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Full Length Research Paper

Ecosystem Difficulties and the Performance of Fisheries Management Systems

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This paper has three objectives. It first provides a brief update of data from a 1997 research by the Organization for Economic Co-operation and Development (OECD) that demonstrated which management strategies are most effective in protecting marine fisheries and producing significant social and economic benefits. According to the original OECD report, individual fishing quotas are a good approach to restrict the number of people participating in a fishery, control exploitation, ameliorate the consequences of race-to-fish and most of its attendant effects, and create resource rent and enhanced profitability. Additionally, it discovered that a race-to-fish and all of its consequences result from competitive TAC management. Furthermore, even though conservation may have suffered in their absence, the OECD statistics demonstrated that area and time closures have not been effective in ensuring resource conservation. The update indicates that most of the original findings remain valid. The second objective is to report on current policy changes since 1995, with a focus on ecosystem-based management approaches. These include large marine ecosystem (LME) programs, marine protected areas (MPAs), and habitat protection initiatives.
The third subject discussed in the paper is the governance concerns of ecosystem-based fisheries management. The report argues that the political marketplace that determines fisheries management policy usually disadvantages conservation and long-term economic benefits. The article concludes with suggestions for strengthening our fishery governance systems.

INTRODUCTION

[1] In this study, we look at the possibility of ecosystem-based fishing management. In particular, we seek an answer to the question: "If current regimes are unable to conserve fishery resources and generate substantial economic and social benefits, can substantial progress be made in accomplishing a wider range of conservation objectives within fisheries management systems?" First, we look at data from OECD member countries with non-ecosystem-based management systems. The data used in the OECD (1997) study, which demonstrated which management strategies are most effective in protecting marine fisheries and producing significant social and economic benefits, has been somewhat updated. Second, we give a summary of some recent changes in fishery management policy that have been revealed by our evidence update. Third, we examine certain governance concerns related to ecosystem-based fishery management. The article concludes with recommendations for strengthening fishery governance structures.

THE OECD RESULTS

[2] The OECD's 1997 study of fisheries management experiences identified the management strategies that had the greatest social and economic benefits and were most effective in protecting marine fisheries. Data for the study came from 24 OECD member nations and more than 100 fisheries. As far as we know, no other study systematically contrasts individual fishing quotas (IFQs) with conventional fisheries management techniques.
[3] Since the initial OECD study only contained data up to about 1994, we attempted to update the experiences with fishery management in OECD member countries for the years 1995–2000.One The update does not cover everything. In other words, we have not been able to collect information on all of the fisheries that were listed in the original OECD report. Additionally, we could not locate information in the update about the economic, social, and administrative outcomes for several fisheries.

The OECD (1997) looked at three different kinds of fisheries management measures: output controls, input controls, and technological measures. Examples of output controls include vessel catch limits, IFQs, and total authorized catch (TAC) (total quotas).2 Examples of input constraints are licensing restrictions, individual work quotas, and limitations on boats and equipment. Technical measures included size and sex selectivity measures that restrict the size and sex of fish that can be caught and landed, as well as time and area limits that limited the time and location where fishing units could operate.
[4] The analytical approach used in this study assumes that restrictions have an effect on fisheries performance. To evaluate this performance, the OECD looked at social, economic, and biological outcomes. Management methods like quotas, closed areas and seasons, and gear restrictions frequently change fishing practices, which affects the fishery's outcomes (stock sizes, landings, revenues, etc.). Of course, actual outcomes are influenced not only by the measures that are put in place but also by the biological, economic, social, and institutional components of the fisheries system (as well as external variables).
[5] To update the results presented in OECD (1997), we applied the techniques described in Sutinen (1999) to a selected set of fisheries. The efficiency of specific management strategies implemented by the relevant institutions was assessed in the first study using a methodical process. In the first step, a set of expected results was created; in the second, these expectations were refuted by evidence; and in the third, the theory underlying the expected consequences was assessed.

Fishing quotas for individuals

Strong evidence that IFQs are an effective tactic for limiting exploitation, decreasing the number of fishery participants, generating resource rent and increased profitability, and mitigating race-to-fish and the majority of its related effects was presented by the OECD (1997). 3.
The effectiveness of IFQs in maintaining catch at or below the TAC level has been determined by management authorities.
[5]. The OECD found that 23 of the 31 IFQ fisheries for which data were available maintained catch at or below the TAC. The TAC overruns that did occur were caused by inadequate enforcement and monitoring. Insufficient information allowed the TAC to be set too high in overexploitation scenarios.
[6] According to OECD data, IFQs mitigate or prevent concerns such as overcapacity, unnecessary labor, waste, hazardous harvesting practices, gear conflict and loss, and decreased product quality. Two of the most notable instances are the Canadian halibut and sablefish fisheries. Seasons that had been reduced to a few days because of competitive TACs and limited access were very immediately expanded to the whole year.
[7] However, not everyone has done away with the race-to-fish. For example, the sole and plaice fishery in the Netherlands and the race-to-fish in the Norwegian cod fishery were not eliminated by IFQs. 4. Because the fishery may be closed once the national quota is met, even if individual fishing quotas have not been met, there is a race to fish in these fisheries. The demersal fishery's decision to choose between individual effort and catch quotas led to an increase in investment in Iceland. There is a race-to-fish in New Zealand's flatfish fishery during years when the population is low. The fact that most fisheries in the race to fish used time or area closures regardless of TAC performance may have affected these results.
[8] Worldwide, the use of IFQs is increasing. This kind of rights-based management is being used by an increasing number of countries for their fisheries. Our update of the OECD evidence shows that managers have recently introduced individual transferable quotas in certain fisheries. This is especially evident in fisheries that were formerly under competitive TAC management.

[9] In Australia, managers established IFQs for the remaining trawl quota in the Southeast Trawl fishery and IFQ management for the school and gummy shark stocks in the Southern Shark fishery. A few countries, including Poland and New Zealand, enacted legislation that provided a means of either transferring the bulk of the commercial fish species that were still in use to a quota-managed system or implementing an IFQ system. While Iceland implemented IFQs for Atlantic wolffish and witch, Canada

introduced them to its large-seine fleet of Pacific herring. Denmark was the first to test impose annual vessel quotas for the Baltic cod fishery and the North Sea herring and mackerel fisheries. Norway used a unit-quota system for its purse seine and cod trawl fleets. A company-wide quota system was also implemented for the groundfish fishery.
[10] Our argument is that fisheries management is implementing IFQs because they work. IFQs have proven to be effective in producing revenue and promoting sustainable fishing management. We think that explaining why IFQs are used is easier than explaining why more fisheries do not use them. Below is a more thorough discussion of this.
[11] Furthermore, the OECD investigation demonstrates that IFQs lead to problems with compliance, enforcement, and quota allocation. The OECD looked at 55 IFQ fisheries and found that 10 of them had problems with quota allocation; however, no counterexamples were given. The first quota allocation is the primary barrier preventing most fisheries from implementing IFQs. When the quota is first distributed, prospective IFQ program participants often fear that they will not receive their fair share. The exceptions are small-scale fisheries with relatively uniform producers. The process of determining a fair and appropriate harvest rights allocation is difficult, drawn out, and hostile. The continuing debate over processor shares in Alaska is a great example of this.
[12] The problem of distributing access to fish, or the right to take fish, is a challenge for all forms of fisheries management, whether they are founded on IFQs or traditional methods. Allocation is always at the heart of legislative discussions, meetings, and choices made by fishery managers. All too frequently, the management system refuses to compromise between IFQs and allocation. The ongoing cost of allocation problems with conventional management approaches is balanced against the substantial upfront cost of initial allocation with IFQs. In the absence of a market to address them, the management system consistently faces allocation challenges. Even though the first distribution of IFQs is extremely difficult, the "pain" is upfront and final. A market then emerges to manage the quota re-allocation necessary for the fishery to adapt, which is especially true for transferable IFQs. 5. If managers are able to avoid the high upfront expenditures involved with the first allocation of transferable IFQs, they will have to deal with the constant distraction of allocation rather than conservation.
[13] There are several approaches to solving the first allocation problem. This discrepancy most likely stems from disagreements on what constitutes a fair and just distribution. Every solution is the result of a negotiation and negotiating process. The most important aspect of the solution is the process used to find it. A transparent and open procedure is necessary to provide institutional legitimacy, credibility, and trust. Furthermore, no process that satisfies these conditions has yet been developed in the USA.
[14] 17 fisheries had more enforcement problems and/or higher enforcement costs than the five that had gains. Enforcement was particularly difficult in high-value, transboundary, and multispecies fisheries. Fishermen were more frequently able and willing to pay these fines, even though individual vessel quotas typically led to increased enforcement costs. There is broad industry support for increased enforcement. Since IFQ holders are aware that the value of their quota rights is diminished by other people's illegal fishing, they have an incentive to help authorities with enforcement.
[15] The funds received from IFQ rents can be used by governments to cover administrative and enforcement costs. The industry funds administration and enforcement in the various IFQ fisheries in Australia, Canada, Iceland, and New Zealand using fees collected from quota owners. In a few of cases, such as the New Zealand lobster fishery, quota holders voluntarily funded further enforcement. Additionally, IFQ management has led to improved cooperation between fishermen and enforcement authorities in several cases, including the USA wreckfish fishery and the fisheries of New Zealand in general. Fishermen have reported increased compliance in the Canadian halibut fishery.

[16] We have learned a lot from IFQ management during the last 20 years. Fishery management is attempting to reduce or eliminate the many and serious problems that have beset IFQs. It has been demonstrated that managers are capable of designing IFQ programs that address justice and fairness concerns while upholding core values (e.g., granting an exclusive harvest right). In circumstances where solutions are not immediately obvious, nations should structure their legal frameworks to encourage investigation and innovation.
[3] What distinguishes IFQs from other approaches to fishery management?7.
[4] The OECD (1997) evaluated a number of management strategies and concluded that none of them performed well without IFQs. To put it another way, they are unable to successfully control exploitation and lessen the rush to fish. However, compared to IFQs, they do not present as many administrative and social difficulties.
[5] The results are summed up as follows:
Total permitted quota for catches
[13] The most obvious effects of competitive TAC management are overcapitalization, shorter seasons, market gluts, and increased harvesting and processing costs, according to the OECD (1997). In most situations, competitive TAC management has not been able to successfully prevent overexploitation of the fishing resource, despite its success in several fisheries.
[14] The update of a few selected experiences supports the preliminary findings that competitive TAC management hasn't prevented resource overexploitation and instead creates a race-to-fish with all of its repercussions. For example, current stock assessment reports indicate that most fishery stocks managed with competitive TACs in the EU are heavily fished. The TACs for certain stocks have been drastically reduced by management authorities in recent years.
[15] Since 1995, TACs have been implemented for several fisheries that were not included in the original OECD report. TACs were imposed in the EU for various species in the North Sea fisheries, including swordfish and tuna. Japan also established a TAC system for six of its commercially fished species to complement existing limited access regimes and technological measurers.
[16] There were also some alterations in a few fisheries that were managed using competitive TAC. The Canadian Pacific herring fishery, for example, continued to adopt competitive TAC management, but separate TACs were established for the spring and fall components of the inshore fleet.
[6] Restricted licenses

[7]The fact that TACs are present in many of the documented cases clouds the OECD's (1997) findings that limited licenses result in overcapitalization and increased harvesting costs. There have been some early allocation problems, but not enough information is available to draw firm conclusions. Limited licenses have not prevented the tendency to overuse the fisheries resource.
[8] Selectivity by size and sex [9]According to the OECD (1997), the results demonstrated that size and sex selection laws result in increased enforcement costs or other problems rather than lowering race-to-fish. Both the average size of fish landed and the number of discards appear to be increasing, according to weak statistics.
[2] In recent years, the EU has set minimum landing sizes for Mediterranean bluefin tuna fisheries. Among other changes to size and sex selectivity measures, the Victorian abalone and scallop fisheries increased their minimum size regulation. In contrast to data in the 1997 study that only weakly supported the assumptions that average size of fish landed grew and discarding decreased, recent assessments have shown that average production in the Victorian scallop fishery has actually fallen and become irregular.

Conclusions

[18] The OECD (1997) concluded that time and area closures have not been successful in ensuring resource protection, even if conservation would have been poorer without them.
[19] Our update indicates that certain time and area closures have been in place since 1995. Within the marine mammal protection area of the Great Australian Bight marine park, the Great Australian Bight Trawl fishery was subject to seasonal closures, and demersal trawling was prohibited in the benthic protection strip region. The impact of the marine park on the fishing is still unknown. Recent surveys indicate that there is some unpredictability in the fisheries, although it appears to be due to differences in the aggregating behavior of the fishes. There were also the first-ever seasonal closures of the EU's Mediterranean bluefin tuna fishery. The area and length of seasons of several fisheries have also increased, including the Tasmanian abalone fishery and the Icelandic capelin fishery.
[20] Originally created to boost groundfish recruitment, three large closed zones on Georges Bank and in the Gulf of Maine have greatly boosted large scallop populations and aided in the recovery of yellowtail flounder in the United States. Scallop biomass increased in the first 20 months after the Georges Bank regions were closed.
Quotas for individual effort [7]OE Individual effort quotas, such days-at-sea or trap quotas, result in overcapitalization, increased harvesting costs, and more enforcement problems, according to OECD research from 1997.
Limits on vessel catch
[8] Vessel catch restrictions, as opposed to IFQs, raise enforcement costs and issues, according to OECD research from 1997.
[9] Our most recent study found that none of the fisheries that continued to use vessel catch limitations saw an improvement in resource protection. For example, when the average production in Victoria's scallop fishery decreased in 1996, the government of Victoria announced that it would buy out the licenses awarded in Port Phillip Bay. The Canadian Pacific's groundfish trawl fishery has declined even more and is currently at its lowest level ever.
Why are IFQs so successful?
[10] Compared to other approaches, IFQs provide a number of advantages. By successfully restricting exploitation within predefined boundaries and lowering overcapacity, gear conflicts, and race-to-fish, IFQs enhance product availability and quality. Using the resource rent to pay for management costs benefits producers, consumers, and the public at large. In addition, there are environmental benefits that are often overlooked. Lowering the 300,000 traps in Area 2 of the North American lobster fishery, for example, is expected to result in a considerable reduction in whale entanglements while preserving the same level of production.
[11] Why are IFQs and other rights-based tactics able to achieve so much? Most social scientists and fisheries economists are not surprised that IFQs perform better than other management techniques. IFQs address several difficulties because they give exclusive harvesting rights. There's a chance that other "rights-based" management techniques will work similarly. Conventional management strategies cannot solve the problems caused by non-exclusive resource consumption because none of them grant exclusive rights.
[12] In fisheries without exclusive harvesting rights, no fisherman has the power to stop other fishermen from stealing any part of the resource. Allowing fish to grow and reproduce means that a single fisherman runs the risk of losing the fish to other fishers. There is no incentive to protect the resource for future use as no fisherman has exclusive use. The non-exclusive nature of fisheries resources is the main factor contributing to overexploitation in modern fisheries.
[14] Without the exclusive right to harvest a specific number of fish, competition to catch fish before others does results in "race-to-fish," which leads to too small and poor-quality landings, fishing seasons that are shorter than optimal for economic performance, and excessive boat and equipment expenditures.
[15] Another effect of fisheries resource harvesting's non-exclusive nature is conflicts between user groups. Because no fisherman has the power to prevent another from using the resource, two or more fishermen can interact in a fishery at the same time and place. They impose external costs on each other in the form of equipment or other losses. One or both pieces of equipment may sustain damage when fixed bottom gear, such as traps, and movable gear, such as trawls, fish in the same area. Large, effective vessels can operate in a fishery that small-scale fishermen primarily depend on, reducing the amount of stock that the smaller fisherman can capture. while these external expenses are ignored while deciding where and how to fish, the fishery performs less economically.
[16] Distributors, wholesalers, merchants, processors, and consumers are all impacted by harvesting's non-exclusive nature. Because of the rush to fish, enormous quantities of fish may be landed in short periods of time, requiring the development of disproportionately large processing, storage, and distribution facilities to handle the intermittent peak loads. According to wholesalers, retailers, and consumers, suppliers of specific fish are either plentiful for short periods of time and scarce for long periods, or the product is treated for extended shelf life, which usually lowers the product's quality and price on the market.

[17] Several traits appear to have an impact on how well IFQ management works. Fisheries with a small number of participants and a well-defined participation group are easier to govern and control thanks to IFQs. Fisheries with limited entry or few participants facilitate initial allocations and provide a well-defined user group. The quota holders have often already developed a sense of ownership over the fishery, which makes it easier for them to accept their own fishing quotas and, in some cases, may also make it easier for them to comply and work with enforcement. When fisheries have uniform fleets, it is simpler to categorize them under IFQs. Allocation decisions are easier, and the fisheries typically need to make less changes.

[18] Involving users in the development and implementation of fishery management plans is one of the most crucial elements of effective management, according to the OECD (1997). Co-management agreements are one of the more viable strategies for boosting user participation. Nonetheless, there are still a lot of unresolved issues around co-management. How, for example, should co-management be implemented? Which responsibilities and rights are the government's and which are the users'? Is more user participation better than less in all fisheries? Is user participation desirable and practical for straddling stocks and highly migratory species? If producers' groups are needed for co-management, how can and should fisherman be organized, especially if they have no prior organizational experience?

[19] More authority over fishing rights and responsibilities has been granted to producers in Canada, Denmark, the Netherlands, Norway, Sweden, and the United Kingdom. These countries have found that the co-management approach reduces administrative costs and dramatically improves compliance with management rules. With a long history of rights-based management, Japan currently has the most extensive and sophisticated fisheries co-management system in the world. Other countries can learn a lot from these experiences.

[20] Rights-based methods (such as IFQs) have the best potential of addressing the fundamental problem of non-exclusive harvesting rights, reducing user conflicts, and producing better economic outcomes while safeguarding fishery resources out of all the management techniques available to managers. Ecosystem-based management and multispecies fisheries.

[21] Theoretically, most management activities should have some conservation benefits, such bringing resource stocks back to predefined levels. Unfortunately, none of the management approaches truly provide optimal resource conservation. Achieving optimal conservation is challenging due to a number of factors or traits, including multispecies, by-catch and discards, and notable volatility in resource inventories and markets.

[22] Despite the complex challenges multispecies fisheries provide, the OECD data shows that IFQs performed better than all other management approaches. This does not, however, mean that IFQs are the only requirements for multispecies fisheries. Rather, when IFQs were used in conjunction with other management techniques (such mesh size limitations), performance improved. When IFQs were not used, performance suffered.

[23] Managing fisheries that capture multiple species is more difficult and costly than managing fisheries that only capture one species. The economic performance and resource preservation of several multispecies groundfish fisheries in OECD countries were below average. Because of the high by-catch and discard rates of the generally non-selective trawls used in these fisheries, management's capacity to regulate exploitation patterns is even more precarious (unless by-catch and discarded catch are monitored well).

[24] Multispecies fisheries complicate all sorts of fishery management. In multispecies fisheries, where multiple species are caught at the same time, no one management strategy—or combination of strategies—will achieve the optimal fishing mortality for all species. Almost all changes to management will favor one species at the expense of another. It appears impossible to implement effective conservation practices on all stocks under these circumstances.

Although the importance of considering multispecies interactions in fisheries research and management is widely acknowledged, not much has been done in this area up to this point. The reasoning behind using models to examine and clarify relationships makes sense. However, the domains of economics and biology lack sufficient empirical evidence. In several countries, multispecies fisheries are being continuously modeled, and the outcomes are already being utilized to guide management choices in some fisheries. IFQs seem to have a lot of promise for addressing the issue of preserving complex marine ecosystems when compared to non-rights-based approaches. Although there are currently no tests or trials being undertaken on additional rights-based solutions, researchers are still looking at them.

[25] By-catch is inevitable in many fisheries with a large number of species. Incentives play a major role in determining the amount of bycatch. A single fisherman will try to control by-catch as long as the benefits to him exceed the drawbacks. Understanding this, good management creates or modifies incentives to lessen the impact of by-catch.

[26] Anecdotal evidence suggests that underreporting of landings and considerable discarding at sea have increased since the implementation of IFQs. However, an OECD study found that, in comparison to the previous limited effort management plan, there was no discernible increase in discards under an IFQ system.

[27] In our update, we were unable to locate any proof that by-catch increased under IFQs. Nonetheless, some IFQ fisheries adopted by-catch action plans, including the South East Trawl Fishery and the Torres Strait Prawn Fishery. In Canada, adding individual vessel by-catch measures to the IFQ-managed groundfish trawl fishery resulted in significant reductions in by-catch mortality.

[28] Some countries have developed tools to counteract discarding. Using standard harvesting technologies, establishing clear and widely publicized discard regulations, setting TACs by species so that multiple TACs can be filled roughly at the same time, implementing flexible monitoring and surveillance that addresses the most pressing issues at any given time, and swiftly and effectively handling alleged violations with sanctions severe enough to discourage such behavior are some of these tools.

[29] Highly shifting fishing resources appear to be particularly challenging for TAC and IFQ management. However, the OECD noted that highly volatile stocks make it difficult to implement any

management strategy that aims to protect the stocks against collapse risk. High year-to-year variance in natural mortality and recruitment, particularly for short-lived species, can lead to stock failures even with cautious management. Selected patterns in the policy for fisheries management since 1995
[9] Our analysis of contemporary experiences with fisheries management also revealed several management policy trends that were not evident in the original OECD study. This section describes some of these policy changes since 1995, with a focus on ecosystem-based management approaches. These include marine protected areas (MPAs), closures, large marine ecosystem (LME) initiatives, and habitat conservation measures.
[10] Marine protected areas and closures
[11] In 2000, President Clinton signed an Executive Order concerning MPAs in the United States. The Executive Order would help preserve the significant natural and cultural riches of the marine environment for the benefit of present and future generations by strengthening and expanding the nation's MPA system.
[12] Additionally, MPAs are increasingly playing a significant role in a number of Australian government initiatives that promote sustainable fishery management. For example, they set rules for exploiting their fisheries resources in an ecologically appropriate way in their Oceans Policy. It also provides a framework to ensure the long-term preservation of their maritime environment and to analyze the need for integrated ocean management and the options available to accomplish so.
[13] In April 1998, the Commonwealth government announced the creation of Australia's second-largest marine park, covering 2.3 million hectares in the Great Australian Bight. It protects a diverse range of benthic plants and animals, including the southern right whale and the Australian sea lion. It has a mammal conservation area and a State inshore park. The second area, which is 20 n.mi. wide and extends from the edge of the Australian Exclusive Economic Zone to the State park boundary, is designated for the conservation of benthic flora and animals.
[14] In 1999, the first deep-sea seamount Marine Reserve was created off the southern coast of Tasmania. This MPA contains two vertical zones. The top 500 meters above the ground is known as a managed resource zone. Zones deeper than 500 meters are considered no-take zones. Later same year, the waters to the southeast of Macquarie Island were also classified as an MPA.
[15] In addition, Canada's Oceans Act created a management framework based on the ideas of ecosystem management. The Oceans Act stated that it provided a framework for the establishment of MPAs, which would be used to manage their fisheries resources sustainably and preserve them.
[16] In 1998, Canada established its first pilot MPAs at Race Rocks and Gabriola Passage. That year also saw the declaration of a pilot MPA for the Sable Gully, which is situated on the Scotian Shelf just north of Sable Island. The Gully is home to a wide variety of marine life, including some of the best examples of northern coral and 200 bottlenose whales, a vulnerable species that lives there all year round. Two new prototype MPAs have been established in the offshore waters of the Pacific Ocean at the Bowie Seamount and the Endeavour Hot Vents Area. Endeavour Hot Vents are located in the offshore waters of the northeast Pacific, approximately 250 kilometers southwest of Vancouver, island. Try your best. Hot Vents Area is the world's first pilot MPA for offshore hydrothermal vents. Bowie Seamount is located 180 kilometers west of the Queen Charlotte Islands in the northeast Pacific. Rising over 3,000 meters above the ocean level, it is an ancient submerged volcano.
[17] Fish stocks on fishing zones can be restored by exporting fish from closures, according to a few studies.
[44] However, it appears that not many closures have been developed especially for this purpose. Remarkably, however, several national organizations, including the IUCN (1994), assert that ensuring the sustainable use of species is one of the goals of MPAs.
[45] However, some studies have shown that fish biomass can increase significantly, that the average size of an individual of a species can fluctuate, and that the density of certain species within closures has increased. A few studies suggest that exploited fish stocks may be restored by allowing larval or adult fish from the closed zones to migrate into regions where fishing is allowed.
[46] Two studies, one in the Philippines and one in Kenya, have shown that large adult fish populations in protected areas increase, and that this leads to further population enhancements in surrounding locations (McClanahan and Kaunda-Arara, 1996; Russ and Alcala, 1996). The benefits of keeping young fish in shelters so they can be exported to fishing locations as young adults are also less well-established. Single-species restrictions for plaice in the North Sea and mackerel in southwest England have increased production by increasing juvenile survival (Horwood et al., 1998).
[47] In December 1994, dredging and bottom trawling were banned across 5000 square miles in the Gulf of Maine and Georges Bank due to the severe decline of groundfish species. The objective was to promote groundfish recruitment by reducing juvenile by-catch and preventing disturbance of juvenile habitat in the closed sections. There is evidence that the three large closed zones have aided in the recovery of yellowtail flounder and greatly boosted the amount of large scallops. Scallop biomass rose within the first 20 months after the Georges Bank zones were closed (NRC, 2001).
[9] Huge Marine Environments
[10] The World Bank and the Global Environment Facility (GEF) have adopted the LME approach to marine ecosystem research and management because it is "an effective way to manage and organize scientific research on natural processes occurring within marine ecosystems [and] to study how pollutants travel within these marine systems …" (World Bank, 1995: Annex A). There are currently 11 LME programs with 62 countries with a combined budget of US$2,750 million.
[41] Fifteen years ago, Kenneth Sherman and Lewis Alexander came up with the concept of LMEs, a scientific method of ocean division. LMEs are geographic areas of oceans that have distinct trophically dependent populations, hydrography, bathymetry, and productivity. The physical boundaries of most LMEs are determined by the extent of continental margins and the seaward reach of coastal currents.
[42] These include the Northeast and Southeast continental shelf of the United States, the California Current, the Eastern Bering

Sea, the Gulf of Alaska, and the Gulf of Mexico. Examples of LMEs that are semi-enclosed seas are the Caribbean, Mediterranean, and Black waters. LMEs can be further separated into sub-systems, such the Mid-Atlantic Bight, Southern New England, the Gulf of Maine, and the Georges Bank, in the case of the Northeast USA Continental Shelf (Sherman et al., 1988).

[43] Nearly 95% of all fish and other living marine resources produced worldwide come from the 51 LMEs. Regrettably, many LMEs are currently under stress due to pollution, habitat degradation, and overexploitation of maritime resources.

[44] The dominant coastal currents and continental shelf are linked to drainage basin management and coastal areas through the LME management strategy. The approach (i) addresses the intricate problem of sustainable development of marine resources; (ii) provides a framework for research monitoring, assessment, and modeling to enable prediction and better management decisions; (iii) helps to focus marine assessments and management on maintaining productivity and maintaining the integrity of ecosystems; and (iii).

[45] Governance, monitoring, and assessment are major challenges for LMEs. The Sutinen (2000) paper presents a method for determining what is known about the socio-economic and governance aspects—the human dimensions—of LME management. The paper provides a basic framework for identifying the main socioeconomic and governance elements and practices of an LME. Methods for monitoring and assessing the various elements and processes are also discussed.

[46] When it comes to LME management, intergovernmental and intersectoral management are more crucial. Government organizations will need to establish alliances and collaborations with non-federal organizations and business sector stakeholders in order to get over barriers to interagency cooperation (Hennessey, 1997). Management agencies must understand how to handle the institutional and organizational complexity of the implementation environment as well as the complexity of ecosystems as natural systems (Hennessey, 1997; Acheson, 1994).

[47] One major obstacle to efficient management is the misalignment of the temporal and spatial scales of ecosystems and governmental entities. At the federal, state, local, and non-governmental organization levels, methods to connect "nested" ecosystems through "networked institutions" will need to be discovered (Hennessey, 1997). How these institutions adapt to the complexity of the environment and governance structure in order to achieve the optimal cost-benefit ratio is a major challenge (Creed and McCay, 1996).

[42] The preservation of marine fish habitat has not historically been given top priority by fisheries management agencies such as the US National Marine Fisheries Service (NMFS). Activities pertaining to threats to the habitat of marine fish continued since NMFS usually lacked the resources and power to deal with these problems. The situation and attitudes have been changing over the last two to three decades as our understanding of ecological links has grown and agency goals have changed.

[43] Additional habitat conservation provisions that mandate NMFS and Regional Fishery Management Councils to identify and protect important fish habitats were added to the Magnusson-Stevens Fishery Conservation and Management Act by the US Congress in 1996. The law requires the NMFS and Councils to take all reasonable measures to mitigate the adverse impacts of fishing on Essential Fish Habitat (EFH) and to identify further means of promoting the conservation and enhancement of EFH. NMFS also created an Office of Habitat Conservation to protect and conserve habitats and ensure that there is sufficient healthy habitat for populations of living marine resources.

Additional rights-based management techniques

[44] A few alternatives to IFQs based on creative rights have been used in the USA. Among the tactics are fishery cooperatives and Community Development Quotas. Alaska is home to these two programs.

[45] In December 1992, the Community Development Quota (CDQ) program was introduced by the North Pacific Fishery Management Council in the United States. The CDQ program directly distributes a portion of the annual fish harvest of certain commercial species to a group of villages in the Bering Sea region. The program was an attempt to bring rural development to isolated coastal towns in western Alaska. The first year of the council's existence granted six CDQ groups, chosen from 56 qualifying communities (now up to 57), 7.5% of the Bering Sea Pollock TAC catch. They managed their harvest quotas and dispersed the prizes. Due to the transferability of the quotas, fishing partners who have received community approval may additionally harvest a share of this TAC in exchange for royalties. In 1996, an amendment to the Magnusson Act added halibut, sablefish, crab, and other groundfish that were governed by Federal Fish Management plans to the Community Development Quota (CDQ) Program.

[46] The CDQ program has provided economic benefits to ettlements in western Alaska. During their first four years of operation, the six CDQ groups generated around US$92 million in gross revenues from fishing partners. The CDQ program has resulted in an increase in the average income and employment of western Alaskans in the commercial fishing industry. There is proof that the program has also improved the technical skills, corporate structure and procedures, and business administration understanding of the village's inhabitants (NRC, 1999).

[47] The Pollock Conservation Cooperatives (PCC) were also founded in the United States in December 1998 with the intention of promoting the catcher/processor sector of the Aleutian islands trawl fisheries off Alaska and the Bering Sea to capture pollock in a reasonable and orderly manner through mutual cooperation among PCC members. The PCC is made up of eight companies that own 19 catcher/processors that are authorized by the American Fisheries Act (AFA) to collect and process pollock in the directed pollock fishery. Under the PCC, each business is contractually given a portion of the directed fishery catch established under the AFA. While cooperatives for the factory trawler business began in 1999, those for the mothership and inshore processing sectors began in 2000.

[48] The annual groundfish discard rate for the Bering Sea-Aleutian Island area (BSAI) and the Gulf of Alaska (GOA) fisheries overall decreased from 14.6% in 1995 to 9.4% in 1999 after a notable decrease in 1998 and a minor increase in 1999. The overall discard rate dropped by 43% after pollock and Pacific cod discards were prohibited in all BSAI and GOA groundfish fisheries beginning in 1998.

The ex-vessel value of domestic landings in the FMP fisheries

decreased from US$ 585 million in 1995 to US$ 531 million in 1996, then increased to US$ 615 million in 1997, then dropped to US$ 416 million in 1998, and finally reached US$ 488 million in 1999, excluding the value added by at-sea processing (Hiatt and Terry, 2000).

[10] The political economy of managing fisheries8.

[44] Despite hopeful trends toward growing implementation of rights-based management techniques, our fishery management institutions have a poor record of managing and conserving fisheries. Between 65 and 68 percent of the world's fish stocks for which statistics are available are exploited at or beyond the level that corresponds to their maximum constraints, according to the United Nations Food and Agriculture Organization (FAO, 2000). More stocks have been exhausted or are recovering from depletion by nine to ten percent. NMFS is responsible for nearly 200 fish stocks in the United States, and 46% of the known fish stocks are overfished. Another 38 percent are fully utilized and may be overexploited.

[45] The FAO has characterized this record as "partially successful". Upon analyzing the data, we have concluded that neither resource preservation nor improving the economic stability of fishing villages has been accomplished by our fishery management organizations. How come our management teams haven't done better? The FAO attributes the poor record to the following problems:

(i) uncertainty about the status and dynamics of the stock;

(ii) a tendency to give priority to short-term social and economic needs at the expense of the longer-term sustainability of the stock;

(iii) poorly defined objectives; and

(iv) institutional weaknesses, particularly in relation to the absence of long-term rights amongst the different key stakeholders and decision-making structures and processes.

[44] We now focus on the last three areas of concern in fisheries management. The first is not usually the source of management failure. After all, managers in the private sector usually succeed in spite of a great deal of uncertainty. We consider the latter three problem categories as manifestations of the incentive structure found in most fisheries governance regimes. Unless it is addressed, the incentive structure of our collective-decision-making institutions will remain biased against the protection of fishery resources.

[45] The political process controls government, and legislative processes produce political decisions in most Western democracies. Voters elect legislators to guide government actions and policies, bureaucrats are hired to implement government policies, and agencies are created. The government's policies and actions are determined by the complex ties among these three groups, which are the primary players in the political process. Voters, especially groups of voters with specific interests, express their demands for government policy and action. Lawmakers enact laws (policy), and government workers implement the policies and initiatives specified in the legislation. Rules and regulations relating to safety, conservation, management, and environmental protection are the primary results of this political marketplace in the context of fisheries.

[46] Next, we examine the dynamics of supply and demand for government policy and action in more detail.

[47] Because they are the consumers of the political process, voters have expectations for political products. The public sector is urged by voters and voter organizations (which are groups formed to promote their own interests) to reduce inefficiencies and redistribute funds, usually in a manner that benefits them. Votes, campaign funds, and lobbying are used to spread these demands.

[48] Politicians include elected officials at the federal, state, and local levels as well as members of the legislative and executive branches. Politicians are motivated by the need to win elections or maintain their position of authority by offering the political goods that the public desires. As a result, politicians select positions that will improve their chances of being reelected.

[49] Furthermore, bureaucrats are employed at the federal, state, and local levels. Agency employees develop programs, implement laws, and enforce regulations. To serve their own interests and acquire as much bureaucratic power as they can, they expand their staff and budget. They typically accomplish this by appealing to lawmakers who have voter-friendly policies.

[50] Political equilibrium is reached as legislators, voters, and bureaucrats make choices that advance their individual objectives. The underlying motivations of these groups can lead to both positive and negative societal outcomes.

[1] Governance failure (a.k.a. socially undesirable outcome) is due to a number of inter-related causes, including:

(i) special interest effects,

(ii) rational voter ignorance

(iii) bundling of issues,

(iv) shortsightedness effects, de-coupling of costs and benefits, and

(v) bureaucratic inefficiencies.

[11] When a small percentage of voters have significant personal gains at the expense of many individuals who experience minor personal losses, this is known as a special-interest effect. When people and organizations try to utilize the political system to transfer money from others to themselves, this is known as rent seeking. Because they may supply campaign funding, media, and people who are fervent about a particular topic, special interests acquire disproportionate power in relation to their numbers. In the meanwhile, rational voter ignorance arises because the average voter rarely finds the expense of obtaining the information necessary to make an educated choice worthwhile. Additionally, when there are many voters, a single voter's decision is rarely crucial. The voter becomes even less inclined to learn more as a result, and they may decide not to cast a ballot all. The politician is influenced by these considerations to support special interests.

[12] Special interest effects and logical voter ignorance are further highlighted by the way the candidate packages or bundles their positions. Voting on a particular subject alone

is unlikely to occur among members of the general public who are comparatively uninterested in that issue. He or she probably cares more about a lot of other things, especially when it has little bearing on their well-being. However, when an issue significantly affects their welfare, members of an interest group are likely to vote strictly in accordance with it. Instead of focusing on a single special interest issue, a political candidate's acceptance or rejection will be determined by their full bundle of positions. The political process becomes imprecise with respect to voter preferences since people may only express their desire through a lawmaker who represents a variety of political goods. For instance, it has been calculated that the average citizen makes only one public option for every thousand private sector decisions. Furthermore, politicians frequently present topics in a convoluted way, making it difficult for the majority of people to understand the full expenses such programs would entail. Special interests, on the other hand, are probably well-informed on the fundamental advantages and disadvantages of a policy tailored to their needs.

[13] Because their reelection cycles are brief—two, four, or six years—politicians frequently have shortsightedness.9. Prior to the next election, they are worried about the effects of policies and initiatives. The politician's calculations usually don't give much thought to the long-term effects. Politicians frequently show a lack of vision. They periodically try to directly affect the content of fishery management plans and frequently pass special legislation and appropriations for fisheries. Politicians tend to be shortsighted by nature.

[14] The demand side also exhibits shortsightedness. When it comes to fishery management policy, fishing interests in the majority of managed fisheries are typically shortsighted. Fishermen do not have a firm claim on the future results of their fishery in open-access areas. In other words, individuals cannot be sure that they will gain from the potential short-term sacrifices they make. Conversely, it is anticipated that fishermen in rights-based fisheries will be less opportunistic. Because they are so unclear about future fisheries regulations, fish stocks, and markets, fishermen also have a tendency to be shortsighted. In their shortsightedness, fishermen are just acting rationally.

[15] Both the supply and demand sides' shortsightedness work together to favor laws that offer obvious present gains at the expense of complicated and hard-to-identify future costs. In this setting, conservation—which demands immediate sacrifice for long-term benefits—tends to be seen negatively.

[16] Decoupled benefits and costs are another feature that has a significant impact on fishing policy and results. Both advantages and disadvantages come with political products. The people who pay for a commodity are not the ones who gain from many fisheries items.

[45] Regarding other goods, A special-interest effect occurs when a small number of voters benefit greatly at the expense of many others who suffer only slight personal losses. Rent seeking is the practice of individuals and groups attempting to use the political system to shift funds from others to oneself. Special interests gain disproportionate power compared to their numbers because they can provide media, campaign funds, and individuals who are passionate about a certain issue. Meanwhile, the average voter rarely finds the cost of acquiring the information required to make an informed decision to be worth it, leading to rational voter ignorance. Furthermore, the choice of a single voter is rarely important when there are numerous votes. As a result, the voter is even less motivated to learn more and may choose not to vote at all. These factors influence the politician's decision to back special interests.

[46] The manner the candidate combines or packages their arguments further emphasizes logical voter ignorance and special interest effects. Members of the general public who are relatively uninterested in a particular issue are unlikely to vote on it alone. He or she most likely cares more about a number of other things, particularly when those items don't directly affect their wellbeing. Members of an interest group are likely to vote rigidly in favor of it, nevertheless, if the topic has a substantial impact on their well-being. A political candidate's approval or rejection will be based on their entire package of positions rather than just one special interest issue. Since voters may only express their views through a lawmaker who represents a range of political goods, the political process becomes imprecise with regard to voter preferences. For example, it has been estimated that for every thousand private sector decisions, the average citizen only chooses one public option. Additionally, politicians usually use complicated language when discussing issues, which makes it hard for most people to comprehend the entire cost of such schemes. On the other hand, special interests are most likely aware of the basic benefits and drawbacks of a policy that is customized to meet their requirements.

[47] Politicians are sometimes myopic because their reelection cycles are short—two, four, or six years.9. They are concerned about the consequences of policies and actions before the next election. The long-term implications are typically not given any consideration in the politician's calculations. Lack of vision is a common trait of politicians. They regularly enact special legislation and appropriations for fisheries, and they occasionally attempt to directly influence the content of fishery management plans. Politicians are inherently shortsighted.

[48] Shortsightedness also shows up on the demand side. In most regulated fisheries, fishing interests tend to be shortsighted when it comes to fishery management policies. In open-access zones, fishermen have no strong claim on the future outcomes of their fisheries. To put it another way, people cannot be certain that the possible short-term sacrifices they make would benefit them. Fishermen in rights-based fisheries, on the other hand, are expected to be less opportunistic. Fishermen also tend to be shortsighted because they are so uncertain about future fisheries laws, fish stocks, and markets. Fishermen are simply being reasonable in their shortsightedness.

[49] The shortsightedness of both the supply and demand sides conspires to support rules that provide clear benefits in the here and now at the expense of complex and difficult-to-identify expenses in the future. Conservation, which necessitates short-term sacrifice for long-term gains, is often viewed unfavorably in this context.

[50] Another aspect that significantly affects fishing strategy and outcomes is the decoupling of costs and benefits. Political products

have both benefits and drawbacks. Many products from fisheries do not benefit the people who purchase them. Costs begin to accrue at a different time than benefits for other products. Decoupled benefits and costs are exemplified by government-funded vessel buyback initiatives, such as the US$25 million vessel/permit buyout scheme in the Northeastern US fisheries. The beneficiaries are the fishermen who keep fishing and those whose boats are purchased under the scheme. However, the costs must be covered by the general taxpayer. Contributions and benefits are not distributed in a way that benefits the payers and the recipients, respectively.

[51] There are no incentives for government agencies to produce goods and services efficiently. By cultivating the political power of powerful legislators and constituent groups, bureaucrats enable themselves to assume control of larger government entities. Bureaucrats compete for tax cash, promotions, bigger wages, and more authority, much like private sector employees do, but they are not encouraged to increase the caliber and reduce the cost of their outputs. Public employees cannot increase their compensation by increasing the efficiency of the agency, and their job performance is usually difficult to measure (at least in terms of the contribution to the agency's production). Consequently, they tend to be less cost-conscious because they are spending other people's money. Comparing revenues and costs is not necessary because there is no measure of inefficiency and no pressure to reduce it. Because government entities are designed with incentives, government goods and services are produced inefficiently.

[52] Moreover, the good or service is often supplied by the government alone. The exclusive right of production is required by numerous statutes. Education and postal services are outliers in the USA. When there isn't constant competition for customers, government production is generally inefficient.

[53] Unlike the commercial sector, government inefficiencies are not routinely eliminated. In the private sector, inefficient companies fail and cease operations. Public sector entities that have high costs or are unable to achieve their objectives are often granted more funding. Agencies that reduce spending without using their allocated cash risk having their budget cut the next year.

[54] These two characteristics—the decoupling costs and benefits of fisheries products and the shortsightedness of the primary actors—have a substantial impact on the choice of fishery management policies. Shortsightedness and a failure to link costs and benefits hinder the adoption of effective conservation measures. The fishery management system's structure tends to promote inefficient conservation strategies because it places short-term costs on resource users in exchange for future benefits that would not necessarily accrue to those users who make the sacrifice.

[55] Fisheries policies and programs that benefit a small number of people while burdening taxpayers with the expenditures are often supported by the political marketplace. Policies and programs related to fishing that have short-term benefits but long-term costs are favored. The political marketplace does not favor policies and programs that have short-term costs in exchange for long-term advantages, or that concentrate costs on a small number of people while benefiting many. Effective conservation measures can only be expected from the fishery political marketplace when those who sacrifice now can look forward to benefits later.

[12] Ecosystem-based fisheries management challenges.

[53] The FAO claims that when management turns its focus from target stocks to ecosystems, all of these problems intensify rapidly, transforming biological uncertainty into ecological uncertainty—a far more complex problem. As the number of competing consumers increases, conflicts of interest occur. The goals become increasingly complex and conflicting, and the number of stakeholders is expanded to include all users of all the many ecosystem components. Of this increasing complexity, of course, is not the result of the mistaken notion that stocks are autonomous, but rather of the recognition of the interdependence of all ecosystem components.

[54] Our model of the fishing political marketplace offers strong evidence in favor of this FAO finding. We have concluded that governance dynamics are generally biased against the preservation of fishery resources and the development of long-term, sustainable economic advantages after creating the model for a single fishery or a small group of fisheries.

[55] We believe that ecosystem-based fishery management tends to increase the risk of governance failure. The unfortunate outcome is that attempts to implement ecosystem-based management strategies may potentially make future efforts to achieve sustainable fisheries more challenging.

[13] Conclusions and a summary

[54] We have provided a framework for developing fishery management policies. A political market determines fishery management policies. The primary actors interacting in the fishery political marketplace are fishermen, environmentalists, politicians, and government officials. Some of these organizations demand fishing policies and programs, while others offer them. In this political-economic marketplace, we conclude that there is a bias against conservation and propose remedies.

[55] We must fundamentally alter our current fisheries governance framework in order to put this simple concept into practice. Which reforms fall under this category?

[56] One obvious way to avoid government failure is to privatize the fishing industry. Several countries have privatized government-owned and operated industries, including utilities, railroads, communications, and the energy sector. Complete privatization of fisheries is rare.

However, there has been a new push to give individuals more power over management in order to privatize many management operations. The OECD (1997) describes and analyzes a few co-managed fisheries.

[57] The term "self-governance" describes a fishery in which resource users make all of the major management decisions without the assistance of the government. If all external externalities can be internalized by self-governance and there are no other reasons that could cause market failure, then a fishery may operate well. Despite the current popularity of co-management, there isn't much of a push for fisheries self-governance. Total self-governance would not be optimal from an efficiency perspective, and there are a number of obstacles to privatizing a fishery.

[58] A first step toward self-governance would be to assign users and other stakeholders with substantial stakes in a fishery a greater share of the rights and responsibilities of

creating management rules and accepting full responsibility for their implementation. This would better connect the benefits of conservation in the future with the sacrifices needed to achieve it today. In other words, consumers should be certain that their profits will be commensurate with the sacrifices they make. If such action were taken, managers' and users' interests would be more aligned with the nation's.

[59] Another shift is the implementation of the notion that beneficiaries should pay based on the benefits they receive. Our current system has far too many regulations and programs that benefit a select few while burdening the others. The costs of fishery management must be recouped by the people who gain from it. This would mean imposing financial fees on users of fishery resources. When correctly designed and implemented, cost-recovery can greatly enhance fishery management performance by decreasing the likelihood that the political economy will produce fishery items with decoupled costs and benefits.

[60] The recovery of fisheries costs appears to be spreading. Australia recovers all ascribed costs for administration and research through taxes. This strategy resulted in the collection of US$ 10 million for management expenses in 1996–1997 and US$ 11 million financing research and development-related costs. Payments made to Canada for fisheries management were recovered. In 1997, commercial fishers yielded 38 million US dollars. It paid for a license to access the fisheries. Additionally, fishermen must cover the cost of dockside monitoring and observers at sea. New Zealand recovers costs associated with fisheries management and conservation services rendered to the commercial sector. The concept of cost recovery holds that the government should reimburse the private sector for costs incurred as a result of the commercial fishing industry. In 1997, this program produced a recovery of US$23 million, a 9% increase over the previous year. Iceland received US$1.8 million from ITQ owners to cover the costs of monitoring ITQ legislation. Even the USA has only recently begun to develop a cost recovery mechanism for its IFQ fisheries.

[61] Lastly, the management of fisheries must not be impacted by the shortsightedness of elected leaders. Political interference in fishery management is pervasive worldwide. A method that is consistent with democratic principles and allows political involvement in fishery management only at the strategic level must be found. Elected officials shall assign the authorized management institutions the daily responsibility of developing and implementing fishery management plans.

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