

CHAPTER 19: ACHIEVING SUSTAINABLE FISHERIES

The current fishery management regime's emphasis on local participation, coupling of science and management, and regional flexibility are laudable. Nevertheless, the last thirty years have witnessed overexploitation of many fish stocks, degradation of habitats, and negative consequences for too many ecosystems and fishing communities. To ensure the long-term sustainability of U.S. fisheries, maximize social and economic benefits, and reinforce the principle that living marine resources are held in public trust for the benefit of all U.S. citizens, fishery management must be improved. While ultimately the management of fisheries should move toward a more ecosystem-based approach, specific reforms can produce some immediate improvements. These include increasing the role of science by separating allocation and assessment, better integration of ecosystem science, data collection, and processing with management and enforcement, and exploring the use of dedicated access privileges. Finally, improved regional coordination and planning will help put fishery management in the broader context of ocean and coastal management.

CONTEMPLATING THIRTY YEARS OF FISHERY MANAGEMENT

When the Stratton Commission report was released in 1969, marine fisheries were largely unregulated and coastal states had primary responsibility for fishery management. The U.S. fishing industry was behind much of the world both in harvesting fish and technical sophistication. Distant fishing nations, such as the then Soviet Union, Spain, and Japan, dominated harvests on the coasts of North America, fishing just outside the 3 nautical mile limit of U.S. territorial waters.

But fishery harvests around the world were increasing in the 1960s, and many people believed they would continue to increase indefinitely. The Stratton Commission predicted that enhanced technology and intensified exploitation of new species could eventually increase worldwide landings from 60 million metric tons in 1966 to 440–550 million tons.¹ That Commission saw fisheries as an area of immense opportunity, and called for the expansion of U.S. fishing capability. Unfortunately, events over the next few decades showed these predictions to be overly optimistic.

In 1970, landings of Peruvian anchoveta, the largest fishery in the world, fell by 10 million metric tons in one year—at the time, roughly 10 percent of world fishery landings.² Although El Niño conditions in the Pacific Ocean are often cited as the cause, many scientists believe the collapse was exacerbated by excessive fishing effort. The following two decades also saw the North Atlantic cod fisheries drastically decline; in the 1990s, Canada completely shut down its cod fishery. Instead of being able to expand worldwide fish landings by eight to ten times, as predicted by the Stratton Commission, it now appears that fish landings were already at or near their peak in the late 1960s.

In 1976, Congress approved the Magnuson–Stevens Fishery Conservation and Management Act (hereinafter, the Act or the Magnuson-Stevens Act) to manage and assert U.S. control over fishery resources within 200

nautical miles of the coast, later designated as the U.S. exclusive economic zone (EEZ). Eight Regional Fishery Management Councils (RFMCs) were created to develop management plans for fisheries in federal waters. The Act required regional plans to be consistent with broad national guidelines, such as the prevention of overfishing and the requirement to use the best available science, but otherwise granted considerable flexibility to the RFMCs. The Act mistakenly assumed that once foreign fishing fleets were removed from U.S. waters, major fishery management problems would be over.

In subsequent years, the domestic fishing industry rushed to enlarge its capacity to catch fish. New technologies were developed while programs such as the Capital Construction Fund and Fishing Vessel Obligation Guarantee Program provided incentives for U.S. fishermen to upgrade or buy new vessels. This led to an unprecedented and unforeseen expansion of U.S. fishing power.

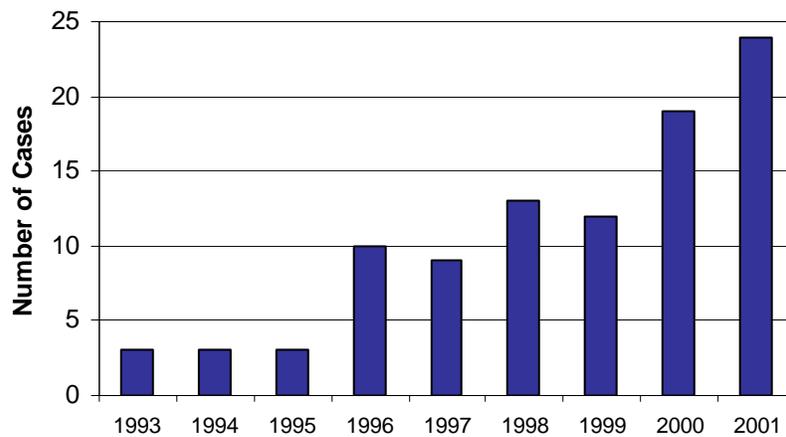
Most of the abundant stocks available to be caught by American fleets were in the North Pacific. In other areas, fish stocks—although still viable—had already been depleted by foreign fleets. The regional flexibility that had been seen as a great strength of the new law now showed its downside as some RFMCs set unsustainable harvest levels, leading to the collapse or near-collapse of several important fisheries.

Another unforeseen and unfortunate consequence of the new management regime was the development of an adversarial relationship between fishermen and government scientists and managers. Because assessments indicated that many stocks were already depleted, scientists urged reductions in catches. Many fishermen however, having made substantial capital investments in boats and gear, resisted these findings and instead raised doubts about the credibility of the assessments. The RFMCs frequently made decisions that supported the fishermen by downplaying scientific advice and increasing catch limits. As a result, in most regions, stocks continued to decline throughout the 1980s.

Contention grew, and the 1990s were characterized by a dramatic increase in litigation, crisis-driven decision making, and management through court orders and congressional intervention (Figure 19.1). As of January 2002, more than 110 lawsuits were pending against the National Oceanic and Atmospheric Administration's (NOAA's) National Marine Fisheries Service (NMFS). And between 1990 and 2000, the National Research Council conducted ten studies aimed at resolving disputes in fishery management.

On a more positive note, the 1990s also witnessed some signs of recovery. Atlantic striped bass were declared recovered in 1995, many New England groundfish species began to come back, and summer flounder stocks in the Mid-Atlantic started to increase.

A 2002 study by the National Academy of Public Administration concluded that the U.S. fishery management system was in disarray and recommended that the U.S. Commission on Ocean Policy explore the need for major changes in the fishery management system.³ While amendments to the Magnuson–Stevens Act have helped reverse fishery declines, additional changes will be necessary to manage fisheries in a sustainable manner over the long term.

Figure 19.1. Fishery Litigation Grows as Interests Clash

From 1993 to 2001, the number of cases brought against the National Marine Fisheries Service increased eight fold. A major cause of new cases during this time was disputes about the validity of stock assessments and resulting catch limits.

Source: National Academy of Public Administration. *Courts, Congress, and Constituencies: Managing Fisheries by Default*. Washington, DC, July 2002.

BUILDING SUSTAINABLE FISHERIES BASED ON SOUND SCIENCE

The Value of Science for Wise Management

Accurate, reliable science is critical to the successful management of fisheries. Two kinds of data are collected to support fisheries science. *Fishery-dependent* data are collected as part of normal fishing activities and include recreational and commercial catch and landings records, dealer reports, and onboard observer data. Observers on fishing vessels provide a variety of useful fishery-dependent data concerning harvest methods and the bycatch of fish and prohibited species, such as turtles and marine mammals. *Fishery-independent* data are collected outside of normal fishing activities, typically through scientifically-designed surveys conducted by specialized research vessels.

Using available data as input, computer models produce stock assessments that estimate the size and characteristics of a certain fish population. Based on these assessments, and an understanding of the biology of that species, scientists can then predict the effects of different levels of fishing intensity on the population. Fishery managers must then determine how, when, where, and—most importantly—how many fish may be caught.

Although fishery data collection and stock assessment models can always be improved, a lack of adequate scientific information has not been the main culprit in most instances of overfishing. The Mid-Atlantic and New England RFMCs, which managed fourteen of the thirty-three stocks that experienced overfishing in 2001, have some of the best scientific support in the world. A 2002 National Research Council report concluded that the problem in most cases of overfishing was that the RFMCs disregarded or downplayed valid scientific information when setting harvest guidelines.⁴ Neither NMFS nor the Secretary of Commerce used their authority to prevent the RFMCs from taking such actions.

The Magnuson–Stevens Act requires each RFMC to establish and maintain a scientific and statistical committee (SSC) to provide “the best scientific information available” and assist in the development of fishery management plans. However, the Act does not require the RFMCs to follow the advice of the SSCs.

Social, economic, and political considerations have often led the councils to downplay the best available scientific information, resulting in overfishing and the slow recovery of overfished stocks. In addition, the selection of SSC members is generally up to each RFMC. No process is in place for ensuring that SSC members have the proper scientific credentials and are free from conflicts of interest. Although some councils do assemble highly respected SSCs and follow their advice, the public and the fishing community should be confident this is the case in all regions.

Recommendation 19–1. Congress should amend the Magnuson–Stevens Fishery Conservation and Management Act and related statutes to require Regional Fishery Management Councils (RFMCs) and interstate fisheries commissions to rely on their Scientific and Statistical Committees (SSCs), incorporating SSC findings and advice into the decision-making process. In keeping with this stronger role, SSC members should meet more stringent scientific and conflict of interest requirements, and receive compensation.

To ensure a strengthened SSC:

- *each RFMC should nominate candidates for service on its SSC. Nominees will typically be scientists with strong technical credentials and experience, selected from federal or state governments or academia. Private sector scientists who are technically qualified may also be nominated if they meet the conflict of interest requirements.*
- *no individual should be allowed to serve on an SSC if he or she is formally or financially affiliated with any harvesting or processing sector.*
- *the National Oceanic and Atmospheric Administration (NOAA) should evaluate the qualifications and potential conflicts of interest of SSC nominees through an independent review process designed by a credible, scientific organization. Ultimately, SSC appointments should be approved by the NOAA Administrator.*
- *SSC members should serve for fixed terms to allow for rotation and new members over time.*
- *like RFMC members, participants in the SSC (or their home institutions) should be compensated for time spent on RFMC business.*

Separating Scientific and Management Decisions

One of the strengths of the U.S. fishery management system is its flexibility in allowing different regions to determine who can fish, as well as how, where, and when. These are called allocation decisions. But the question of how many fish can be sustainably harvested (the assessment decisions) should be insulated from political pressures.

Because of their knowledge of the fisheries and communities in their region, RFMC members are best suited to make decisions about allocation of the available harvest and other issues related to the operations of regional fisheries. However, scientific decisions are more appropriately made by the SSCs created to support the RFMCs. Scientific decisions include stock assessments and determinations of allowable biological catch—the maximum amount of fish that can be harvested without adversely affecting recruitment or other key biological components of the fish population.

While determining allowable biological catch is a scientific question, it must be informed and guided by long-term objectives set by managers for both the fishery and the ecosystem. The role of scientific information should be as strong as possible in fishery management and subject to the least possible political influence.

For this reason, many fishery managers and analysts have recommended separating scientific assessment decisions from the more political allocation decisions. While not required by law, some RFMCs have already taken this step. For example, the North Pacific council has a history of setting harvest levels at or below the level recommended by its SSC. Many policy makers believe this practice is largely responsible for the successful management of the fisheries in that region.

Recommendation 19–2. Scientific and Statistical Committees (SSCs) should be required to supply Regional Fishery Management Councils (RFMCs) with the scientific information necessary to make fishery management decisions. Such information could include reports on stock status and health, socioeconomic impacts of management measures, sustainability of fishing practices, and habitat status. In particular, the SSCs should determine allowable biological catch based on the best scientific information available to them.

Recommendation 19-3. Each Regional Fishery Management Council should be required to set harvest limits at or below the allowable biological catch determined by its Scientific and Statistical Committee. The councils should begin immediately to follow this practice, which need to be codified at the next opportunity in amendments to the Magnuson–Stevens Fishery Conservation and Management Act.

The Need for Independent Review

Independent review is the hallmark of the scientific process, providing assurance that appropriate procedures for data collection and analysis have been used. Typically such reviews are conducted by scientists with expertise similar to those who have done the work; thus the process is called peer review.

Many of those affected by RFMC decisions have questioned the adequacy of the scientific information on which those decisions were based. Although scientific findings are always easier to accept when they bring good news, the lack of a standardized, independent, and transparent review process in all regions has added to the level of distrust. Many of the RFMCs and interstate commissions with management responsibilities currently apply the peer review process sporadically. The North Pacific, New England and Mid-Atlantic regions have long-standing peer review programs. Other RFMCs use an external peer review process only when results are expected to be controversial. In some cases where scientific information is reviewed, the reviewers have not been perceived as independent, a critical feature of the process.

The National Research Council (NRC) has conducted a number of reviews of NMFS science. However, the NRC cannot be called upon to review every scientific decision, particularly stock assessments, at the rate they are generated for the RFMCs. An interesting model for external scientific review is the Center for Independent Experts that was established by NMFS in 1998 to conduct reviews of fisheries-related science. Although NMFS pays for its operation, the center is currently based at the University of Miami and is completely insulated from NMFS once it initiates a peer review. Although the center’s experts have examined a number of controversial topics, their reviews have so far been less subject to challenge than internal NMFS peer reviews.

Recommendation 19–4. The National Marine Fisheries Service, working with the Regional Fishery Management Councils and the interstate fisheries commissions, should develop a process for independent review of the scientific information generated by the Scientific and Statistical Committees in all regions.

The process should include three distinct procedures:

- *a standard review, undertaken annually by regional scientists, to ensure that the correct data and models are being used.*
- *an enhanced review to evaluate the models and assessment procedures. To ensure that these reviews are independent, a significant proportion of the reviewers should come from outside the region and be selected by a group such as the Center for Independent Experts. These types of reviews would be conducted on a three- to five-year cycle, or as needed, to help ensure that the latest methods and approaches are being used.*
- *an expedited review to be used when results are extremely controversial or when the normal review process would be too slow. In these cases, all reviewers should be selected by a group such as the Center for Independent Experts.*

As these review procedures are implemented and become a regular part of the fishery management process, NMFS, the RFMCs, and states should be able to develop routine quality assurance steps and standards to be applied to all stock assessments and other scientific input to the fisheries process. A certification procedure for stock assessment scientists will help ensure implementation of these standards.

Using Default Measures to Ensure Progress

The difficult process of establishing allowable biological catch, and then determining allocations based on that figure, can result in lengthy delays in developing or revising fishery management plans. The Magnuson–Stevens Act does not require RFMCs to submit a new or revised plan to NOAA on any specific schedule. As a result, council delays can lead to a fishery having no management measures in place or relying on outdated, inadequate plans. When that happens, the RFMCs are not penalized; instead, the adverse consequences are all borne by the fishery resource. There are two possible sources of delay: SSC difficulties in reaching agreement on allowable biological catch and RFMC delays in submitting management plans to NOAA for approval.

The science behind stock assessments is complex and constantly evolving. By nature and training, many scientists are reluctant to declare a definitive numerical conclusion in the face of inevitable uncertainty. And yet, decisions must be made. By joining an SSC, scientists must accept the necessity of giving the best advice possible within a real-world timeframe.

Delays in formulating management plans within the RFMC can be more intractable. Under the current system, RFMCs can simply avoid difficult decisions by postponing development of plans. While the councils cannot be sued for their slowness, NMFS can be. In fact, an increasing number of lawsuits are prompted by delays in management actions, particularly for plans to end overfishing.

The very possibility of extended delays puts pressure on NMFS to recommend approval of inadequate management plans. Based on a recommendation from NMFS, the Secretary of Commerce may approve, partly reject, or reject a plan, but may not amend it. As part of its recommendation, NMFS is aware that rejection of a plan could result in no conservation measures being in place until the RFMC agrees on a revised plan—a process that could take many months.

Although the Secretary of Commerce can legally choose to develop a fishery management plan within the agency instead of waiting for a regional council to do so, this is almost always impractical. Since Congress clearly desired RFMCs to have the lead in fishery management, the Secretary can either enter into a protracted, contentious, and politicized process to develop a departmental plan, or continue to wait for the RFMC to act. Under either scenario, the resource may remain unprotected for an extended period of time.

Indecision on the part of SSCs or RFMCs, for whatever cause, should not delay measures to ensure the long-term health and economic viability of a fishery. By setting clear deadlines for action, and activating established default measures if a deadline is missed, the roles of the different entities can be maintained without sacrificing the resource.

Recommendation 19–5. Each Regional Fishery Management Council should set a deadline for its Scientific and Statistical Committee (SSC) to determine allowable biological catch. If the SSC does not meet that deadline, the National Marine Fisheries Service Regional Science Director should set the allowable biological catch for that fishery.

Recommendation 19–6. Once allowable biological catch is determined, whether by the Scientific and Statistical Committee or the National Marine Fisheries Service (NMFS) Regional Science Director, the Regional Fishery Management Council should propose a fishery management plan in time for adequate review and approval by NMFS. If the plan is not presented in a timely fashion, all fishing on that stock should be suspended until NMFS can review the adequacy of the management plan.

Making Research Relevant

As noted above, independent reviews have generally concluded that NMFS stock assessment programs are technically sound and highly credible. However, improvements could be made to better serve the RFMCs' information needs, support recreational fisheries, and expand opportunities for cooperative research to involve scientists and fishermen in joint projects.

RFMC Input on Research Priorities

RFMC members need access to reliable information to do their jobs. The NMFS science program has done well in providing biological information to manage single species. However, the research program is less well positioned to answer many other pressing questions.⁵ Generally, questions that involve interactions among fisheries, habitat, and other protected species, as well as social science and economic questions, have received less attention than traditional stock assessment science and fishery biology.^{6,7} The move toward ecosystem-based management, including considerations such as essential fish habitat, highlights these shortcomings. As the agency charged with responsibility for federal fishery management, NMFS should ensure that its research agenda supports the information needs of the RFMCs.

Recommendation 19–7. The Regional Fishery Management Councils and their Scientific and Statistical Committees should develop an annual, prioritized list of management information needs and provide it to the National Marine Fisheries Service (NMFS). NMFS should incorporate these needs to the maximum extent possible in designing its research, analysis, and data collection programs.

The lists of RFMC information needs will also be of great value to the regional ocean information programs discussed in Chapter 5, which would be responsible for crafting regional research strategies to meet management needs. Fisheries research and data requirements should also be included as an integral part of planning for the Integrated Ocean Observing System discussed in Chapter 26.

Data Needs for Recreational Fisheries

Recreational fishing is an important part of the culture and economy of many coastal communities. In 2002, an estimated 9.1 million saltwater recreational fishermen spent over \$20 billion and supported almost 300,000 jobs.⁸

Recreational fishing has many impacts on fishery resources. On the beneficial side, the increasing number of catch-and-release programs has been associated with helping some stocks recover. In addition, the Ethical Angler program, a voluntary code developed with cooperation between NMFS and constituent groups, promotes a stewardship ethic among recreational fishermen on behalf of the entire marine environment. On the other hand, recreational fishermen can contribute significantly to the overall mortality of certain stocks. For example, in 2001, recreational anglers landed over 19 million pounds of striped bass on the East Coast, three times the amount caught by the commercial sector.⁹

Despite the economic and ecological importance of recreational fishing, much less data are collected in this area than for commercial fisheries. The NMFS Marine Recreational Fisheries Statistics Survey, the primary recreational data collection program, is accomplished using two methods: an intercept survey, where fishermen are interviewed at coastal fishing ports, and a random telephone survey of all coastal households. The telephone survey results could be greatly improved if the sample of individuals called could be drawn from a list of licensed recreational fishermen rather than all coastal households. This would require coastal states and the federal government to require licenses for all saltwater anglers.

Although the existing survey methodology is adequate for long term tracking of recreational fishing trends, it has proven less useful for in-season management. For example, on the East Coast, the lack of in-season tracking of catches by recreational fishermen has led to the chronic overharvesting of summer flounder.¹⁰ Due to the increasing popularity of marine recreational fishing, and its growing proportion of the total catch in some fisheries, it will be critical to collect timely data in this sector to allow for sustainable management of fisheries.

Recommendation 19–8. The National Marine Fisheries Service, working with states and interstate fisheries commissions, should require all saltwater anglers to purchase licenses to improve in-season data collection on recreational fishing. Priority should be given to fisheries in which recreational fishing is responsible for a large part of the catch, or in which recreational fishermen regularly exceed their allocated quota.

The Value of Cooperative Research

Involving fishermen in the research process, referred to as cooperative research, is a promising approach that can produce benefits for the fishermen, the scientists, and ultimately the management process. Underutilized fishing vessels can provide cost-effective research platforms to expand the scope of data gathering and create an additional source of income for fishing communities waiting for stocks to recover. Fishing vessels are usually significantly less expensive to operate than traditional research vessels, while still suitable for many types of research. Scientists can also benefit from the knowledge and experience gained by fishermen during years at sea.

Increased interaction and rapport between fishermen and fishery scientists is another benefit of cooperative research. In many regions of the country, fishermen are skeptical of the science and analysis used to support fisheries management. Until the 1990s, scientists rarely included fishermen in either the design or data collection phases of their research. This has fed the perception in fishing communities that scientists do not understand fishing and do not value the experiences of fishermen. Greater involvement of fishermen in research programs appears to have been successful in reversing this perception and promoting better understanding between fishermen and scientists.

In 1977, when NMFS stock assessments indicated that bowhead whales off Alaska's North Slope were at extremely low levels, the International Whaling Commission proposed a ban on all whaling, including that done for subsistence. The indigenous whaling community, convinced that the assessment had under-counted whales, provided NMFS scientists with additional information on whale locations and migration patterns based on traditional knowledge. The scientists revised their survey protocols to incorporate this new information, determined that they had in fact underestimated the whale population, and allowed the subsistence harvest to continue.

Similarly, in 1999, initial estimates indicated that Atlantic monkfish were severely overfished and a management plan was created to curtail fishing and rebuild the stock. When fishermen contended that the NMFS survey was missing significant stocks of monkfish in deeper waters, NMFS initiated a cooperative

research program to investigate. The results indicated that monkfish were indeed present in significant numbers in deeper waters, allowing managers to reduce the severity of catch restrictions.

In both of these examples, anecdotal or traditional information was not unconditionally accepted. Instead, scientists used data from fishermen as the basis for further investigation. Scientists can benefit from fishermen's experience by incorporating their suggestions into the design of research programs. At the same time, fishermen need to realize that informal information can only be used in decision making after it has been tested and verified according to a methodical, scientific process.

Cooperative research has the potential to be applied quite broadly. Although fishery-specific research, particularly experiments with new or modified gear types, is the most obvious application, others should be considered. The RFMC lists of information needs, suggested above in Recommendation 19–6, will be helpful in selecting topics for cooperative research. For example, NOAA should organize its oceanographic research programs to take advantage of cooperative opportunities, as should scientists conducting economic or social science research related to oceans and coasts.

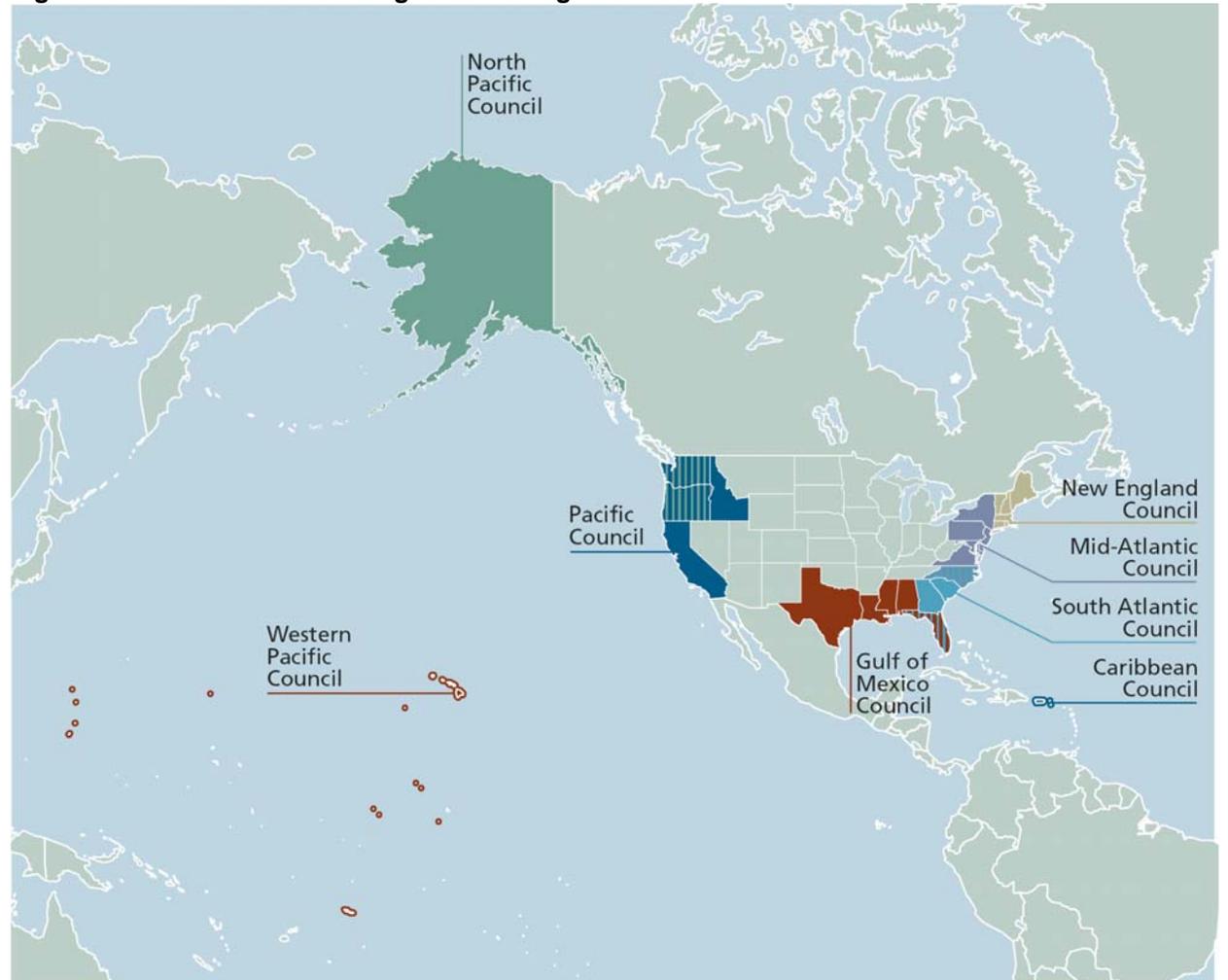
Recommendation 19–9. Congress should increase support for an expanded, regionally-based cooperative research program in the National Oceanic and Atmospheric Administration (NOAA) that coordinates and funds collaborative projects among scientists and commercial and recreational fishermen. NOAA should develop a process for external evaluation and ranking of all cooperative research proposals to ensure the most worthwhile projects are funded, the most capable performers are undertaking the research, and the information produced is both scientifically credible and useful to managers.

STRENGTHENING FISHERY GOVERNANCE

Clarifying Fishery Management Authority and Jurisdiction

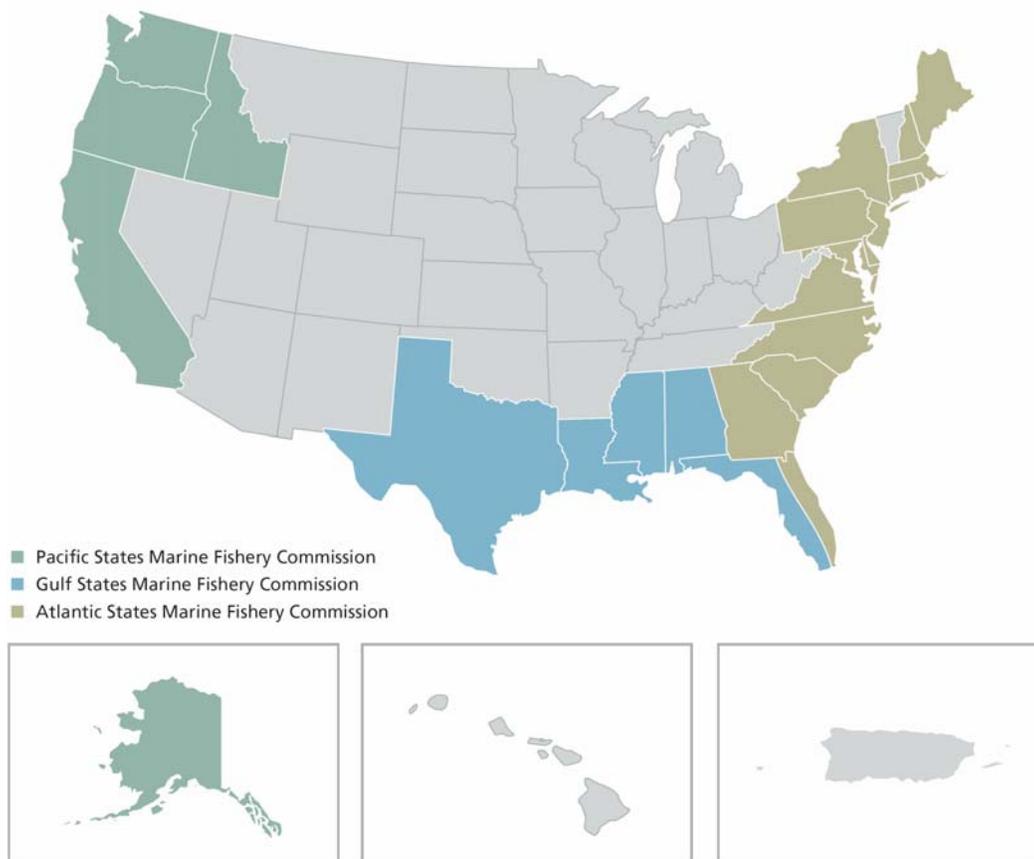
In 1976, the Magnuson–Stevens Act greatly expanded the federal government's marine fishery management jurisdiction from the seaward boundary of state waters out to 200 nautical miles from the coast. Known as the Fisheries Conservation Zone, this newly created area was later subsumed into the EEZ. In general, marine fishery management jurisdiction is divided among the states, three interstate fisheries commissions, eight RFMCs, and the federal government. The RFMCs develop management plans for fisheries within their portion of the EEZ (Figure 19.2). Based on advisory group recommendations, NMFS develops and implements plans for highly migratory species (including tuna, swordfish, billfish, and sharks) within the EEZ in the Atlantic, Gulf of Mexico, and Caribbean regions. In the Pacific, the RFMCs or states include highly migratory species in their management plans.

Figure 19.2. Fisheries are Managed at the Regional Level



The Magnuson-Stevens Fishery Conservation and Management Act of 1976 created eight regional fishery councils to manage the harvest of living marine resources within each region. The councils are responsible for sustainable development of domestic fisheries and link the fishing community more directly to the management process. Several states belong to more than one council. For example, Oregon and Washington are members of both the Pacific Council and North Pacific Council.

Each coastal state has authority over fisheries that occur only in that state's waters, while interstate fisheries commissions can develop management plans for fisheries that occur primarily in state waters but cross the boundaries of many states (Figure 19.3).

Figure 19.3. Migratory Fish Require Larger Management Areas

The three interstate marine fisheries commissions are critical to managing and conserving migratory fish that traverse the jurisdictional waters of multiple states.

Interstate Fisheries Commissions

For most of their history, the Atlantic States and Gulf States Marine Fisheries Commissions provided forums for assembling interstate catch statistics and designing fishery management plans to conserve and sustain fish stocks. State compliance with these plans was voluntary. The Gulf States Commission's plans remain voluntary, but the Atlantic Coastal Fisheries Cooperative Management Act of 1994 authorized the Secretary of Commerce to close fisheries that the Atlantic States Commission determined are out of compliance with its management plan. The Pacific States Marine Fisheries Commission is primarily a research coordination agency that provides a forum for discussing interstate fishery issues.

The Great Lakes Fishery Commission, established by agreement between Canada and the United States in 1955, develops coordinated research programs and recommends measures to maximize productivity of Great Lakes fisheries. It also oversees a program to eradicate or minimize sea lamprey populations in the Great Lakes.

Recommendation 19–10. Congress should develop new statutory authority, similar to the Atlantic Coastal Fisheries Cooperative Management Act, to support and empower the Gulf States and Pacific States Fisheries Management Commissions. All interstate management plans should adhere to the national standards in the Magnuson–Stevens Fishery Conservation and Management Act and the

federal guidelines implementing these standards. States should participate in guideline development to ensure they are relevant to interstate plans.

Clarifying Lead Authorities for Joint Planning Purposes

Dividing the natural world into neat management units is never easy, and fish populations are no exception. Although a few fish species remain in one area for most of their lives, others are highly mobile and cross federal, state, and interstate boundaries. The lack of effective mechanisms for coordination and cooperation among the many fishery management entities exacerbates the problem of managing transboundary stocks.

The existing jurisdictional structure requires the development of joint plans, primarily in the Atlantic, by two or more RFMCs, and by the states and RFMCs. In most cases, each entity in the joint planning process has equivalent authority. This joint planning process has generally been inefficient. Joint plans take longer to approve and amend, causing delays in needed conservation measures. In addition, the varied jurisdictions create confusion for fishermen and the public about who is in charge of management and enforcement. Changes are needed to reduce the jurisdictional confusion in marine fishery management and improve cooperation among the states, interstate commissions, RFMCs, and the federal government.

Recommendation 19–11. When a fish stock crosses administrative boundaries, Congress should clearly assign fishery management jurisdiction and authority. For each fishery management plan, a state, Regional Fishery Management Council (RFMC), interstate fisheries commission, or the National Oceanic and Atmospheric Administration (NOAA) should be established as the lead authority. That designation should be based primarily on the proportion of catch associated with each management authority. However, once designated, management authority should not shift based on annual changes in landings.

Specifically, fishery management jurisdiction and authority should be addressed as follows:

- *for interjurisdictional fisheries that occur primarily within state waters, interstate fisheries commissions should take the management lead within both state waters and the exclusive economic zone. For the Atlantic Coast, this could be implemented using authorities provided in the Atlantic Coastal Fisheries Cooperative Management Act. The Great Lakes Fishery Commission should continue to oversee Great Lakes fisheries.*
- *for fisheries that occur primarily in the exclusive economic zone, one RFMC should be responsible for developing the plan. For fisheries that are shared substantially among the jurisdictions of two or more RFMCs, the RFMCs should designate a lead. If the RFMCs are unable to agree, the NOAA Administrator should designate the lead RFMC.*
- *no changes are recommended in jurisdiction for management of highly migratory species.*
- *for any other disputes regarding jurisdiction, the NOAA Administrator should designate the lead authority.*

Improving the Regional Fishery Management Councils

Building on Success

Much of the criticism of fishery management has been directed at the RFMCs. Every council except the North Pacific and Western Pacific has jurisdiction over stocks that are being overfished, and all oversee stocks that have been overfished in the past. The North Pacific RFMC appears to be working well in most facets of its management responsibility. Of the 82 stocks under its jurisdiction with sufficient information to assess, none was classified as overfished in 2001 and only 2 stocks are at levels of abundance that indicate past overfishing. For the remaining seven RFMCs, of the 147 stocks with sufficient information to assess, 33 (22 percent) were being overfished in 2001, and 50 are at levels of abundance that indicate past overfishing.¹¹

Despite this mixed record, several aspects of the existing RFMC system echo the major themes outlined in this report: a regional approach to management based on geographically defined ecosystems; a management process that requires local participation; and the incorporation of science-based, peer-reviewed information in the development of management plans. The following recommendations seek to strengthen the management process for all RFMCs, while maintaining the positive features of the system and building on the successes some have achieved.

Broadening Council Membership

The Magnuson–Stevens Act states that the Secretary of Commerce must “to the extent practicable, ensure a fair and balanced apportionment ... of the active participants” on the RFMCs. However, the Secretary can only choose RFMC members from the slate of candidates forwarded by the governors. The governors themselves are under no legal obligation to put forth a fair and balanced slate of candidates. Under the Act, their only obligation is to ensure that each candidate is “knowledgeable regarding the conservation and management, or the commercial or recreational harvest, of the fishery resources of the geographical area concerned.” This loophole has resulted in uneven representation on some RFMCs.

The governors are not required to recommend candidates from outside the fish harvesting industry, such as consumer groups, academia, subsistence fishermen, or environmental organizations, although these perspectives could help achieve a more balanced management regime. As it stands, the fishing industry representatives who make up the majority of RFMC members may tend to favor economic interests over the long-term sustainability of the stocks. The relatively narrow representation on RFMCs may also fuel legal challenges to fishery management plans based on allegations of conflict of interest—although it should be noted that industry groups challenge fishery management decisions as frequently as public interest groups.

Amendments are needed to ensure that RFMC membership is balanced among competing user groups and other interested parties, and that fishery management plans reflect a broad, long-term view of the public’s interests. Identifying the best mix will require knowledge of the federal fishery management process and an understanding of other factors affecting ocean ecosystems. This expertise resides in the NOAA Administrator, not the Secretary of Commerce who is currently responsible for appointing RFMC members.

Recommendation 19–12. Congress should amend the Magnuson–Stevens Fishery Conservation and Management Act to require governors to submit a broad slate of candidates for each vacancy of an appointed Regional Fishery Management Council seat. The slate should include at least two representatives each from the commercial fishing industry, the recreational fishing sector, and the general public.

Recommendation 19–13. Congress should give the Administrator of the National Oceanic and Atmospheric Administration responsibility for appointing Regional Fishery Management Council members with the goal of creating councils that are knowledgeable, fair, and reflect a broad range of interests.

Training New Council Members

Fishery management demands expertise in biology, economics, public policy, and other disciplines. Although RFMC members are required to be knowledgeable about the fishery resources in their region, very few come into the process with resource management experience or scientific training. As Julie Morris, a member of the Gulf of Mexico council, said in testimony before the Commission (Appendix 2), “When I first began working with marine fisheries, the concept of ‘spawning potential ratios’ was difficult to understand. Now, after six

months, I'm still struggling to understand the concepts of optimum yield, biomass at maximum sustainable yield, minimum stock size threshold, and how they all fit together to determine the allowable catch.”

NMFS offers a training course for new RFMC members, but they are not required to attend—and many do not. Friction between NMFS and some RFMC members has added to skepticism about the value of this training. As a result, council members often make important decisions affecting fishermen, fishing communities, and fishery resources without an adequate understanding of all relevant scientific, economic, social, and legal information.

Recommendation 19–14. The National Marine Fisheries Service (NMFS) should require all newly appointed Regional Fishery Management Council (RFMC) members to complete a training course within six months of their appointment. NMFS should contract with an external organization to develop and implement this training course and Congress should provide adequate funding. Members who have not completed the training may participate in RFMC meetings, but may not vote.

The training course should:

- *cover a variety of topics including: fishery science and basic stock assessment; social science and fishery economics; the legal requirements of the Magnuson–Stevens Fishery Conservation and Management Act, the National Environmental Policy Act, the Administrative Procedures Act, and other relevant laws or regulations; conflict of interest policies for RFMC members; and the public process involved in developing fishery management plans.*
- *be open to current RFMC members and other participants in the process as space permits.*

ENDING THE RACE FOR FISH

U.S. fishery management has historically made use of access systems—whether open or limited—that promote an unsustainable “race for the fish.” This approach has produced serious resource conservation problems in many U.S. fisheries and must be changed.

Traditional Management Approaches

Until the end of the 20th century, most U.S. fisheries allowed access to anyone who wanted to fish. There were few, if any, limits other than the usually nominal cost of a permit and possession of the necessary fishing gear. In profitable fisheries, this led to ever-increasing numbers of entrants, with ever-increasing pressure being put on the fishery resource.

Recognizing the dangers posed by overfishing, managers began to regulate fishermen by placing controls either on input or output. Input controls include such measures as closing access to fisheries by limiting permits, specifying the allowable types and amounts of gear and methods, and limiting available fishing areas or seasons. Output controls include setting total allowable catch (the amount of fish that may be taken by the entire fleet per fishing season), bycatch limits (numbers of non-targeted species captured), and trip or bag limits for individual fishermen.

These management techniques create incentives for fishermen to develop better gear or to devise new methods that allow them to catch more fish, and to do so faster than other fishermen, before any overall limit is reached. They provide no incentive for individual fishermen to conserve fish, because any fish not caught is likely to be scooped up by someone else. This race for fish created an unfortunate cat-and-mouse chase.

In response to each new measure designed to limit fishing effort, fishermen developed new fishing methods that, although legal, undermined the goal of reaching sustainable harvest levels. This prompted managers to

promulgate more restrictive measures and fishermen to develop more ingenious methods to work around them. For example, if managers limited the length of the boat, fishermen increased its width to hold more catch. If managers then limited the width, fishermen installed bigger motors to allow them to get back and forth from fishing grounds faster. If managers limited engine horsepower, fishermen used secondary boats to offload their catch while they kept on fishing.

One input control many managers turned to was limiting fishing days for each fisherman or for an entire fleet. In response, many fishermen found ways to increase their fishing effort during the shorter season. In New England, the multispecies groundfish fishery shrank from a year-round fishery to less than a hundred days at sea per fisherman, with recent proposals for even lower limits. In the historically year-round halibut/sablefish fishery in the Gulf of Alaska, the fishing season dwindled to less than a week by the early 1990s.

In addition to conservation concerns, the race for fish can create safety problems. Faced by a sharply curtailed amount of time in which to harvest, fishermen often feel compelled to operate in unsafe weather conditions while loading their boats to capacity and beyond.

The constant race for fish, and the increasingly adversarial relationship between fishermen and managers, created intense pressures. Fishermen fished harder for smaller returns and managers hesitated to further reduce catch limits, fearing political and economic consequences. These pressures have been identified by many as a contributing factor in the decline of several fish stocks, notably the New England groundfish fishery.¹²

For reasons of tradition or culture, most managers hesitated to limit the number of new entrants to a fishery. However, the ineffectiveness of other controls eventually did lead managers in some fisheries to control access, for example by limiting the number of available permits.

Dedicated Access Privileges

To solve the problems described above, managers began exploring dedicated access privileges, a novel form of output control whereby an individual fisherman, community, or other entity is granted the privilege to catch a specified portion of the total allowable catch. With this assurance in place, there would no longer be an incentive for fishermen to fish harder and faster because each could only catch his or her share of the total. The incentive would then be to catch the full share at a low cost and sell the best quality fish at the highest obtainable price.

There are several different types of dedicated access privileges:

- *Individual fishing quotas* (IFQs) allow each eligible fisherman to catch a specified portion of the total allowable catch. When the assigned portions can be sold or transferred to other fishermen, they are called individual transferable quotas (ITQs).
- *Community quotas* grant a specified portion of the allowable catch to a community. The community then decides how to allocate the catch. For example, the Community Development Quota Program in Alaska granted remote villages a portion of the total allowable catch to enhance fishery-based economic development.
- *Cooperatives* split the available quota among various fishing and processing entities within a fishery via contractual agreements.
- *Geographically based programs* give an individual or group dedicated access to the fish within a specific area of the ocean.

Many other variations and combinations of dedicated access privileges are possible. Dedicated access programs can provide substantial benefits in addition to ending the race for fish. Consumers benefit because fresh, rather than frozen, fish are available for most of the year. Many believe that these programs will enhance safety because fishermen will no longer have to go out in bad weather and the U.S. Coast Guard will not be overwhelmed by thousands of fishermen operating in small areas or during a compressed season. Fishermen can develop better long-range business plans because they can more accurately anticipate their annual catch and are less likely to over-invest in boats and gear. They can also fish more carefully, minimizing gear loss and bycatch of protected and other non-targeted species. Finally, these programs allow fishermen and managers to work cooperatively instead of in conflict.

Dedicated Access Privileges: A Better Description

In this chapter, the Commission recommends steps to end the race for fish through the use of “dedicated access privileges.” While this term is not new, it is not yet in wide use. More commonly used are the terms “rights-based management,” “individual transferable quotas” (ITQs) or “individual fishing quotas” (IFQs). None is satisfactory as a general term.

“Rights-based management” implies granting to an individual the “right” to fish. However, U.S. fishermen do not now and will never have inalienable rights to fish because the fisheries resources of the United States belong to all people of the United States. Under current law, fishermen are granted a privilege to fish, subject to certain conditions. Because this privilege can be taken away, it is not a right.

The second two terms, ITQs and IFQs, are too narrow for general application. Both terms describe specific kinds of dedicated access privileges. Their general use has caused confusion, creating the impression that ITQs or IFQs are the only tools that can end the race for fish. In many areas, particularly along the east coast, the term ITQ has gained a negative connotation as the result of events in the surf clam/ocean quahog ITQ program. In addition, both terms imply that individual fishermen own a share of a public resource.

The term dedicated access privileges is preferable for several reasons. First, it highlights the fact that fishing is a privilege, not a right. Second, it is an umbrella term that includes access privileges assigned to individuals (ITQs; IFQs; individual gear quotas), as well as to groups or communities (community development quotas; cooperatives; area-based quotas, community-based quotas). Finally, it reflects the fact that the dedicated privilege being granted is *access* to the fish, rather than the fish themselves.

Currently, four U.S. fisheries grant dedicated access privileges: the surf clam/ocean quahog fishery in the Mid-Atlantic (ITQ); the wreckfish fishery in the South Atlantic (ITQ); the halibut/sablefish fishery in the North Pacific (ITQ); and the Bering Sea pollock fishery in the North Pacific (co-op). Many other countries, including New Zealand, Australia, and Iceland, rely heavily on dedicated access regimes for fishery management.

But dedicated access regimes are not without their drawbacks. After the ITQ program began in the Mid-Atlantic surf clam/ocean quahog fishery, fleet size shrank from 128 vessels to 59 vessels in two years because many fishermen decided to simply sell their share of the harvest to outside investors. By 1995, very few owner-operators were left in the fishery, and the largest holders of fishing quotas were a bank and an accounting firm. To many observers, this turned the working fishermen into the equivalent of sharecroppers for absentee landlords.¹³

Based largely on that experience, many fishermen, especially in New England, opposed any effort to explore ITQs. Some RFMC members also questioned the enforceability of dedicated access privileges in multispecies fisheries with large numbers of participants or many ports of landing. Public interest groups also expressed

concerns, although for very different reasons. They felt that granting fishermen exclusive access to harvest, buy, or sell a portion of the overall catch appeared to create an individual property right to a public resource, although all existing dedicated access programs in the U.S. clearly state that granting an individual access to a portion of the catch does not confer a right to any fish before it is harvested.

In response to such concerns, the 1996 amendments to the Magnuson–Stevens Act created a moratorium on further development of IFQ programs, pending consideration by the National Academy of Sciences. The resulting National Research Council study concluded that IFQ programs are in fact a promising management option that RFMCs should consider.¹⁴ Examples of carefully designed dedicated access programs in the United States and elsewhere show that it is possible to overcome most of the concerns raised about them. During the development of the Alaska halibut/sablefish dedicated access program, concerns were raised about the socioeconomic impacts of individual fishing quotas on communities. As a result, the North Pacific RFMC customized the program to account for vessel size and type, placed a one percent cap on the share of quota any one person or entity could control, and prohibited absentee ownership to ensure quotas would remain in the hands of working fishermen. Halibut and sablefish fishermen, previously skeptical, are now among the program’s biggest supporters. This illustrates the value of taking potential socioeconomic ramifications and other stakeholder concerns into account during the design phase of any dedicated access program.

Even though the Magnuson–Stevens Act moratorium on individual fishing quotas has expired and the National Research Council study endorsed this as a viable approach, most RFMCs will remain unwilling to spend time and effort developing dedicated access programs until they are sure Congress will not overrule them.

Recommendation 19–15. Congress should amend the Magnuson–Stevens Fishery Conservation and Management Act to affirm that fishery managers are authorized to institute dedicated access privileges. Congress should direct the National Marine Fisheries Service to issue national guidelines for dedicated access privileges that allow for regional flexibility in implementation. Every federal, interstate, and state fishery management entity should consider the potential benefits of adopting such programs.

At a minimum, the national guidelines should require dedicated access programs to:

- *specify the biological, social, and economic goals of the plan; recipient groups designated for the initial quota shares; and data collection protocols.*
- *provide for periodic reviews of the plan to determine progress in meeting goals.*
- *assign quota shares for a limited period of time to reduce confusion concerning public ownership of living marine resources, allow managers flexibility to manage fisheries adaptively, and provide stability to fishermen for investment decisions.*
- *mandate fees for exclusive access based on a percentage of quota shares held. These user fees should be used to support ecosystem-based management. Fee waivers, reductions or phase-in schedules should be allowed until a fishery is declared recovered or fishermen’s profits increase.*
- *include measures, such as community-based quota shares or quota share ownership caps, to lessen the potential harm to fishing communities during the transition to dedicated access privileges.*
- *hold a referendum among all permitted commercial fishermen after adequate public discussion and close consultation with all affected stakeholders, to ensure acceptance of a dedicated access plan prior to final Regional Fishery Management Council approval.*

Reducing Overcapitalization of Fishing Fleets

As discussed above, the race for fish pushes fishermen to invest more and more capital to buy bigger, faster boats, new gear and additional labor. These investments are perceived as essential to stay alive in the race for

fewer and fewer fish, not necessarily to make the business more efficient. The inevitable result is economic decline, with more vessels pursuing a shrinking resource. If managers respond by further lowering the total allowable catch, costs rise even more while average revenues drop.

Over the past three decades, federal programs to subsidize the purchase or upgrade of fishing vessels have resulted in U.S. fishing capacity that far exceeds the available catch. For example, the Capital Construction Fund allowed fishermen to create tax-free accounts to repair or construct vessels, and the Fishing Vessel Obligation Guarantee Program provided long-term credit for fishing vessels and related facilities. The challenge now goes beyond removing subsidies and incentives that promote overcapitalization; it will also take a sustained effort to reduce the excess capacity already in place.

Past capacity reduction efforts, such as the New England groundfish buyout program in the early 1990s, have been effective at removing capacity from the fleet. However, their initial success was undermined when new fishermen and boats were allowed to replace those that had been retired. A new federal program, the Fishing Capacity Reduction Program, has been criticized as being too bureaucratic and slow.

Two types of management regimes can ensure that a capacity reduction program has lasting results: (1) dedicated access programs which, by definition, limit overall effort in a fishery; and (2) restrictive regimes that freeze the number of active fishermen and prohibit any changes to fishing methods or gear until a fishery has been declared recovered. The second option would be difficult to enforce and could meet with strong resistance from fishermen and managers. Yet steps must be taken to end the inefficient and counter-productive over-investment in fishing vessels and gear.

Recommendation 19–16. Congress should repeal the Fisheries Finance Program (formerly the Fishing Vessel Obligation Guarantee Program), the Capital Construction Fund, and other programs that encourage overcapitalization in fisheries. The National Oceanic and Atmospheric Administration (NOAA) should implement programs to permanently reduce fishing capacity to sustainable levels.

Reducing overcapitalization in fisheries will be assisted by the following:

- *to the maximum extent practicable, capacity reduction programs should be funded by those who profit from them—the fishermen remaining in the fishery.*
- *federal contributions to capacity reduction programs should only be made where additional effort is prohibited from entering the fishery. The highest priority for public funding of capacity reduction should be given to fisheries that grant dedicated access privileges to participants.*
- *NOAA should monitor capacity reduction programs to ensure they meet their objectives.*
- *fishermen should be allowed to transfer existing Capital Construction Fund accounts into IRAs or other appropriate financial instruments.*

IMPROVING FISHERY ENFORCEMENT

Enforcement of fishing restrictions is essential to allow fishery resources to be economically harvested and protected for future generations. However, increasing pressures on agencies hinder effective enforcement and delay the evolution of fishery management plans toward a more ecosystem-based approach. For example, area closures put greater demands on enforcement agencies that must patrol larger, more widely dispersed areas. Redirection of existing enforcement resources for homeland security and the reduction of state personnel due to budget cuts also hamper fisheries enforcement. If this gap between needs and resources is to be narrowed, the agencies tasked with enforcing fishery management plans must apply resources and

technology in innovative ways, such as through enhanced vessel monitoring technologies, expanded cooperation between enforcement agencies, and strengthened public education and outreach.

Fishery Enforcement Mechanisms

The two federal agencies with primary roles in enforcing marine fishery regulations are NMFS and the Coast Guard. Under the authority of the Magnuson–Stevens Act, these agencies enforce conservation and management plans for federally regulated fishery resources in the 200 nautical mile EEZ. The Coast Guard also enforces applicable international agreements in waters beyond the U.S. EEZ.

The Coast Guard employs personnel, vessels, aircraft, communications and support systems to maintain a law enforcement presence in the EEZ and on the high seas. Agents from NMFS' Office of Law Enforcement conduct dockside inspections, investigate civil and criminal violations, seize illegal property and contraband, and seek to prevent unlawful trafficking in marine wildlife products. State enforcement personnel enforce state fishery plans in their own waters and federal plans if there is a cooperative agreement.

Both the Coast Guard and NMFS enforcement representatives participate in the RFMC process. The Coast Guard and NMFS also cooperate with state enforcement agencies to pool limited assets and reduce duplication of effort.

Enforcement Partnerships

New partnerships and enhanced cooperation are basic elements of the Coast Guard and NMFS fishery enforcement strategic plans. Cooperative enforcement agreements among federal, state, tribal, interstate, and international organizations will be essential as ecosystem-based or area-based management becomes more prevalent and as the Coast Guard assumes additional homeland security responsibilities.

Cooperative Enforcement Programs

One of the most successful existing partnership programs is the Cooperative Enforcement Program between NMFS and state agencies. In this program, state enforcement officers are deputized to enforce state and federal fishery management plans for commercial and recreational fisheries. Through Joint Enforcement Agreements (JEAs), NMFS provides federal funds for state involvement which are then matched by the states, providing an opportunity to enlarge the overall pool of enforcement resources. JEAs have also led to significant progress in creating uniform enforcement databases, identifying regional and local fishery enforcement priorities, and extending coordination to other areas, such as investigations.

Twenty-three coastal states and territories have entered into JEA partnerships with NMFS. From 1998 to 2000, following implementation of the JEA with South Carolina, state patrol officers logged over 1,095 hours conducting federal enforcement from the edge of state waters to 70 nautical miles offshore. Their patrols uncovered 172 cases of fisheries violations in the EEZ or on vessels returning from the EEZ, as well as many additional cases of boating safety and permit violations.¹⁵ JEAs are particularly effective because state agents are familiar with local waters, know when and where enforcement infractions are likely to occur, and provide opportunities for significant public outreach and education.

Although the Coast Guard is not currently a signatory to these cooperative NMFS–state agreements, Coast Guard participation would be valuable, particularly during the development of enforcement plans and priorities, and would help assure commitment of Coast Guard resources to joint enforcement efforts.

Despite the JEA program's advantages in leveraging resources and enhancing cooperation, its federal funding was reduced from approximately \$15 million in fiscal year 2001 to \$7 million in the fiscal year 2002 and 2003 budgets. The reduced federal funding led to smaller state matching appropriations and, ultimately, a reduction in enforcement personnel.

Recommendation 19–17. Congress should increase funding for Joint Enforcement Agreements to implement cooperative fisheries enforcement programs between the National Marine Fisheries Service and state marine enforcement agencies. The U.S. Coast Guard should be included as an important participant in such agreements.

Cooperative Federal Enforcement

There are also significant opportunities to strengthen cooperation at the federal level between NMFS and the Coast Guard. Currently, each agency has its own strategic plan, goals and objectives for enforcement of federal fisheries laws. At the regional and local levels, the degree of cooperation is uneven and can vary considerably over time, even within the same geographic area.

At the national level, a jointly developed strategic plan for federal fisheries enforcement can provide a framework for prioritizing common goals and identifying cooperative enforcement policies. At the regional level, existing agency training centers can be given a broader role as forums for NMFS, Coast Guard, and state enforcement personnel to share information specific to a particular fishery, and to identify opportunities for more effective resource utilization. At the regional and local levels, a stronger and more consistent process can be developed for joint planning and implementation of fishery enforcement operations. Strengthening the national, regional, and local frameworks should lead to better resource utilization and fisheries enforcement.

Recommendation 19–18. The National Marine Fisheries Service and the U.S. Coast Guard should strengthen cooperative enforcement efforts at the national level by developing a unified strategic plan for fisheries enforcement that includes significantly increased joint training, and at the regional and local levels, by developing a stronger and more consistent process for sharing information and coordinating enforcement.

Technology for Enforcement

Vessel Monitoring System

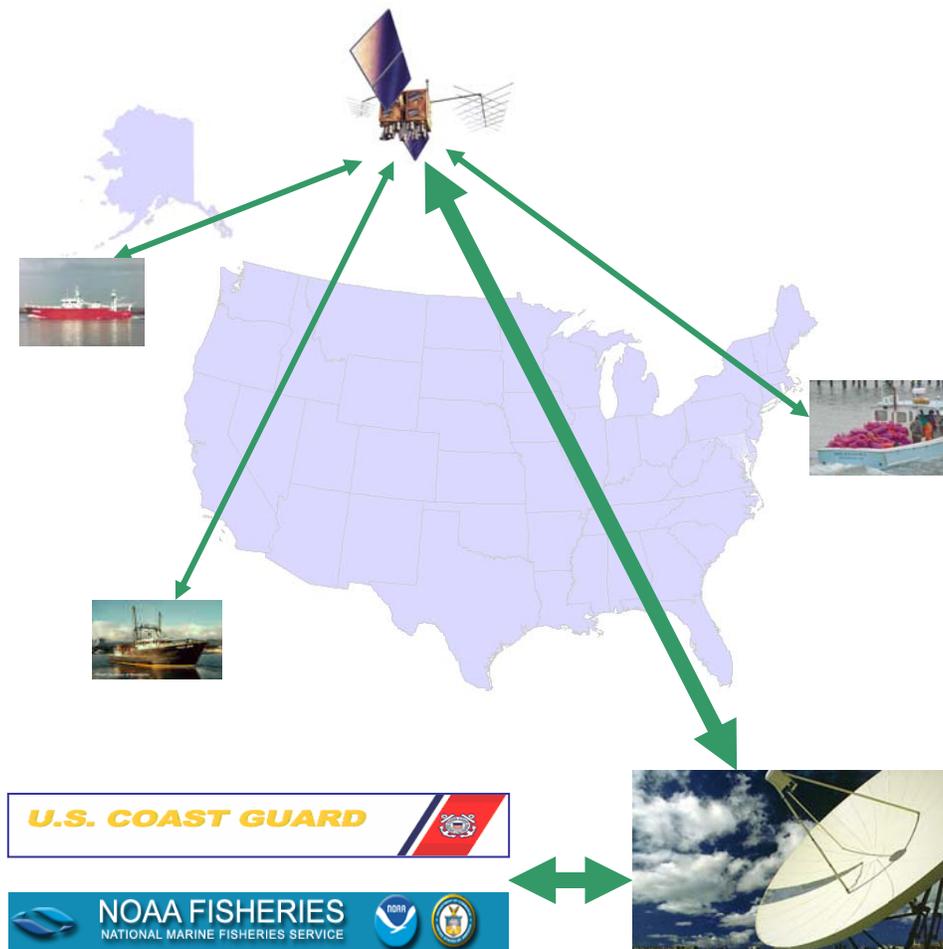
Vessel monitoring is now an accepted part of fishery management worldwide and is endorsed by the United Nations Food and Agriculture Organization's Code of Conduct for Responsible Fisheries. Since its initial implementation in 1988, the Vessel Monitoring System (VMS) has dramatically increased the effectiveness of limited fishery enforcement resources.

Ships equipped with VMS transmit accurate Global Positioning System data via satellite to monitoring centers ashore (Figure 19.4). This information identifies specific vessels and their precise locations. When fully implemented, the system can also provide information useful to law enforcement, maritime security, safety efforts, environmental protection, and resource management.

VMS can be configured for two-way communications to enable vessels to receive pertinent safety and enforcement information from observing parties onshore, such as weather alerts and safety broadcasts for vessels in potentially hazardous circumstances. In emergencies, the Coast Guard can pinpoint the location of a stricken vessel and communicate directly with it and other boats in the area through two-way VMS links. Two-way VMS allows fishermen to be in constant contact with other fishermen, enforcement personnel, and

fleet operators. Because their position can be verified, fishermen can remain on scene longer prior to fishery closures, rather than having to depart the area as is often currently required. The extension of VMS monitoring to state fisheries could also be useful, particularly for vessels wanting to operate legally in state waters adjacent to closed federal waters.

Figure 19.4. Monitoring Fisheries from Space



The Vessel Monitoring System (VMS) transmits Global Positioning System data from vessels to enforcement monitoring stations via satellite. VMS can also be configured for two-way transmission, allowing VMS personnel to send useful information to fishermen at sea.

Beyond the benefits to fishermen and the potential benefits to scientific research through the transmission of near real-time data, two-way VMS is a useful system for enforcement and management personnel. Enforcement personnel can protect resources by preventing potential fishery violations, and VMS can save the Coast Guard and NMFS time and money spent in enforcement actions. The system provides the Coast Guard and NMFS a broader awareness of ships as they approach restricted areas, enabling the agencies to inform a fishing vessel that it is about to enter a protected area. Sensors can also be added to fishing gear, allowing VMS to indicate when a vessel is actively fishing. Managers can also use VMS system capabilities for daily catch and effort information used in quota management, and can gather other data, such as temperature, depth, and salinity, to inform broader fishery management planning decisions.

The cost of VMS for fishing vessel owners is small relative to its many benefits. VMS equipment with two-way communications capabilities is available at a modest cost of several thousand dollars. Some current NMFS programs offer limited reimbursement for initial equipment purchase. In addition to the one-time installation costs, there are continuing, although modest, costs associated with data transmission.

Recommendation 19–19. The National Marine Fisheries Service, working with the Regional Fishery Management Councils, the U.S. Coast Guard, and other appropriate entities, should maximize the use of the Vessel Monitoring System (VMS) for fishery-related activities by requiring that VMS with two-way communication capability be phased in for all commercial fishing vessels receiving permits under federal fishery plans, including party and charter boats that carry recreational fishermen, incorporating VMS features that assist personnel in monitoring and responding to potential violations, and identifying state fisheries that could significantly benefit from VMS implementation.

Integrating VMS into a Data Collection and Dissemination System

Although NMFS is currently overseeing the development of the VMS fisheries enforcement infrastructure nationwide, VMS data are also being incorporated into a larger monitoring system that extends beyond fishery enforcement concerns. VMS data will be part of a multipurpose data collection and dissemination system that includes other Coast Guard data sources and provides a comprehensive picture of many offshore activities. The larger Coast Guard data system will support a variety of missions, such as maritime security, safety, search and rescue, law enforcement, and environmental protection (Chapter 16). The Coast Guard and NMFS will need to cooperate to establish uniform national policies and technical requirements for VMS information, while providing for regional flexibility.

Recommendation 19–20. The U.S. Coast Guard should be the lead organization in managing the integration of a fishery Vessel Monitoring System (VMS) database into the larger maritime operations database and should work with the National Marine Fisheries Service to ensure effective use of VMS data for monitoring and enforcement.

Using New Technologies for More Effective Enforcement

VMS presents just one of many opportunities to use technology for more effective enforcement. Fixed radars on platforms have been used successfully in particularly sensitive environmental areas close to shore, and satellites present additional opportunities for offshore monitoring. The advantage of these monitoring systems is that they identify vessel traffic and activity in a particular area so that enforcement resources can be sent to investigate only when circumstances warrant. Directed enforcement efforts are less costly than general enforcement patrols. Enforcement planning at all levels should include a continuing focus on identifying and funding new and emerging technologies that provide for more successful and cost-effective use of enforcement resources.

Improving Enforceability as Part of the Management Process

Clear, easily enforceable regulations are critical to the success of fishery management policies. A management regime that is—or is perceived by the public to be—impossible or exceptionally hard to enforce is unlikely to succeed. Of course, some management regimes are more difficult or costly to enforce than others. In particular, area closures with boundaries that are difficult to detect at sea are problematic and provide tenuous grounds for legal action. Enforcement difficulties are also generated by gear restrictions that require fishermen to haul out their gear for boarding officers to examine. As part of their effort to ensure sustainable fisheries, the RFMCs should pay particular attention to enforceability when drafting management plans.

MOVING TOWARD AN ECOSYSTEM-BASED MANAGEMENT APPROACH

In keeping with the overarching theme of this report, fishery managers should begin to move toward a more ecosystem-based management approach. This will provide direct benefits to the ecosystem and create a better mechanism for addressing apparent conflicts between socioeconomic and biological goals.

Linking Fisheries Management with other Regional Concerns

Several measures now in place have begun the transition to a more ecosystem-based approach to fishery management. Such an approach requires that we look beyond fisheries to consider interactions with other resources and activities.

The fishery regions were originally defined roughly along the lines of Large Marine Ecosystems and thus have the geographic reach necessary to encompass ecosystem concerns. In addition, all RFMCs have multispecies management plans that force the councils to look broadly at the ecosystem they manage. Despite these positive efforts, most RFMC multispecies fishery management plans now focus only on species assemblages that are commercially important, or those taken by particular types of gear. Little attention is given to species that, while commercially insignificant, are still important to the functioning of an ecosystem. New ecosystem-based measures are needed, such as studies of system components and interrelationships, assessment and ranking of dangers, and development of comprehensive management plans. These should carefully consider the relationship between fishery management measures and management of other sectors, including protected species, pollution control, and habitat conservation and restoration.

Fishery managers have also used marine protected areas to either promote stock recovery or, in some circumstances, prevent damage to special habitats. In addition, marine protected areas established for other purposes have benefited many fisheries. The initial steps in designing marine protected areas need to be improved. (For further discussion of marine protected areas, see Chapter 6.)

In some respects, the job of the RFMCs will change little with the move toward ecosystem-based management. The councils will retain broad responsibilities for managing fish populations and fishing activities, bearing in mind the interests of fishing communities. However, they will also need to interact regularly with other regional, state, and local entities with related responsibilities. For example, if an RFMC implements a scientifically sound fishery management plan, but the stock continues to decline due to other factors such as pollution, the problem could be raised at the regional level (as described in Chapter 5) with managers responsible for pollution control. On the other hand, if coastal managers develop a regulatory plan that could affect fisheries, they should be working with the RFMCs to understand the fishery-specific implications. There also should be changes in the way that management measures are evaluated to comply with NEPA. As regions implement an ecosystem-based management approach, environmental impact assessments should be based on a shared knowledge of the ecosystem across the planning entities. Rather than having the RFMC, NMFS, EPA, and the U.S. Army Corps of Engineers all prepare separate environmental impact statements, without sharing information on cumulative impacts, these analyses need to be combined to reduce duplication and improve the quality of ecosystem evaluations.

Ecosystem-based management will also bring changes to the RFMC process. As mentioned elsewhere in this chapter, fishery management plans have traditionally focused on single stocks, or at most, groupings of stocks that are commercially important. Managers usually set biomass or mortality rate goals, with little consideration of other characteristics of the stock, and even less of broader ecosystem concerns. With the move toward an ecosystem-based management approach, this will change.

Several recent reports have described the profound impacts that fishing industry activities can have on marine ecosystems, such as reducing the average size of individuals within a single stock or removing a high percentage of large predators like tuna and billfish.¹⁶ By targeting some species and not others, fishermen can affect the balance and structure of ecosystems. In the Gulf of Maine, some scientists believe that the multispecies fishery has contributed to a re-structuring of that ecosystem from one dominated by groundfish to one dominated by dogfish and skates. Fishery managers need to take such impacts into account in developing management plans and amendments.

An ecosystem-based management approach will also allow managers to better consider the impacts of their plans on fishermen and the communities in which they live. Unfortunately, the amount of sociologic or economic information we have on fishermen and fishing communities is paltry. It is important to collect such data so managers can better understand the overall effects of the measures they take and the plans they approve. The more managers know about the social and economic factors influencing fishing behavior, the more success they will have in designing regulations that have the intended effect.

The 1996 amendments to the Magnuson-Stevens Act specifically recognize the need to consider the impact of fisheries management measures on fishing communities. Although NMFS has begun to improve its ability to describe and predict such impacts, further improvements in collecting and interpreting socioeconomic data are needed. To this end, the legal barriers that now exist to collecting some economic information from fishermen and processors should be reconsidered.

The move toward an ecosystem-based management approach will also allow the human and biological components of fisheries to be brought together through consideration and adoption of ecosystem goals and objectives. As discussed in Chapter 3, goal setting is an important but difficult part of ecosystem-based management. As in any system with multiple competing objectives, it will not be possible to meet every one.

In fisheries, the competition is usually between helping overfished stocks recover and preserving the short-term economic health of traditional fishing communities. Both goals are desirable but the measures required to achieve them often appear to be in conflict. Yet long-term economic health depends on healthy fish stocks. This may require a temporary reduction in fishing effort, with related short-term economic pain. The challenge is to devise a formula that rebuilds stocks at a reasonable rate without causing unacceptable economic hardships.

Scientists can help predict how quickly a stock will be replenished at different harvest levels, but there is no scientific basis for actually deciding what the appropriate rate of rebuilding should be. That is a judgment call, requiring managers to weigh the benefits of quickly restoring fish stocks to healthy and sustainable levels against the interim economic costs to the fishermen and communities involved. The task is complicated by the fact that even short-term hardships can drive fishermen permanently out of business. Ironically, the resultant pressure to go slow has sometimes led to continued overfishing...and even deeper and longer-term socioeconomic harm. An ecosystem-based management regime will inevitably require tough choices, but it does provide a comprehensive context within which those choices may be made.

The RFMCs should participate in a collaborative process to share their concerns and help shape regional goals and management plans. Because of their experience in dealing with diverse constituents and multiple objectives, the councils could be extremely helpful in developing a comprehensive ecosystem-based management approach in the regions.

In addition to integrating fishery issues into an overall regional perspective, the principles of ecosystem-based management can guide NMFS and the RFMCs in implementing two difficult provisions of the Magnuson-Stevens Act related to essential fish habitat and bycatch.

Essential Fish Habitat

As discussed in Chapter 11, maintaining healthy, functioning habitats is an essential element of an ecosystem-based management approach. The 1996 amendments to the Magnuson–Stevens Act included measures designed specifically to protect habitats important to managed species. Essential fish habitat (EFH) is defined in the Act as “those waters necessary to fish for spawning, breeding, or growth to maturity” and the RFMCs are required to “describe and identify essential fish habitat” for each fishery. However, it is not easy to determine which habitats are required by fish. With scant legislative guidance and little scientific information available on habitat requirements, RFMCs tended to be broad in their designations.

For example, in the case of Atlantic halibut, the New England RFMC designated the entire Gulf of Maine and almost all of Georges Bank as essential. The North Pacific council designated almost the entire EEZ below the Arctic Circle as essential for one species or another. But when everything is special, nothing is. The current methods have resulted in the designation of so much habitat that the original purpose of identifying areas that deserve focused attention has been lost.

Perhaps in recognition of this, NMFS designated a subset of EFH to be called “habitat areas of particular concern.” These areas were defined in 2002 NMFS regulations as “discrete areas within essential fish habitat that either play especially important ecological roles in the life cycles of federally managed fish species or are especially vulnerable to degradation from fishing or other human activities.” Less than one percent of the area initially designated as EFH has been further characterized as habitat areas of particular concern.

Two alternate approaches for determining critical habitat attempt to improve on the current one. Both look at habitat from an ecosystem perspective, instead of trying to identify habitat necessary for the survival of an individual species. The first approach uses the abundance of juveniles of several commercially important species as indicators of habitat preference.¹⁷ It then uses a statistical method to locate the smallest total area that contains a sufficient amount of preferred habitat for all species of concern. The second approach expands on the first, by attempting to link species distribution with specific habitat types.¹⁸

Of course, the identification of important habitats is only the first step. Rather than focusing solely on protecting these habitats from fisheries impacts, NOAA should identify the full range of threats and work with other agencies to develop management plans that mitigate the activities posing the greatest risks. Ultimately, the process for designating and managing EFH should result in the protection of major fish species during vulnerable stages of their life history, while minimizing disruption to fisheries or other offshore uses. Like other resource management programs, any approach to protecting EFH must also be enforceable and reasonably simple to implement.

Recommendation 19–21. The National Marine Fisheries Service (NMFS) should change the designation of essential fish habitat from a species-by-species to a multispecies approach and, ultimately, to an ecosystem-based approach. The approach should draw upon existing efforts to identify important habitats and locate optimum-sized areas to protect vulnerable life-history stages of commercially important species. NMFS should work with other management entities to protect essential fish habitat when such areas fall outside their jurisdiction.

This effort should include:

- *well-documented, science-based analytical methods.*
- *consideration of ecologically valuable species that are not necessarily commercially important.*
- *an extensive research and development program to refine existing analytical methods and develop additional means to identify habitats critical to sustainability and biodiversity goals.*

Reducing Bycatch

The unintentional catch of non-targeted species by recreational and commercial fishermen, commonly known as “bycatch,” is a major economic and ecological problem. One of the national standards of the Magnuson–Stevens Act states that fishery management plans should minimize bycatch to the greatest extent practicable. Reducing bycatch is a goal that everyone can support: for fishermen, bycatch decreases efficiency and costs money; for the environmental community and many others, bycatch is viewed as wasteful and harmful to the ecosystem; and, in the case of endangered species, bycatch can threaten a population’s survival. Nevertheless, the total elimination of bycatch from a fishery is probably impossible, and too great a focus on bycatch could inhibit progress on other issues more important to ecosystem functioning.

The first requirement for addressing bycatch is better information. Existing fish stock assessments attempt to account for all sources of mortality for commercially targeted species; however, estimates of impacts on non-target species are lacking. An ecosystem-based management approach will require that mortality to all components of the system be estimated. Of course, cataloging all bycatch in every fishery would only be possible if an observer were placed on every fishing boat, a prohibitively expensive proposition. Instead, bycatch monitoring should be based on statistically significant sampling, using information gathered by fishermen and a selected number of observers.

NMFS, in cooperation with the RFMCs, has initiated a National Bycatch Strategy that moves in the right direction.¹⁹ The strategy calls for the development of regional implementation plans to reduce bycatch, but only of specific commercially important species. As ecosystem-based management evolves, those implementing the National Bycatch Strategy will need to look more broadly at overall ecosystem impacts.

Recommendation 19–22. The National Marine Fisheries Service (NMFS) and Regional Fishery Management Councils should develop regional bycatch reduction plans that address broad ecosystem impacts of bycatch. Implementation of these plans will require NMFS to expand current efforts to collect data on bycatch, not only of commercially important species, but on all species captured by commercial and recreational fishermen. The selective use of observers should remain an important component of these efforts.

MANAGING INTERNATIONAL FISHERIES

The Status of International Fisheries

Intensive exploitation of fish populations at the international level is jeopardizing global marine life and the marine environment. An estimated seven out of ten fish stocks worldwide are being exploited at or beyond the level of sustainability.²⁰ Not unlike the U.S. situation, factors contributing to the rapid depletion of global fish stocks include:

- the open-access nature of high seas fisheries;
- excess fishing capacity, with global investments annually exceeding revenues by \$14.5 to \$54 billion;²¹
- widespread illegal practices, and difficulties in enforcing the law;
- ever more sophisticated fishing technology and gear;
- major government subsidies aimed at building up national fishing industries;
- bycatch of non-target species;
- high levels of discards, reaching approximately 20 percent of the total catch;²²
- fishing practices that degrade habitat;
- inadequate understanding of how marine ecosystems function; and
- lack of monitoring data and poor statistics.

The Law of the Sea Framework

As noted in Chapter 2, the traditional freedom of the high seas was based on a belief that the ocean's bounty was inexhaustible and that humans would never be in a position to exploit much of it. As ocean resources grew in importance, and its vastness was conquered, these attitudes changed. In 1976, the United States asserted jurisdiction over fishery resources within 200 nautical miles from its shores. In 1982, the United Nations Convention on the Law of the Sea (LOS Convention) created EEZs extending generally out to 200 nautical miles from the shores of all coastal states.

In restricting what had previously been part of the high seas, the LOS Convention initially put more emphasis on national self-interest than on international cooperation in managing fish stocks. But many stocks transcend a single country's EEZ, including highly migratory stocks (like tuna) and those that migrate between fresh water and the open ocean (like salmon and eels). In the absence of international cooperation and some form of international governance, the community of nations could witness the classic "tragedy of the commons," leading to the potentially irreversible overexploitation of living marine resources.

International management challenges are exacerbated by the fact that the regulation of fishing on the high seas has traditionally been left to the nation under which a vessel is registered—the so-called flag state. As discussed in Chapter 16, flag state enforcement is extremely uneven and vessel owners can seek less stringent regulations and enforcement simply by reflagging their vessels.

Global Fishery Conservation Agreements

In the 1990s, the international community, working mainly through the United Nations Food and Agriculture Organization's (FAO's) Committee on Fisheries, began to address deficiencies in international fisheries management, with the United States playing a lead role. Two global agreements were reached that are binding on signatories: the FAO Compliance Agreement and the Fish Stocks Agreement. The FAO also adopted a number of voluntary measures that provide guidance to nations on managing fisheries. Although they do not have the force of law, these nonbinding instruments can influence national practices and customs, provide nations with flexibility in implementation, and make headway in the face of scientific or economic uncertainty.

The FAO Compliance Agreement

In 1993, the FAO adopted the Agreement to Promote Compliance with International Conservation and Management Measures by Fishing Vessels on the High Seas, known as the FAO Compliance Agreement. This agreement requires each participating flag state to:

- ensure that vessels flying its flag do not undermine international conservation measures;
- limit the right to harvest fish to those vessels it has affirmatively authorized;
- maintain a register of such authorized fishing vessels; and
- monitor catches and make such information available to the FAO.

The United States ratified the FAO Compliance Agreement in 1995, and it came into force in 2003, when a sufficient number of nations had signed. However, many major fishing countries—including Norway, Sweden, Mexico, Japan, Canada, and Argentina,—have still not ratified the Agreement and are, therefore, not bound by its provisions.

The Fish Stocks Agreement

At the 1992 United Nations Conference on Environment and Development (also known as the Earth Summit), the nations of the world recognized that the LOS Convention's appeal for international cooperation on straddling stocks and highly migratory species did not adequately address the global crisis in fisheries. The result was the 1995 United Nations Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks (known as the Fish Stocks Agreement).

The Fish Stocks Agreement authorizes nonflag states to engage in compliance and enforcement activities for fishery violations on the high seas, including boarding, inspecting, and bringing a vessel to port. It also allows port states to inspect documents, fishing gear, and catch on board fishing vessels and to prohibit landings if a high seas catch has been taken in a manner that undermines regional or global conservation and management measures.

The Fish Stocks Agreement adopts a precautionary approach as the fundamental standard for managing shared fisheries and calls upon nations to agree on efficient and expeditious decision-making procedures within regional organizations. The United States was a leader in negotiating the Fish Stocks Agreement and in 1996 became the third nation to ratify it. The Agreement finally came into force in late 2001, although several major fishing nations, including Japan, Poland, Korea, and Taiwan, have not yet ratified it.

Recommendation 19–23. The U.S. Department of State, working with other appropriate entities, should encourage all countries to ratify the Fish Stocks Agreement and the United Nations Food and Agriculture Organization's Compliance Agreement. In particular, the United States should condition other nations' access to fishing resources within the U.S. exclusive economic zone on their ratification of these agreements. Other incentives should be developed by the United States and other signatory nations to encourage all nations to ratify and enforce these agreements.

The effective management and conservation of global marine species, and the enforcement of international treaties, require a combination of domestic, bilateral, regional, and international approaches. Although regulation of fisheries on the high seas is conducted within broad regions of the seas, the existing regional fishery organizations are generally weak. They lack adequate financial resources or enforcement capabilities, and allow member states to opt out of individual management measures they dislike.

The United States is a member of more than a dozen regional fishery commissions and related organizations concerned with straddling stocks or high seas living marine resources. These organizations undertake fishery research, adopt measures to conserve and manage the fisheries under their mandate, and attempt to reduce and regulate bycatch. They also develop policies for the conservation, sustainable use, and ecosystem-based management of living marine resources.

The work of regional fishery organizations must be paid for by their members. The cost of U.S. participation is set at roughly \$20 million annually, although in fiscal year 2003, Congress did not appropriate the amount requested.

Recommendation 19–24. Congress should fully fund existing U.S. commitments to international fisheries management. The U.S. Department of State, working with the National Oceanic and Atmospheric Administration, should review and update regional and bilateral fishery agreements to which the United States is a party, to ensure full incorporation of the latest science and harmonize those agreements with the Fish Stocks Agreement.

Non-binding International Documents

The FAO has adopted a number of voluntary, nonbinding instruments, beginning in 1995 with the Code of Conduct for Responsible Fisheries (the Code). While acknowledging the diversity of national and cultural traditions, the Code sets out principles and standards for responsible practices in fisheries and aquaculture. Its purposes are to promote conservation of biodiversity, ecosystem-based management, and sustainable use of living marine resources. More specifically, the Code calls for use of the best scientific information, application of traditional knowledge where possible, adoption of an ecosystem-based and precautionary approach, effective flag state control, and participation in regional organizations.

More recently, the FAO has adopted a number of International Plans of Action that elaborate on the Code and address weaknesses in existing regulatory schemes involving such issues as the bycatch of seabirds and sharks. The International Plan of Action on illegal, unreported, and unregulated fishing, although emphasizing flag state responsibility, also calls upon regional organizations to play a role in monitoring, surveillance, and deployment of observers, and urges port state control. These International Plans of Action can be best implemented through corresponding National Plans of Action.

NOAA's fishery and technical experts helped develop criteria (since adopted by FAO and accepted as worldwide standards) for defining overcapacity in marine fisheries. Nevertheless, progress has been slow in persuading many nations to implement capacity reduction measures.

Recommendation 19–25. The National Oceanic and Atmospheric Administration, working with the U.S. Fish and Wildlife Service and the U.S. Department of State, should design a National Plan of Action for the United States that implements, and is consistent with, the International Plans of Action adopted by the United Nations Food and Agriculture Organization and its 1995 Code of Conduct for Responsible Fisheries. This National Plan should stress the importance of reducing bycatch of endangered species and marine mammals.

Recommendation 19–26. The international committee of the National Ocean Council (discussed in Chapter 29), should initiate a discussion to determine the most effective methods of encouraging other nations to implement the United Nations Food and Agriculture Organization's Code of Conduct for Responsible Fisheries and other Plans of Action and provide its findings to the U.S. Department of State and the National Ocean Council.

In particular, the international committee should suggest methods to encourage nations to:

- *join relevant regional fishery management organizations.*
- *implement and enforce regional agreements to which they are bound.*
- *reduce or eliminate illegal, unreported, and unregulated fishing by ships flying their flag.*
- *reduce their fishing fleet capacity, particularly on the high seas.*
- *reduce bycatch of non-targeted species, in particular endangered populations such as sea turtles and marine mammals, via the use of innovative gear and management methods (such as onboard observer programs).*

The international committee should consider potentially effective incentives such as greater access to U.S. markets, bilateral aid, debt forgiveness, subsidies, and preferential loans for cooperating nations, as well as disincentives for those that do not implement these agreements.

International Fisheries and Trade

Intentional and unintentional harm to marine mammals and endangered species remain major problems at the global level. Large populations of sea turtles, dolphins, sharks, and seabirds are unintentionally caught in the huge nets used by shrimp and tuna fishermen. And the global trade in endangered species continues.

In the 1990s the United States attempted to employ trade sanctions to combat damaging harvesting practices. Such sanctions can be very effective when the nation imposing them is a major importing market. In response to a recent U.S. initiative, but amid considerable dispute, the FAO established an informal consultative process to consider greater cooperation between its fishery management activities and the Convention on International Trade in Endangered Species of Wild Fauna and Flora, which regulates global trade in endangered species.

Not surprisingly, the World Trade Organization (WTO) generally discourages nations from taking unilateral trade action, arguing that it undermines free trade. But the WTO has also recognized that conservation can be a legitimate objective of trade policy. When the United States banned the import of certain shrimp products from nations whose harvesting practices resulted in a large bycatch of sea turtles, a complaint was filed at the WTO. Although the WTO ultimately ruled against the United States on procedural grounds, it affirmed that the ban served a legitimate conservation objective under the General Agreement on Tariffs and Trade. The United States should continue to press for the inclusion of environmental objectives—particularly those specified in international environmental agreements—as legitimate elements of trade policy.

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³ National Academy of Public Administration. *Courts, Congress, and Constituencies: Managing Fisheries by Default*. Washington, DC, July 2002.

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⁶ National Academy of Public Administration. *Courts, Congress, and Constituencies: Managing Fisheries by Default*. Washington, DC, July 2002.

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