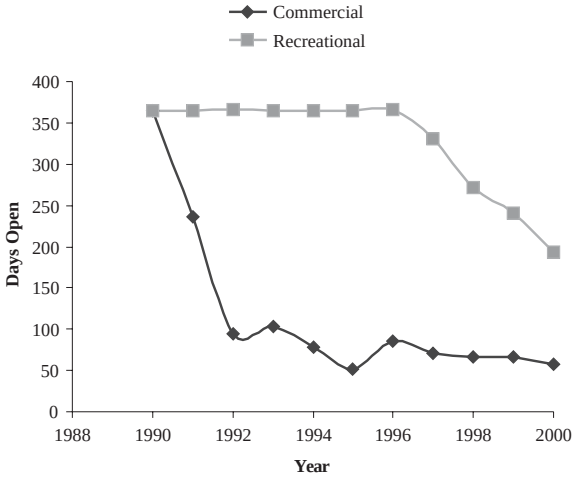

Fig. 2. Gulf of Mexico Red Snapper Fishery days open (from [14]).

management, control fishing mortality, and address the dispersion and heterogeneous characteristics of the recreational fishery.

4. Integrated management

The recreational sector of a fishery is fully integrated into the fishery's management program when management measures applied to the recreational sector are sufficient to enable managers to achieve the goals of the fishery management plan (such as sustainability and socioeconomic objectives), and achieve the agreed upon allocation of catches among recreational, commercial, and other user groups. For example, the recreational

Box 1

Seven principles of integrated management

Principle 1: Integrated recreational management is desirable only where the benefits of integration outweigh the costs of integration.

Principle 2: A workable mechanism must exist for allocating catches among recreational, commercial and other user groups as a precondition for integrated recreational management.

Principle 3: Managers must implement management measures that in practice provide a high degree of control over recreational fishing mortality.

Principle 4: Recreational fishery management should be based on a system of strong angling rights.

Principle 5: Recreational fishery managers should consider assigning angling rights to organizations or other groups as well as individuals in recreational fisheries.

Principle 6: Recreational fishery management should be decentralized with limited management authority devolved to and shared with local organizations and governing institutions.

Principle 7: Cost recovery should be applied to recreational fishery management since it will strengthen accountability and improves the overall performance of the management program.

sector would not be fully integrated into a fishery management program where the management measures provide little or only weak control over recreational fishing mortality; or where the measures allow one sector to erode the amount of catch to which the other sector is entitled.

This section develops a set of seven basic principles for improving the management of recreational fisheries (see Box 1). Each principle builds on the previous principle, and all are essential ingredients for fully realizing the benefits of integrated management.

Despite the potential gains from integration, it may not be socially beneficial for managers to fully integrate the recreational sector into management for all fisheries. The primary element determining whether management should fully integrate the recreational sector is the balance between the social *costs* and *benefits* of integration. These, in turn, depend on the characteristics of the fishery. For example, if recreational catch accounts for a small proportion of total fishing mortality, full integration into the management program may not be warranted. Even where recreational fishing mortality is significant, the costs of full integration may make it undesirable on economic grounds. These costs include the costs of collecting and analyzing data on the sector, and the costs of administering and enforcing the integrated program [3]. This leads to *Principle 1*, that integrated recreational management is desirable only where the benefits of integration outweigh the costs of integration.

Managers must set a TAC consistent with sustainability of fishery resources, and allocate this TAC among user groups. The allocation of catch among user groups often is a highly contentious and controversial process. Integration of the recreational fishery into management does not eliminate issues related to initial TAC allocation. The mechanism for allocation—whether administrative or market-based—must have widespread support among stakeholders. This leads to *Principle 2*, that managers must develop a workable mechanism for allocating catches among recreational, commercial and other user groups as a precondition for integrated recreational management.

Effective management of a fishery requires strong control of fishing mortality from all sources (commercial, recreational, subsistence, incidental, etc.). There are many fisheries in which managers exercise weak control of recreational catches, leading to conflict and unsustainable harvests. A hard or binding recreational TAC appears to offer the highest degree of control over recreational fishing mortality. This leads to *Principle 3*, that managers must implement management measures that in practice provide a high degree of control over recreational fishing mortality.

The current trends of decreasing open seasons and shrinking bag limits in recreational fisheries reflect the fundamental flaws in existing management measures. Such measures are ultimately doomed to failure, because they cannot satisfactorily address pressures related to growth within the recreational sector itself and conflicts with other resource users. Under a system of strong angling rights (a.k.a. rights-based management), existing recreational anglers would be secure from the threat of new entrants into the fishery. The establishment of a secure harvest-right would provide standing and precedent with which the interests of recreational fishery could be protected from those who might otherwise seek to appropriate fishery resources for their own use.[5]

[5] For example, commercial fishers may view a growing recreational sector as a threat, and may seek to influence policy so as to limit total recreational harvest. In fisheries with commercial IFQs, owners may argue that they have more at stake in a fishery than anglers without such rights. In such cases, the commercial sector tends to have a stronger voice, and the recreational sector a weaker voice, in matters of research and management policy [16,17]. Currently, the recreational fishery has little means—outside of costly lobbying activities—to protect itself from these threats and to ensure the long-term

'Rights-based' is a term that is commonly used as a shorthand expression for a management regime that assigns *strong* property rights to users of fishery resources.[6] The assignment of the rights to harvest or fishing grounds may be to individuals or to groups collectively. As Scott [18,19] explains, a holder of a property right has three important powers: (a) the power to use or manage the property; (b) the power to dispose of the property (by sale or grant); and (c) the power to receive the stream of benefits yielded by the property. Examples of rights-based fisheries include those where fishing quotas have been allocated to individuals (individual fishing quotas—IFQs) or to groups (such as community organizations, cooperatives, producer organizations); and fisheries in which spatially defined rights to fish have been allocated to individuals or groups (a.k.a. territorial use rights in fisheries—TURFs).

Rights-based systems have a proven record of accomplishment of promoting sustainable management of fisheries and producing wealth. Rights-based systems effectively constrain exploitation within set limits, mitigate the race-to-fish, reduce overcapacity and gear conflicts, while improving product quality and availability. Producers benefit, consumers benefit, and, when the resource rent is used to pay for the cost of management, the general public benefits. In addition, there are environmental benefits that result from reduced fishing capacity [20,21].

There is a growing awareness of the importance of rights-based fisheries. Several prominent organizations are now urging fishery managers to implement rights-based management approaches. ICLARM, the international fisheries development organization in Asia, argues that '[T]he lack of sustainability and poor economic performance of fisheries management systems can only be reversed if rights-based fisheries management systems are established'.[7] The organization bases its support of rights-based fisheries on a wide range of studies by ICLARM and its partners of management schemes in which community groups hold exclusive fishing rights.[8] Other prominent groups that promote the use of rights-based fisheries include the Food and Agriculture Organization of the United Nations, the Organization for Economic Cooperation and Development, and the National Research Council in the US [20,22].

While recreational fisheries are in many ways different from their commercial counterparts, and the only significant evidence on rights-based fisheries experiences is from commercial fisheries, the sectors share many of the same concerns related to resource stewardship. The distinguishing characteristics of recreational fisheries suggest that while rights-based approaches will likely offer many of the same advantages to the recreational sector as they have provided in commercial fisheries, the details of successful rights-based approaches may differ between the recreational and commercial sector.

As the evidence cited shows, stronger angling rights are superior to weak angling rights. This leads to *Principle 4*, that recreational fishery management should be based on a system of strong angling rights.

Harvest rights need not be allocated to individual fishers. In response to controversies associated with IFQs in commercial fisheries,[9] some management authorities have developed group and community-based alternatives that also feature strong harvest rights. Management authorities in countries such as Canada, Denmark, the Netherlands, Norway, Sweden, and the United Kingdom, have allocated harvest rights to organizations of commercial fishers. Within the US, Community Development Quotas and harvest cooperatives (both in Alaska) represent creative rights-based alternatives to IFQs.

The North Pacific Fishery Management Council implemented a Community Development Quota (CDQ) program in December 1992. The CDQ program allocates a portion of the annual fish harvest of certain commercial species directly to a coalition of villages in the Bering Sea region. The program was an attempt to accomplish rural development in rural coastal communities in western Alaska. In its first year, the council allocated 7.5% of the TAC catch of Bering Sea Pollock to six CDQ groups, organized from 56 eligible communities (recently expanded to 57). They managed their harvest quotas and allocated the returns. The quotas are transferable, and thus those fishing partners authorized by the communities in exchange for royalties can also harvest a portion of this TAC. In 1996, an amendment to the Magnuson Act extended the CDQ Program to include halibut, sablefish, crab and assorted groundfish managed under Federal Fish Management plans.

(*footnote continued*)
sustainability of the fishery. The establishment of a rights-based management system would provide a clear incentive for stewardship within the recreational sector, and a stronger legal basis for protecting the interests of those who benefit through recreational fishing activities.

[6] Note that the term property right, as used in the fisheries management literature, is not necessarily a legal property right—where compensation must be paid by government if the right is taken or substantially weakened. *Strong* rights are rights with high degrees of exclusivity, transferability, permanence, and security [18].

[7] Dr. Meryl J. Williams, Director General of ICLARM—The World Fish Center, in her keynote address at the Sixth Asian Fisheries Forum, November 25–29, 2001, in Kaohsiung, Taiwan. http://www.iclarm.org/news/news_6.htm.

[8] ICLARM, whose mission is to promote sustainable development and use of living aquatic resources based on environmentally sound management, has worked for a quarter of a century in the fisheries of Asia.

[9] Such controversies often surround the initial allocation of quota among individual producers, which can create class divisions in fishing communities, potential threats to the way of life in coastal communities, and the claim by some that the government should not give away publicly owned fish resources.

The Pollock Conservation Cooperative (PCC) was formed in December 1998, to promote the rational and orderly harvest of pollock by the catcher/processor sector of the Bering Sea and Aleutian Islands trawl fisheries off Alaska, through the mutual cooperation of PCC members. The PCC is made up of eight companies that own 19 catcher/processors eligible under the American Fisheries Act (AFA) to harvest and process pollock in the directed pollock fishery. Under the PCC, each company is contractually allocated a percentage of the directed fishery catch specified under the AFA. The cooperatives for the factory trawler sector began in 1999, and the cooperatives for the mother ship and inshore processor sectors began in 2000.

These experiences lead us to propose *Principle 5*, that recreational fishery managers should consider assigning angling rights to organizations or other groups as well as to individuals in recreational fisheries.

National governments are also decentralizing fisheries management by devolving management authority to lower levels of government. In recent years, Canada, Denmark, the Netherlands, Norway, Sweden, the United Kingdom, and other countries have devolved fishing rights and duties to fishers and their organizations.[10] Japan has built on a lengthy tradition of rights-based management and now has the world's most extensive and sophisticated fisheries co-management system [22]. The trend towards devolved and shared management authority emphasizes local organizations and governing institutions [12].

Governments do not typically devolve all management authority, nor do they decentralize all management functions. The authority to make conservation decisions is nearly always kept in the hands of government and at a fairly centralized level. For example, the authority to establish TACs or to establish areas closed to fishing activity typically remains with the government. Socioeconomic decisions, on the other hand, are devolved to lower levels of government or to fishing organizations. For example, in the US, the Atlantic States Marine Fisheries Commission sets TACs for several species and then allocates these TACs among coastal states. Individual coastal states choose various methods to remain within their individual TACs. In Europe, the European Commission sets TACs for numerous species, while individual coastal countries have the authority to manage their fishing fleets so as to maintain harvests within their TACs. In the UK, the government has further divided the country's TACs among producer organizations, and each producer organization is given the authority to manage its share of national TACs to optimize the socioeconomic objectives of its members. In Canada, the government has allocated TACs to community-based fishing organizations and authorized the local organizations to regulate its members to achieve collective socioeconomic objectives.[11]

Why do governments devolve management authority? These countries have found that the sharing of management authority with fishers—known as co-management—reduces administrative costs and greatly improves compliance with management regulations. Decentralized management has proved to be more effective and to produce more benefits than highly centralized management [12]. There are several reasons for this.

First, while centralized approaches may involve the public in fishery management, it is impractical to keep all parties informed on detailed issues and solicit their views on all issues. Accordingly, decision-making is usually delegated to small groups that may not adequately represent the diverse interests that are affected by the decisions. Fishers justifiably feel excluded from the process, and view the resulting rules as imposed by others who do not share their interests. Hence, overly centralized fishery management often loses the trust and confidence of fishers. The rules have little legitimacy in the eyes of fishers, who are not willing to comply with the rules unless coerced to do so by enforcement authorities.

Second, centralized management approaches tend to establish common rules for nearly all aspects of fishing activity over large spatial scales. This approach is partially justified on the basis of biological considerations, since stock status must be evaluated at broad spatial scales. The conventional approach to management adopts this biological scale as the unit for management and for establishing rules of use. However, the use of the same broad spatial scale for establishing management rules threatens the ability of management to achieve socioeconomic objectives. In general, the broader the spatial scale, the more the diverse the interests of fishers, and the greater the difficulty in designing rules that are optimal for all. Acceptable compromise is often difficult to achieve. The inappropriateness of common rules tends to alienate fishers, who often feel excluded from meaningful participation in management decisions.

Third, a decentralized system can draw on the knowledge and social networks available in local communities. It is well known that regulations are more

[10] We use the term devolution to refer to the act or process of shifting some decision-making and implementation authority to lower levels of government and to non-governmental organizations and individuals. Managing fisheries requires that management authority is distributed across several levels of government and users of the resource. Co-management is where this authority is shared with users of the resource [23].

[11] See, for example, James [24] for an excellent analysis of the experience with co-management in the fisheries of British Columbia, Canada.

effective when developed and implemented with extensive involvement by fishers. Resulting regulations are more appropriate for local circumstances and fishers are more willing to monitor one another and to comply with the regulations since they feel that they have a stake in the management program. In addition, we expect that fishers will be more willing and able to invest some the increased economic benefits from properly managed fisheries towards research, enforcement and habitat improvements.

Both reasoning and evidence lead to *Principle 6*, that recreational fishery management can be improved by more decentralization, where limited management authority devolved to and shared with local organizations and governing institutions. The key question is how to accomplish this in specific cases. We address this issue in depth below.

Governments allocate significant financial resources to fisheries management—principally on research, enforcement and management administration. OECD countries governments spent a total of US $2.24 billion in 1997 on fisheries management [25]. This amount is equivalent to 6% of the value of OECD fisheries landings. Most fishery management programs are entirely financed by taxpayers. However, a few countries in recent years have made major changes in the way fishery management services are financed and provided. Australia, Canada and New Zealand have implemented user charges to recover the costs and devolved or made contestable the provision of fishery management services.[12] The Commonwealth of Australia began applying in the mid-1980s the principles of cost-recovery in a wide range of administrative and program delivery areas.[13] Canada, in the mid-1990s, began collecting user fees from license holders in the Atlantic and Pacific commercial fisheries.[14] New Zealand switched from collecting fishery resource rentals to cost-recovery in 1995.[15] In the United States, the Sustainable Fisheries Act of 1996 authorizes collection of user fees on fisheries managed using IFQs and CDQs. Other countries, like Denmark, have a partial cost-recovery framework [27].

Who pays and how they pay for management services influences the performance of a fishery as well as the nature and extent of fisheries expenditures. Financing is often viewed as 'merely' a distributional issue, but in fact sustainable financing has become an increasingly important issue not just to ensure that revenues cover costs, but also as a way to affect incentives that encourage favorable behavior and discourage unfavorable actions. Cost-recovery measures have the potential to realize significant improvements in the overall performance of fisheries management. In other words, cost-recovery can improve economic efficiency and conservation of fishery resources [28].

Efficiency gains can come from two sources. The first source of efficiency gains is improved cost-efficiency in the production of services, such as research, administration and enforcement. The second source of efficiency gains is the production of a more valuable mix of management services—a mix that better reflects needs of the users. Simply put, government managers have less of an incentive to minimize costs associated with management, and less of an ability to identify the mix of management services most valued by resource users. In the absence of well-defined fishing rights, government control over management services and research may be required, as individual users have little incentive to pursue activities or management methods that sustain the resource in question. However, within a strong rights-based system, users have a stronger stewardship incentive. In such cases, society typically gains when resource users both pay for and influence the set of management services or mechanisms applied.

We conclude this section with *Principle 7*, that cost-recovery should be applied to recreational fishery management, since it will strengthen accountability and improve the overall performance of the management program.

5. Angling management organizations

In this section, we propose a method for fully integrating the recreational sector into the management

[12] The term contestable, in this context, means that there is a competitive bidding process that determines who provides the management services (research, enforcement, administration), and the cost of same.

[13] The cost-recovery policy is based on the philosophy that users of Commonwealth services should pay for services in proportion to the benefits they receive. The Australian Fisheries Management Authority is required to recover 100% of recoverable costs which include the running costs of Management Advisory Committees and Consultative Committees, licensing, AFMA's day-to-day fisheries management activities, the cost of maintenance of management plans, logbooks and surveillance.

[14] Canada follows the 'user pays' principle in which those who benefit from a public resource pay a fee that reflects the value of the fishing privilege. The fees recover some of the costs of dockside or catch monitoring, at-sea observers, basic fisheries science, enforcement and other fisheries management services. The cost-recovery charges are paid to either the government or private contractors, whichever provides the service. The charges for services provided by private contractors are set on a competitive basis over which government has no control.

[15] At first, fishery management costs were recovered on the basis of the 'avoidable cost' principle, which involves recovering the government's costs that otherwise would have been avoided if the fisheries were not used for commercial purposes. After discovering first-hand that the avoidable cost approach led to numerous problems, New Zealand changed, in 1999, the basis for recovering costs from an avoidable cost approach to an efficiency-based approach [26]. Under the efficiency-based approach, those who benefit from a service pay for the cost of such service.

of red snapper in the GOM. Integrated recreational management appears to be highly desirable in this fishery. Recreational catches are significant in the fishery and are approximately comparable to commercial catches. Recreational catches have often exceeded the recreational TAC set by the GMFMC and, over time, the length of the open fishing season has diminished, bag limits have become smaller, and the minimum fish size has increased.

Principles 1, 2 and 3 are already satisfied in the fishery. Under the reef fish fishery management plan, a mechanism currently exists for allocating red snapper catches among recreational, commercial and other user groups as a precondition for integrated recreational management. The plan sets a TAC for the recreational sector, which, in principle, provides a high degree of control over recreational fishing mortality.[16] The problem to date has been that the measures for implementing the TAC (bag limits and seasons) have not always succeeded in limiting recreational catch to the TAC limit.

At present, principles 4–7 are not satisfied in the fishery. Principle 4 states that recreational fishery management should be based on a system of strong angling rights. Given the advantages of rights-based management and the potential costs and complications associated with individual recreational quotas (explained below), we propose establishment of a novel set of institutions that we shall entitle AMOs. AMO management conforms to the seven principles enumerated above, and represents the combination of devolved co-management with rights-based fishery management. As detailed below, AMOs are appropriate for fisheries in which (1) the apparent benefits of integrated recreational management outweigh the apparent costs of integration, (2) a workable mechanism exists, or can be created, for allocating catches among all user groups, and (3), managers implement management measures that provide a high degree of control over fishing mortality—our first three principles of integrated management.

AMOs are non-governmental organizations comprised of groups of recreational anglers (cf. Principal 5). Unlike traditional IFQ management in which rights are assigned to individuals, here angling rights are assigned to AMOs, through an assignment of a fixed share of the recreational TAC. Individual recreational anglers obtain the right to manage a proportion of the recreational harvest through ownership of shares in a particular AMO, much as one might own shares in a private company. After initial distribution, AMO shares may be bought and sold much like shares in companies are traded on a centralized stock market or exchange. Some of the more important attributes of the AMOs include: Each AMO has the exclusive right to determine how its share of the recreational TAC is used; it has the authority to implement measures to optimize socio-economic objectives; it is a non-governmental organization of anglers; it is financially independent and sustainable; and it provides equal opportunity to fish to all anglers.

The proposed system would devolve limited responsibility to AMOs—an application of co-management to the recreational fishery (cf. Principle 6). Each AMO would be jointly responsible for ensuring that its share of the TAC was not exceeded. The consequence of recreational TAC violation at the AMO level would be a reduction (either temporary or permanent) in its share of the recreational TAC. Hence, there would be strong incentives for self-policing of member anglers. Moreover, because each AMO—and by extension AMO shareholders—would have a strong right to a certain share of the total harvest, the advantages of rights-based management would be maintained.

In contrast, were standard IFQs to be applied to recreational fisheries (in which quotas were held by all individual anglers), management authorities would be responsible for overseeing the harvest of all anglers—a more costly form of centralized management. In addition, the highly dispersed and heterogeneous nature of recreational anglers would tend to complicate the use and enforcement of IFQ management. Unlike commercial fishers—typically fewer in number and with easily identifiable locations at which harvests are landed—recreational anglers are more numerous and may land harvests at locations that are more difficult to observe. Moreover, transactions costs associated with the management and trading of quota shares, as well as the integration of anglers into the quota management system, are likely to be greatly inflated as the number of individual recreational quota holders increases.[17]

AMOs satisfy all seven principals. AMOs represent a rights-based approach in which rights are held by well-defined angler groups. Moreover, both management authority and cost—to a limited extent—are devolved or decentralized to local organizations with a clear stake in the resource. The proposed AMOs can be viewed as logical extensions of many existing angling organizations, and are not dissimilar from some producer

[16] This does not explicitly address the issue of recreational high-grading, discard mortality, or the potential mortality associated with catch and release fishing. Schirripa and Legault [15,29,30] illustrate that in recent years, a substantial portion of the total red snapper harvests are subsequently released. However, problems of discard mortality under the proposed AMO management are expected to be no greater than exist under current management. Moreover, the increased stewardship incentives (among recreational anglers) encouraged by the rights-based attributes of AMOs may diminish discard mortality.

[17] As explained below, IFQs may be appropriate for the for-hire sector of a recreational fishery.

organizations that now play active roles in the management of several commercial fisheries (such as the cooperatives described above). However, as explained below, there are some important differences in institutional structure and performance between the proposed AMOs and commercial producer organizations. The following sections further detail the attributes and characteristics of AMOs, as they would be applied to GOM red snapper or similar recreational fisheries.

5.1. Rights and duties of angling management organizations

Each AMO shall possess a bundle of rights and duties. The foremost right is the exclusive right to catch a share of the sustainable total catch of a species each year. Each AMO shall have the authority and duty to manage the organization's quota, and would be responsible for developing and implementing appropriate controls on catch. AMOs would be authorized to administer and enforce management measures imposed on the fishery by the AMO, and be bound to use all reasonable means to maintain the total annual harvest under its quota.

5.2. Ownership of angling management organization shares

A group of shareholders would own and operate each AMO. AMOs shall be non-governmental organizations that take the form of conventional business (for-profit) entities, such as a corporation, limited liability company, or limited partnership. Shares of the AMOs shall be publicly traded, primarily to insure that the rights of minority shareholders are adequately protected.

Individual shareholders do not directly own a quota or right to a certain quantity of harvest, however. There is a distinction between owning a share of an AMO, and having the right to harvest a particular proportion of the quota under control of that AMO. In other words, individuals do not have exclusive authority over a share of the organization's quota. Rather, all AMO shareholders collectively share the authority to manage the quota, which may be distributed to individual anglers (both AMO members and non-members) through a variety of mechanisms. That is, the AMO as an organization has a strong right to a certain quantity of harvest. Ownership of the AMO, in turn, is held by shareholders.

Each AMO is free to determine the use of its quota that will provide the greatest benefits to its shareholders, subject to certain rules that provide equal opportunity to all anglers. However, this opportunity, in turn, may be subject to the angler's willingness to pay a license, access, or other fee. For example, an AMO might (1) auction off the right to fish in certain areas, (2) sell fishing licenses or rights to a certain quantity of harvest, (3) conduct fee-based fishing tournaments, or (4) conduct lotteries for rights to harvest in prime fishing grounds, among other options. As long as the right to participate in these programs is open to all interested anglers, they would be allowable. The right to raise revenue from the fishery resource provides the critical strong incentive for resource stewardship that is the hallmark of the proposed AMO program.

This is directly analogous to private companies who manage capital resources for profit. For example, a company that owns a private fishing lake may charge individuals for the right to fish in that lake. In this case, equal opportunity implies that all individuals have an equal opportunity to purchase fishing rights for that lake; it does not imply that individuals may access the lake without charge or constraint. Similarly, private landowners may conduct lotteries for game harvests on their land. All hunters have an equal opportunity to participate in the lotteries, but only a limited number would be chosen for the hunt, and even then must pay an access fee.

With share ownership, stakeholders have a valuable stake or interest in the AMO and in the fishery. Share ownership provides the incentive for shareholders to utilize more efficiently the resource than they otherwise would under alternative institutional arrangements. Owners would face the full consequences of their decisions regarding management of the AMO. As a result, shareholders would have the incentive to efficiently manage the AMO and the fishery. Ownership of the AMO provides a strong incentive to find ways to maximize the value of recreational fisheries (management methods, access facilities, habitat, artificial reefs, etc.). As ownership may (initially) be distributed in some fashion to current fishery stakeholders, the right to benefit from the capital resource would be assigned to those currently using the resource. The subsequent ability to buy and sell AMO shares would provide the ability for others to "buy-in" to any AMO.

Under AMOs, recreational fish stocks would be viewed as capital assets. The owners of the rights to use the assets (AMO shareholders) will seek to maximize the value of recreational fishing in order to maximize the value of their portfolio of these assets. Ownership of AMO shares is important also for creating incentives to develop and use meaningful sources of AMO revenue. Otherwise, the pressure for creative solutions is not present and members would constantly be approaching government for subsidies and other forms of support.

Share ownership is superior to other forms of ownership. If the AMOs were to hold the quota in trust for anglers, there would be no strong incentive to invest in the fishery and improve the benefits of fishing. A trust

would not necessarily attract the most able managers and decision makers. Hard decisions would be postponed or avoided and significant achievements rare. Rent seeking would sap resources and the value of recreational fishing would suffer.[18] The same problems would occur if the government, whether local, regional or national, were the trustee. Hence, private ownership of shares is the superior alternative.

5.3. Membership in angling management organizations

AMO membership shall consist of voting members and non-voting members. The voting members shall be the shareholders of the AMO. Non-voting members could attend meetings and serve on AMO committees at the discretion of voting members. AMOs are expected to encourage participation by other stakeholders in order to resolve conflicts or identify and avoid conflicts before they arise. Voting is proportional to the number of shares owned. The AMO can decide to issue shares, or reduce the minimum number of shares held, to increase its membership. Membership ought to be open, with all citizens eligible to acquire shares.

5.4. Management measures and authority

The AMO has the authority to manage the organization's quota. With that authority, the AMO will be tempted to use input controls and management measures other than the quantity of fish taken. To what extent should this authority be granted? A management measure, such as a ban on a certain fishing method, would be considered legitimate and acceptable if it were done for sustainability purposes. However, if the measure is used solely for allocation, i.e., to exclude or disadvantage some users, it is of questionable merit, and must be discouraged or banned.[19]

5.5. Access to the fishery under angling management organization management

All anglers ought to have equal opportunity to acquire a unit right of access to the fishery. However, the AMO must have the ability to restrict access to the fishery in order to manage its quota effectively. The right to fish (defined in terms of fish caught, days fished, etc.) can be allocated to a limited number of anglers so long as each interested angler has a fair and equal opportunity to acquire the right. It is critical that AMO guidelines are established to prevent intentional or unintentional disenfranchisement of certain angler groups. While AMOs would have the right to charge fees for fishery access, it is important that these fees do not become a de facto barrier to entry, preventing fishery access to less wealthy anglers. Hence, the structure of allowable fees, along with any limitations on those fees to encourage equitable access, would be specified prior to the establishment of any AMO.

5.6. Characteristics of quota and shares

The unit of quota—whether in weight or numbers of fish—is one of the more important issues. It would likely be best to specify recreational quota in terms of numbers of fish rather than in terms of weight.[20] Basing quota on numbers of fish greatly simplifies offloading, reporting, and enforcement by eliminating the weighing requirement. In addition, most recreational anglers are familiar and comfortable with management measures based on numbers, rather than weight, of fish landed. Limits on pounds of fish landed are not commonly used in recreational fisheries, because of the higher number of vessel landings and dispersed nature of the fishery. Moreover, since sport-caught fish are not bought or sold, it is impractical and expensive to have enforceable weigh stations at all sites of sport landings [32]. For these reasons, it is anticipated that quotas should be denominated in numbers of fish rather than by weight.

Other important characteristics of quotas and shares include the duration, divisibility, and transferability of both quota and AMO shares. Greatest security and value of rights are provided by those with a certain, indefinite duration, complete divisibility and transferability. In most instances, there is no reason to specify these characteristics to be different from those required for commercial quota or for shares in any legal company.[21]

5.7. Quota trading

Rights are stronger when no or few restrictions are placed on quota trading. Trades of any quantity of quota ought to be allowed at any time, and between any quota holders. In other words, quota trades should be allowed among AMOs, and between AMOs and commercial fishers. However, while unrestricted trading of quota among different AMOs would offer the potential for the greatest net benefits of the fishery resource, it could also risk the concentration of harvest

[18] Rent seeking is a term to describe actions by individuals and interest groups designed to restructure public policy in a manner that will either directly or indirectly redistribute more benefits to themselves [31].

[19] In addition, the usual provisions of business laws in most states would protect the rights of minority shareholders in such circumstances.

[20] The plan for charter IFQs in the Alaska halibut fishery involves issuing quota in numbers of fish. The Alaska Department of Fish and Game will translate numbers to pounds based on an average weight estimate.

[21] Some of the other characteristics of quotas and shares are discussed above.

shares in a particular geographic region, leading to potential localized depletion. Moreover, anglers and managers are likely to be at first unfamiliar and uncomfortable with unconstrained trading. Accordingly, some restrictions on quota trading may be desirable. As an example, the plan for charter IFQs in the Alaska halibut fishery allows charter boat operators to purchase IFQ shares from the commercial fishery, but shares originally allocated to the charter sector cannot be sold to the commercial sector. Constraints such as this are sometimes required to insure acceptance and/or a smooth transition to the implementation of a quota trading scheme, and to prevent localized stock depletion. After a trial period (e.g., 5 years) restrictions ought to be evaluated to determine whether they should be relaxed to further strengthen angling rights.

5.8. Funding and sustainability of angling management organizations

AMOs have the potential to be financially independent. Indeed, fiscal independence and sustainability are critical features of the AMO structure. AMOs must be fully responsible for raising their own revenue and covering their own costs. Otherwise, inefficiencies are certain to occur. The need to be fiscally sustainable creates a potent incentive to maximize the value of the fishery net of the costs of management.

To conform with Principle 7, each AMO shall have the right to raise revenue to cover the cost of its management program (research, enforcement and administration) in several ways. One is to lease quota to parties who are willing to pay for exceptional rights to the quota, such as charter boats, fishing tournament organizers, and commercial fishers. Another is to authorize the AMO to impose levies on users of the resource (license, fuel, tackle, etc.). The AMO could impose a surcharge on share trades to raise revenue. Additional shares can be sold to raise funds. The AMO would be given exclusive authority to organize fishing competitions, and to receive and sell the fish caught in said competitions if it so chooses.

Each AMO ought to have the authority to decide whether to allow anglers to sell their catch. Allowing sale of fish results in the more efficient utilization of the resource. An angler who catches some fish and who values the fish less than others in society is improving social welfare by selling the fish. Being able to sell fish also enhances the value of the recreational fishery. An AMO may choose to allow sale of recreational fish only at specific outlets and collect a levy on the sale. However, allowing sale encourages anglers to change the recreational nature of the fishery. If no comprehensive reporting system is in place, selling also may tend to weaken compliance and create serious enforcement problems.

5.9. Spatial attributes and considerations

The quota rights held by each AMO ought to be defined for a specific spatial area as well as the quantity of each species that may be caught. This would enable each AMO to limit the number of anglers and other users who have access to the area. Having the right to control access to an area will allow AMOs to alleviate conflicts among user groups and fishing methods, and to avoid depletion of favorite fishing locations. Specifying rights in terms of an area and quantity of fish strengthens the exclusivity of the angling right, which will lead to more efficient utilization of marine resources and less conflict among users of the resources. This would also insure that efforts to displace anglers from operating in some areas could only be done with compensation.

There would be a variety of options for addressing spatial characteristics of AMOs. For example, AMOs might be defined purely geographically, such that only one AMO could operate in a specific geographic area. In contrast, one might allow multiple AMOs in a single region, defined by harvest category (e.g., charter boat vs. individual angler). The process must also address the issue of what species to assign to each AMO. Note that any spatial exclusivity of AMOs applies only to *recreational* fishing. It would be possible, indeed likely, that commercial fishing activity would overlap with spatial areas for which exclusive recreational fishing rights were held by an AMO.

6. Implementation issues

AMOs represent a fundamental change in recreational fishery management. While the use of rights-based management and co-management in commercial fisheries is becoming more common, they have not yet been applied to recreational fisheries in a comprehensive manner. The development of the proposed AMOs would create a paradigmatic shift in the approach to recreational management—unlike the management changes typical in recreational fisheries, which often involve marginal adjustments in existing input or output controls.

Implementation of AMOs raises a number of issues, including eligibility criteria and means of selecting share recipients, disposing of AMO shares and quotas, characteristics of the shares and quota (extent and duration, divisibility, transferability), distribution of AMO shares and quotas among recipients, the size and scope of an AMO, monitoring and enforcement, and how to facilitate the transition from the status quo to the proposed AMO structure. These issues must be addressed in the process of designing and implementing the AMO organizational structure.

6.1. Initial allocation and disposition of quota rights; selecting eligible recipients[22]

Once the recreational TAC is set for each recreational species, provisional AMOs would be initially formed for each recreational TAC. For example, a provisional AMO would be formed for each community-based or port-based share of the recreational TACs for red snapper, shallow water grouper, etc. Each AMO would issue shares and allocate the shares to eligible recipients. Shareholders collectively own the AMO and its quota holdings.

Defining the eligibility criteria for the initial allocation of AMO shares is a critical implementation step. The eligibility criteria will determine the set of AMO owners who, as a group, would receive the rights to the organization's recreational fishing quota. The principal consideration when setting eligibility criteria ought to be that they are perceived as fair by anglers and the larger public. Eligibility criteria for the initial allocation of AMO shares not perceived as fair would likely result in great resistance to the institution and may defeat it altogether.

So long as the shares can be traded and the cost of share trading not great, the eligibility criteria for initial allocation are not expected to affect the long-term performance of AMOs. After a period of initial trading, the individuals who have greatest to gain from share ownership will acquire the shares, and will manage the AMO to produce maximum net value from the fishery.

At least two options are evident for determination of share eligibility. One is to make every citizen eligible, regardless of whether they are an angler. Another option is to restrict eligibility to those who can demonstrate past participation in a marine recreational fishery, such as by evidence of having held a saltwater license or of having owned recreational fishing gear and equipment, or other relevant evidence. Obviously, establishing a set of eligible recipients under the latter option could be time consuming and costly.

6.2. Initial allocation of angling management organization shares

Once the eligibility criteria for the initial allocation of AMO shares are set, the next step is to allocate AMO shares among eligible recipients. This requires decisions to be made regarding the number of initial shares in each AMO and the selection of initial recipients from the eligible pool of people. Both fairness and efficiency must be considered in these decisions. Anglers in general must perceive the method of initial allocation as fair. Otherwise the legitimacy of the AMO system would suffer. A legitimate system is needed to support voluntary compliance and to protect the system from political meddling. The initial allocation method also must insure that the AMO can be managed and operated cost-effectively. A very large number of small shareholders may not have the incentive to run the AMO effectively. Moreover, voting and share trades may be costly and problematic under such circumstances.

One initial allocation option is to set the number of shares equal to the number of anglers in the fisheries over which the AMO has jurisdiction. Another option would be to allow anglers to nominate themselves to receive shares in one or more AMOs of their choice. Many casual anglers probably would not bother to nominate themselves, thus reducing the number of shareholders in each AMO. A third option would be to fix the number of shares in each AMO and distribute them to anglers using a lottery. Eligible anglers would place their name in a drawing for the AMO(s) of their choice. Names of new shareholders would be drawn at random for each AMO.

6.3. Scope and size of angling management organizations

The optimal scope and size is likely to be different for each AMO. Also, there is no reliable way to specify the optimal scope and size ex ante. AMO members will have the collective interest to maximize the value of the recreational fisheries under its jurisdiction. Over time the inherent economies of scope, size and spatial area will operate to induce AMOs to merge or split into optimal entities. For example, the members of an AMO that is too large may find it in their interest to divide into two or more separate AMOs in order to better optimize their individual socioeconomic objectives and economize on costs of administration, research, monitoring, etc. Therefore, the law and regulations should facilitate AMOs changing their scope and size, so that each AMO finds its optimum in the course of time.

There is clear risk in allowing a large number of interest groups to establish separate AMOs—the result of such fractionalization could be AMOs insufficient to sustain required trading and regulatory activity. Hence, as a general guide, we recommend that AMOs be designed initially to be too large rather than too small. Rules should be established to minimize the costs of splitting into to smaller AMOs, where such division would increase net benefits to participating members.

6.4. Relationship to existing management structures

To be effective, it will be necessary for AMO management to supplant existing management and regulatory structures. The replacement of existing management structures will likely require phase-in of

[22] For examples of how managers have addressed the challenges of initial allocation of individual quota in commercial fisheries, see [33].

some duration. For example, existing for-hire recreational vessels have access to the red snapper fishery by permit. Clearly, retaining the validity of these permits would reduce the incentive to join AMOs, and would markedly reduce the efficacy of AMO management. Hence, just as in cases in which other types of rights-based management systems have been established worldwide, the proposed AMO system would replace existing permits and rights in the fishery. Existing recreational fishing permits and licenses would become invalid as AMO management was established.

6.5. Monitoring and enforcement

The proposed AMOs are not expected to pose threats to compliance and enforcement burdens that are significantly greater than alternative management regimes. As indicated above, each AMO would have the authority and obligation to manage its share of the recreational TAC, and to administer and enforce management measures to maintain the total annual harvest under the organization's quota. AMOs' advantage over alternative regimes is that shareholders have the incentive to protect their capital assets by monitoring the fishery and enforcing management measures. As anglers, shareholders themselves will tend to be more compliant and also tend to apply social pressure on others to comply. To maximize voluntary compliance, AMOs will likely find it in their interest to adopt procedures for developing and implementing policy that are open and perceived by the fishing public to be fair (cf. [34]).

6.6. Transition period and transactions costs

Making the transition from Gulf-wide management by the GMFMC to shared management with a network of AMOs will present many issues that need to be addressed. AMOs will have to be organized and chartered. Each AMO would have to develop a means to develop and implement management policy. As in any management transition, the transition from current management to AMO-based management would involve substantial transactions costs. Accordingly, one of the primary considerations in considering whether AMOs are desirable in a given fishery is the relative magnitude of these costs relative to AMO benefits (see *Principal 1*). The same considerations apply to more traditional fishery co-management changes [35].

The approach to implementation that we propose, however, is not dependent on a prior estimate of costs and benefits. We propose an approach that, in its early stages, is not costly to implement, and relies on the beneficiaries of integration to take the initial steps towards integration. In other words, the parties who can best assess the relative costs and benefits of integration are provided the authority to determine the extent and nature of the integration measures that are ultimately implemented.

In addition to a process that minimizes initial transactions costs, it is critical that the process of establishing any new management structure be widely viewed as transparent, open, and fair, and not result in transactions costs that outweigh the potential benefits of management change [35]. AMO implementation ought to encourage maximum stakeholder participation to resist 'capture' of the process by any single stakeholder group or entrenched interest. However, it is equally critical that the process not be paralyzed by the contentions of too many narrowly defined interests. Elsewhere [36], we outline a detailed strategy for integration and transition, based on prior works that address the implementation of fisheries co-management worldwide.

We propose establishing a Transition Authority to explore and facilitate the formation of provisional AMOs. The Transition Authority would be appointed by and directly responsible to the Secretary of Commerce, would have a small number of members with appropriate expertise and a support staff and budget. The Transition Authority would be given a specified amount of time (e.g., 2 years) in which to complete the task of forming the regional network of AMOs, in coordination with preexisting angler organizations and representatives. The first step in this process would be the establishment of a guided dialog among recreational and commercial fishers, other stakeholders, and regulators—a relatively low-cost process that would assess the potential role of AMOs in the fishery. From this initial step, further stages of implementation would proceed as outlined elsewhere [36].

The members of the Transition Authority should include at least one person with privatization experience, one with experience managing a private business, one with strong recreational interest, and one with in-depth knowledge of the fishery management system. The authority would receive a special funding appropriation to carry out its terms of reference.

7. Expected achievements

The set of institutional arrangements proposed here for recreational fishery management are conceptually sound, and provide an option for full integration of the recreational and commercial fishing sectors in fishery management. In addition, the incorporation of strong fishing rights associated with AMOs offers to encourage sustainable, efficient and financially sound utilization of fishery resources. Devolution of both management authority and expense provides incentives for superior

and cost-effective management, greater levels of voluntary compliance, and the ability to tailor management mechanisms to the socioeconomic goals of specific regions. Finally, paired with rights-based approaches in the commercial sector, AMOs would provide a greater balance of influence and power among stakeholders in political and commercial marketplaces, and a superior means of resolving conflicts among stakeholders.

Members of AMOs have a direct stake in the outcomes of their policies since they are owners of the community-based organization. The value of each AMO's shares directly reflects the performance of their policies and value that anglers place on their approach to managing recreational TACs. That is, recreational fishery managers must face the consequences of their decisions, which aligns their private interests with the public interests.

8. Alternatives to angling management organizations

We also examine five alternatives to AMOs, including the status quo. We conclude that each of the five alternatives is inferior to AMOs in terms of the seven principles of integration developed above.

8.1. Sub-regional recreational management councils

The first alternative to AMOs is to establish sub-regional recreational management councils. The sub-regional recreational fisheries management councils could be either modeled after or operate as subunits of the regional (parent) management councils. The sub-regional councils would operate under the same legal authority as the parent council, except that the sub-regional councils would not be charged with conservation decisions, which would be retained by the regional council. After setting TACs for recreational species, the parent council would allocate the recreational TACs among the sub-regional councils. The principal task of each sub-regional council would be to manage their share of the recreational TAC by setting management measures to optimize the region's socioeconomic objectives.

A closely related variant of this option would be the allocation of shares of regional recreational TACs among individual states (rather than sub-regional councils), and assigning to each state the authority to manage their share of the recreational TAC.[23] Each state would have the option to further allocate recreational TAC shares to local communities and delegate associated management authority to appropriate local government bodies. Each state or local government would be free to establish its own regulations, provided that the state's recreational catch does not exceed its TAC.

There are some distinct advantages to this decentralized structure. First, it separates the conservation decision from on-going allocation decisions (save for the initial allocation of TACs among the sub-regional councils or states). This separation has been recommended for the federal fishery management system by several observers (e.g., [38,39]), and is expected to encourage a more precautionary approach to conservation.

The principal disadvantages are related to Principles 4–7, which are not satisfied by this option. This option does not strengthen angling rights and, as a result, is not expected to improve the anglers' motivation to conserve stocks and enhance the value of recreational fisheries. While this option does have the merit of some degree of decentralization, management authority is not shared with local institutions.

In addition, this option has no provisions for strengthening accountability among managers and anglers. Sub-regional council members (or managers at the state level) have no direct stake in the outcomes of their policies. Councils or state management authorities neither reap the benefits of adding value to their recreational fisheries nor bear the costs of their proposed management actions; and there are no provisions for financial independence and fiscal sustainability.

8.2. Sub-regional advisory committees

This option involves the establishment of a set of sub-regional advisory committees to recommend recreational fisheries policies to regional councils. A system of sub-regional advisory committees would function somewhat similarly to the sub-regional councils described above. The principal difference is that the sub-regional committees would operate within the structure of the regional councils in much the same way as current advisory committees.

As with the previous option, the regional council would allocate the recreational TACs among the sub-regions. The principal task of each sub-regional advisory committee would be to recommend to the council a set of measures to optimize the region's socioeconomic objectives, while maintaining catches within the sub-regional TAC.

This option has all the disadvantages of sub-regional councils, as noted above. Moreover, unlike sub-regional councils, the sub-regional advisory option lacks the advantage of separating conservation decisions from allocation decisions. Hence, this option appears inferior to either AMOs or sub-regional management councils. However, the increased flexibility afforded by

[23] This is similar to the way in which the Gulf States Marine Fisheries Commission manages interstate fisheries. See, for example, *The Spotted Seatrout Regional Fishery Management Plan* [37].

sub-regional advisement may increase net benefits compared to the status quo.

8.3. Individual fishing quotas

If feasible, individual recreational fishing quotas would achieve complete integration of the recreational and commercial sectors in the fishery management system. There are many reasons to favor such a management system, among them the seamless integration of recreational and commercial harvests and the elimination of the need to revisit commercial/recreational harvest allocation decisions.

Despite the potential advantages of recreational fishing quotas, the establishment and implementation of fishing quotas for *individual recreational anglers* face at least two formidable problems that likely render this option infeasible. The first problem, though not insurmountable in theory, is the initial allocation of quota among anglers. Since catch histories are non-existent for most if not all recreational anglers, the most common basis for initial quota allocation cannot be used. While other means of initial allocation may be acceptable, this remains a fundamental challenge.

The second, and perhaps more formidable problem is enforcement. Detecting non-compliance among recreational anglers is typically more difficult and costly than for their commercial counterparts [40]. Individual recreational quotas can only aggravate these problems, since thousands of individuals' catches would have to be monitored. Enforcement, in all likelihood, would be ineffective. The regime would have to rely heavily on voluntary compliance. Extensive voluntary compliance with individual quotas could arise only with widespread support for IFQs among anglers, an unlikely prospect in the near term.[24]

IFQs for the for-hire sector (charter, party, and guide boats) of certain recreational fisheries, however, may be a feasible and desirable option, and could supplement AMOs applied to individual anglers. Problems of initial allocation and enforcement, while still significant, are not expected to be more severe in the for-hire sector than in the commercial sector. The Alaskan halibut charter IFQ program is an example of such a program [8].[25] This reflects the important distinction between management measures most appropriate for the for-hire sector and those most appropriate for individual anglers.

8.4. Status quo

The status quo, in which full management authority rests with the GMFMC and the federal government, is clearly inferior to the AMO alternative described in this paper. The status quo fails to satisfy principles 4–7, and shares all of the disadvantages of the first three options (sub-regional councils, state councils and sub-regional advisory committees) described above. In addition, as a Gulf-wide, centralized management authority, the GMFMC cannot easily decide upon and implement customized rules across the varied interests represented in the coastal communities of the GOM.

9. Summary and conclusions

This paper explores means to fully integrate the recreational sector into fishery management. After outlining recent trends in fisheries and their management, we develop a set of seven principles of integration. Based on these principles, we present a novel, practical option for recreational fishery management: the angling management organization or AMO. Unlike other existing and proposed management alternatives, AMOs satisfy each of the seven principles of integration. As a result, AMOs are expected to encourage improved resource stewardship, reduced enforcement and monitoring costs, fewer management conflicts, and greater long-term net economic benefits in recreational fisheries.

The proposed AMOs are logical extensions of many existing recreational angling organizations, and are not dissimilar from some of the organizations of producers that now play active roles in the management of several commercial fisheries. However, there are some important differences in institutional structure and performance between the proposed AMOs and commercial producer organizations. Some of the more primary attributes of AMOs are that each has the exclusive right to determine how to use its share of the recreational TAC; it has the authority to implement measures to optimize socioeconomic objectives; it is a non-governmental organization of anglers; it is financially independent and sustainable; and it provides equal opportunity to fish to all anglers.

The proposed AMOs would represent a paradigmatic shift in recreational fishery management, involving significant initial transactions costs. These costs notwithstanding, the desirable mix of incentives created by the proposed structure of these community-based organizations should provide a mechanism to decrease

[24] Even if the problems of initial allocation and enforcement were readily solved, the added benefits of individual quotas compared to the proposed group quotas may not be significant. In commercial fisheries, individual quotas effectively mitigate the race-to-fish, a damaging feature of competitive TACs and other non-rights-based management measures. The race-to-fish in commercial fisheries significantly increases costs of production, post-harvest losses, by-catch and discards, and worsens product quality and safety. These same problems are not expected to be significant in recreational fisheries subject to community-based quotas.

[25] It is important to note that the Alaska IFQ program only applies to charter anglers—non-charter anglers are not incorporated into the IFQ program.

management costs in the long run, while markedly increasing recreational fishery benefits.

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References

[1] USF&WS. 2001 national survey of fishing, hunting, and wildlife-associated recreation: national overview. Preliminary findings. Washington, DC: US Department of the Interior, Fish and Wildlife Service; 2002 (http://library.fws.gov/nat_survey2001.pdf).
[2] NMFS. The marine recreational fishing statistics survey, queries. http://www.st.nmfs.gov/st1/recreational/queries/index.html, 2002.
[3] Chapman L, Blias A, Gooday P. Incorporating the recreational sector in the management of Australia's Commonwealth fisheries. ABARE report to the Fisheries Resources Research Fund, October 2001.
[4] Teirney L, Kilner A, Bradford E, Bell J, Millar R. Marine recreational fisheries working group draft report, May 1995.
[5] Teirney L, McKinnon S, Kilner A, Sylvester T. Marine recreational fisheries working group report, November 1991.
[6] NMFS. Annual report to congress on the status of US fisheries—2001. Silver Spring, MD: US Department of Commerce, NOAA, Natl. Mar. Fish. Serv.; 2002. 142pp.
[7] Johnston RJ, Sutinen JG. Appropriate and inappropriate economic analysis for allocation decisions: the case of Alaska halibut. Research paper prepared for The Halibut Coalition, Juneau, AK, 1999.
[8] North Pacific Fishery Management Council (NPFMC), National Marine Fisheries Service, Alaska Department of Fish and Game, and the International Pacific Halibut Commission. Proposed halibut Guideline Harvest Level (GHL) management measures discussion paper. Anchorage: North Pacific Fishery Management Council; 1998.
[9] NPFMC and ISER. Environmental Assessment/Regulatory Impact Review/Initial Regulatory Flexibility Analysis (EA/RIR/IRFA) for proposed regulatory amendments to implement management alternatives for the guided sport fishery for halibut off Alaska. Condensed Draft for Council and Public Review. North Pacific Fishery Management Council and the University of Alaska Institute for Social and Economic Research. Anchorage: North Pacific Fishery Management Council, 1997.
[10] NAPA. Courts, congress, and constituencies: managing fisheries by default. A Report by a Panel of the National Academy of Public Administration for the Congress and the US Department of Commerce. Washington, DC: National Marine Fisheries Service; 2002 (http://commerce.senate.gov/hearings/hearings0202.htm).
[11] Kammer R. Testimony before the senate committee on commerce, science and transportation subcommittee on oceans. Atmosphere and Fisheries 2002.
[12] Pomeroy RS. Devolution and fisheries co-management. In: Meinzen-Dick R, Knox A, Di Gregorio M, editors. Collective action, property rights and devolution of natural resource management: exchange of knowledge and implications for policy. Proceedings of the International Conference, June 21–25. Penang, Malaysia: International Center for Living Aquatic Resource Management, 1999. pp. 111–46.
[13] Sutinen JG, Johnston RJ, Shaw R. A review of recreational fisheries in the US: implication of rights-based fisheries. Unpublished, Department of Environmental and Natural Resource Economics, University of Rhode Island, 2002.
[14] GMFMC. Regulatory amendment to the reef fish fishery management plan to set a red snapper rebuilding plan through 2032. Tampa, FL: Gulf of Mexico Fisheries Management Council; 2001.
[15] Schirripa MJ, Legault CM. Status of the red snapper in U.S. waters of the Gulf of Mexico: updated through 1998. Miami, FL: National Marine Fisheries Service, Southeast Fisheries Science Center, Sustainable Fisheries Division; 1999. 86pp + Appendices. Contribution: SFD-99/00-75.
[16] Sutinen JG. Recreational entitlements: integrating recreational fisheries into New Zealand's quota management system. Wellington, New Zealand: Ministry of Fisheries; August 1996.
[17] Pearse P. Building on progress: fisheries policy development in New Zealand. A report prepared for the Minister of Fisheries, Government of New Zealand, Wellington, July 1991.
[18] Scott A. Introducing property in fishery management. In: Shotton R, editor. Use of property rights in fisheries management. FAO Fisheries Technical Paper, 404/1. Rome: Food and Agriculture Organization of the United Nations; 2000. p. 1–13.
[19] Scott A. Conceptual origins of rights based fishing. In: Neher P, Arnason R, Mollett N, editors. Rights based fishing. Dordrecht: Kluwer Academic Publishers; 1988.
[20] OECD. Towards sustainable fisheries: economic aspects of the management of living marine resources. Paris: Organization for Economic Cooperation and Development; 1997. 268pp.
[21] Arnason R. Review of experiences with ITQs. A Report for CEMARE. Unpublished manuscript, Department of Economics, University of Iceland, 2001.
[22] NRC. Sharing the fish: toward a national policy on individual fishing quotas. National Research Council. Washington, DC: National Academy Press; 1999.
[23] Berkes F, Mahon R, McConney P, Pollnac R, Pomeroy R. Managing small-scale fisheries. Ottawa, Canada: International Development Research Center; 2001.
[24] James M. Co-management and beyond: the British Columbia Experience. Paper presented to the XXth Conference of the International Institute of Fisheries Economics and Trade, Wellington, New Zealand, August 19–22, 2002.
[25] Wallis P, Ola F. Fisheries management costs: concepts and studies. In: Shrank W, Arnason R, Hannesson R, editors. The cost of fishery management. Aldershot, Hampshire, England: Ashgate Publishing; 2003. 318pp [Chapter 10].
[26] Wyatt N. Cost recovery in fisheries management: the New Zealand experience. In: Shrank W, Arnason R, Hannesson R, editors. The cost of fishery management. Aldershot, Hampshire, England: Ashgate Publishing; 2003. 318pp [Chapter 13].
[27] Shrank W, Arnason R, Hannesson R. The cost of fishery management. Aldershot, Hampshire, England: Ashgate Publishing; 2003. 318pp.

[28] Andersen P, Sutinen JG. Financing fishery management: principles and economic implications. In: Shrank W, Arnason R, Hannesson R, editors. The cost of fishery management. Ashgate Publishing; 2003. 318pp [Chapter 4].
[29] Schirripa MJ. Status of red snapper in the U.S. waters of the Gulf of Mexico. Miami, FL: NMFS, SEFSC; 1998. 85pp. Contribution SFD 97/98-30.
[30] Schirripa MJ, Legault CM. Status of the red snapper in U.S. waters of the Gulf of Mexico: updated through 1996. Miami, FL: National Marine Fisheries Service, Southeast Fisheries Science Center, Sustainable Fisheries Division; 1997. 8pp + Appendices. Contribution: MIA-97/98-05.
[31] Buchanan JM, Tollison RD, Tullock G, editors. Toward a theory of the rent-seeking society. College Station, TX: Texas A&M University Press; 1980.
[32] NPFMC. Environmental Assessment/Regulatory Impact Review/Initial Regulatory Flexibility Analysis for a regulatory amendment to incorporate the halibut charter sector into the halibut individual fishing quota program or implement a moratorium on entry into the charter fleet for Pacific halibut in Areas 2C and 3A. Anchorage: North Pacific Fishery Management Council; March 12, 2001.
[33] Shotton R, editor. Case studies on the allocation of transferable quota rights in fisheries. FAO Fisheries Technical Paper, No. 411. Rome: FAO; 2001. 373pp.
[34] Sutinen JG. Fisheries compliance, management: assessing performance. Canberra, ACT: Australian Fisheries Management Authority; August 1996.
[35] Kuperan NMRA, Pomeroy RS. Transactions costs and fisheries co-management. Marine Resource Economics 1998;13:103–14.
[36] Johnston RJ, Sutinen JG. Angling management organizations: an option for fully integrating the recreational sector into the management program for the Gulf of Mexico Red Snapper Fishery. Research paper prepared for Environmental Defense, Austin, TX, 2003.
[37] GSMFC. The spotted seatrout fishery of the Gulf of Mexico, United States: a regional management plan, Publication No. 87. Ocean Springs, MS: Gulf States Marine Fisheries Commission; 2001.
[38] Sissenwine M, Mace P. Governance for responsible fisheries: an ecosystem approach. A paper presented to the Reykjavik Conference on Responsible Fisheries in the Marine Ecosystem, Reykjavik, Iceland, October 2001.
[39] Sissenwine MP, Rosenberg AA. Marine fisheries at a critical juncture. Fisheries 1993;18(10):6–14.
[40] Sutinen JG. Recreational and commercial fisheries allocation with costly enforcement. American Journal of Agricultural Economics 1993;75(5):1183–7.