Coming up empty:
Management Failure of the New England Groundfishery

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Abstract Almost seventy percent of the world's marine fisheries are overexploited or endangered. One of those is the New England groundfishery, once one of the most prolific fisheries in the world. Although it has been under scientific management for decades, stock sizes and catches are lower now than when management began. This article explores the reasons that management has failed from the perspective of rational choice theory. I argue that interactive factors are responsible. Many can be seen in the history of management efforts, including bureaucratic complexity, intransigent factions, opposition by industry, cheating, and some government actions. Additional factors are not obvious from the historical record, including technical and biological factors and a lack of faith in management. These lead to a high discount-rate strategy that produced a downward trajectory in which failure fed on failure. Rational choice theorists have described many variables that make it impossible to generate effective rules, but others have been overlooked.

Introduction

The twenty-first century is opening on the specter of massive fisheries failure. Fully sixty-nine percent of the world's marine fisheries are exploited at a level at or beyond the level corresponding to MSY (maximum sustainable yield) (Garcia and Newton 1997:14). One of those is the groundfisheries of the Gulf of Maine, once one of the world's most prolific fisheries where groundfish populations are in a 'poor state' (Pauly and Maclean 2003:17). Although this fishery has been under management for decades, the size of the stocks now is far smaller than it was when management began. What we are witnessing is both stock failure and management failure. In this paper, I will focus on answering why New England groundfish management has failed. (Throughout this paper, when I refer to groundfish or groundfish management, I am referring only to the New England groundfishery). The history of management provides many clues about what happened. I argue that a large number of social, economic political, technical, and cultural factors interacted in a complicated way to produce the downward trajectory of this groundfishery.

Knowing why management efforts failed is important if we hope to develop effective management regimes in the future. The New England groundfish industry provides an important case study of management failure.

Characteristics of the Groundfishery

Groundfish refers to an assemblage of species that live near the ocean bottom, including cod, haddock, hake, pollock, and redfish. Historically, they have been the most important fisheries in the Northwest Atlantic.

The groundfishery is quite heterogeneous. Currently dragging or otter trawling, which involves dragging a large net along the ocean floor, is the most important technique used, but large numbers of fish are caught with gill nets and hook-and-line technology is still used in some ports, such as Chatham, Massachusetts. The sizes of boats vary from thirty feet to 120 feet. The smaller boats have one- or two-man crews and take only one- or two-day trips. They generally fish within sixty miles of their home harbors. The larger vessels have crews of five to ten and stay at sea for up to two weeks. They range all over the Gulf of Maine and increasingly go into waters off the Middle Atlantic states.

Groundfishing vessels may sell their catches in a variety of ports. Crews of these vessels are part of a social network, but people in that network do not all interact with each other. It is common for men to fish on the same grounds with crews whom they scarcely know. A recent study indicates fifty-nine percent of groundfishermen identify their community as being the area they fish and seventy-one percent frequently share information with a group of approximately twelve other groundfishermen (Holland *et al*. 2010:2-3). But the large geographic ranges make it possible to be quite anonymous with regard to the fishery as a whole. Increasingly, groundfishermen from a given general area, using similar size boats and gear, are banding together into lobbying associations to protect their interests in the management arena. In 2009 thirty-three percent of the groundfishermen surveyed in a study defined their fishing community as those 'who belong to the same industry association as they do' (Holland *et al*. 2010:2).

The Failure of Groundfish Management: The Perspective of Rational Choice Theory

The root problem with groundfish management is that the management agencies and the industry have not been able to devise enforceable rules that effectively conserve fish stocks. Understanding the reasons for such failures to develop effective resource-management rules has been a topic of considerable interest to rational choice theorists in the past two decades.

One of the most valuable insights of rational choice theory is that people choose to establish norms or rules that make it possible to gain the benefits of coordinated activities and joint action. However, simply because norms should produce favorable results is no guarantee they will be developed. The essential problem is that there is a divergence between what is rational for individuals and what is optimal for the group (Taylor 1990), a situation termed a collective-action dilemma by rational choice theorists. In collective-action dilemmas, rational action by individuals brings disaster for larger social units (Elster 1989).

Among rational choice theorists, there is a consensus that rules to constrain individuals will improve outcomes in collective-action dilemmas. However, there is little consensus on the conditions under which rules are generated. Curbing 'free riding' is thought to be essential. People will not invest in public goods or rules if large amounts of the benefits go to those who did not sacrifice to produce them. In general there is a consensus that the development of rules will be facilitated if the group is small, if people know a good deal about each other's histories, if the game is played repeatedly, and if it is possible to enforce the rules (Elster 1989:1; North 1990:12,32-36; Ostrom 1990:71-72,189; Knight 1992:48-64,174-178). Under these circumstances, people know who is likely to cooperate and can monitor and identify shirkers. Many variables have been mentioned as facilitating cooperation: homogeneity, group size, discount rate, political entrepreneurship, trust, community, and ability to change the rules (Ostrom 1990, 2000a, 2000b; Agrawal 2002).

Open-access fisheries present a collective-action dilemma. Since there are no property rights, no one has any incentive to protect the fish stocks. Under these conditions, it is rational for each fisherman to take all the fish he can as quickly as possible. This is true even though a rule constraining fishing effort would result in a healthier breeding stock, increased catches, lower prices for consumers, and a biologically sustainable fishery. Despite the favorable results that will stem from generating rules that constrain effort, it is in the short-run interests of resource users to overexploit. In all too many cases, including the New England groundfishery, the people involved do not solve the collective-action dilemma they face (Acheson and Knight 2000).

Rational choice theorists have identified a number of social and cultural factors that make it difficult or impossible to develop norms to manage resources. Some of those factors play a role in the failure of management of the New England groundfishery (that is, community characteristics, inability to monitor each other, and top-down management). However, some of the factors affecting groundfish management in New England have not been identified by the rational choice theorists (that is, technical and biological characteristics of the fishery and attitudes of fishermen towards science).

Methods

Data for this article were collected at two different time periods. One large-scale interviewing project was carried out in the summer and fall of 1978, in which Acheson and others interviewed 184 or fifty-nine percent of the captains or owners of groundfish boats in Maine and New Hampshire (154 Maine boats and thirty New Hampshire), and another 128 from Massachusetts and Rhode Island, who represented a smaller proportion of the captains from those states (Acheson *et al.* 1980:Table 5). We obtained a list of groundfish boats from the Maine Department of Marine Resources (DMR) and interviewed the captains or owners of these vessels personally.

Another study of the groundfishery was done in the summer of 2008. At that time, very few fishermen remained in the industry. To study when groundfishermen dropped out of the industry and why they did so, we obtained the groundfish license lists from the Maine DMR and telephoned all of the people who had had licenses in 1970, 1975, or 1978. We were able to contact a total of 102 of the approximately 614 on those lists (as might be expected, many had died, moved, or could not be contacted). Only seven were still groundfishing.

In both surveys, we obtained information on the personal characteristics of the groundfishermen (for example, age, education), attitudes towards management, and types of gear they used or had used. We placed special emphasis on entry/exit decisions. In 1978, many people were entering groundfishing and ordering new boats. Thus, we obtained detailed information on gear switching (that is, the characteristics of their present boat, the boat they owned five years ago, and the characteristics of the boat they had ordered, if any). In the 2008 survey, we placed special emphasis on getting the history of the fisherman, and the reasons he/she remained in the fishery or left it.

In 2008, we also interviewed twenty-one key informants, people who were presently involved or had been involved in groundfish management. They included fishermen, academics, agency directors, and employees of the Maine DMR and National Marine Fisheries Service (NMFS). Twelve were either on the New England Fishery Management Council (NEFMC) or had been members. These people were selected for their knowledge of groundfish management, their knowledge of key events about which we wished to learn more, and their willingness to talk with us. I have known many of them for years and felt they would give accurate information. These interviews were most instructive. In addition, a great deal of information about the history of groundfish management was obtained from archival sources, especially *Commercial Fisheries News,* whose reporters consistently have done a good job reporting on the politics of management.

Early History of Management of Gulf of Maine Groundfish Stocks

Groundfishing was the New World's earliest industry, and what is present day New England played a prominent role in that industry. The discovery of large schools of cod in the northwest Atlantic spurred the exploration and settlement of the New World (Lear 1998).

The exploration of the Gulf of Maine and exploitation of its fisheries was relatively late in comparison to Newfoundland. After the Revolution, however, fishing in New England expanded rapidly, particularly in Massachusetts (McFarland 1911). By the latter part of the seventeenth century fishing dwarfed all other industries in New England (Lear 1998). Catches reached their peak about 1860 (O'Leary 1996). Since that time, catches have varied, but the general trend has been downward (Ackerman 1941; Pauly and Maclean 2003). Now, the entire Gulf of Maine only produces six percent of the fish that were produced in Maine's Blue Hill Bay in the 1860s (Alexander *et al.* 2009).

Despite the long-term decline, groundfish management began only recently. There was no management of groundfishing in the Northwest Atlantic until 1950 when the International Commission for the North Atlantic Fisheries (ICNAF) was formed. ICNAF had eleven signatories, including the United States, Canada, Great Britain, Poland, and the USSR. ICNAF attempted to manage by setting a quota, and allocating that quota to individual member states. One fishery official said that ultimately ICNAF failed due to enforcement problems. The member states were charged with enforcing violations of the rules by their own citizens. Some states did a fair job of enforcement, but others did not. The result was overexploitation of the stocks (Acheson 1984).

In the 1960s, the Gulf of Maine was invaded by a large fleet of trawlers and factory ships, which quickly overexploited stocks of herring, cod, haddock, hake, whiting, and various flounder stocks (Playfair 2003). By 1972, groundfish stocks in the Gulf of Maine were so depleted that the foreign fleets left the Gulf of Maine (Acheson 1984). New England fishermen became concerned about the demise of groundfish stocks, and they joined a chorus of people advocating that the jurisdiction of the United States and all other nations be extended to 200 miles.

The Fisheries Conservation and Management Act

The Fisheries Conservation and Management Act (FCMA) was passed by the U.S. Congress in 1976. This law gave the federal government authority to manage all fish species from the three-mile line to 200 miles (the area from the beach to three miles is managed by the states) (Anonymous 1973). Groundfishermen were happy this act was passed because it promised to end fishing by foreign vessels in the Gulf of Maine, but their support quickly turned to dismay when they learned that the act gave the federal government power to regulate them. Implementation of this law went forward with increasing disillusionment and extreme resistance.

Under the FCMA, the United States and its territories are divided into eight coastal zones. Each zone has a regional council composed of the heads of the state fisheries agencies, a representative of NMFS, a representative of the U.S. Coast Guard, and representatives of the states, usually from the fishing industry, appointed by the governors of the states involved. The council charged with managing fisheries from Maine to New York is the NEFMC.

These councils propose management plans for each species or assemblage of fish to the Secretary of Commerce, who, with the advice of NMFS, rejects or accepts these plans. Accepted plans are published in the Federal Register and are enforced by federal enforcement agencies, including the Coast Guard. According to the FCMA, the goal of management is to obtain 'optimum yield,' which means that not only biological ends are to be taken into account, but social, economic, and ecological aspects of the fishery as well (PL94-265; sec 303.). After reauthorization of FCMA, the goals are in (16U.S.C.B1801 *et. seq.* sec [2][a]94).

The policy of the federal government was to accomplish three goals. First, the establishment of the Exclusive Economic Zone (EEZ), popularly known as the 200-mile-limit law, was designed to keep most foreign boats out of U.S. waters. Second, the federal government aimed to expand and modernize the fishing fleet, which resulted in the establishing the Capital Construction Fund and the Fishing

Vessel Obligation Guarantee Program (Apollonio and Dykstra 2008). Third, the federal government wanted to conserve fish stocks in the EEZ. As we shall see, the policy was successful in removing the foreign fleets from U.S. waters and in building up the U.S. fishing fleet. Attempts to conserve the fish stocks, however, have been a failure.

The First Management Plan: The Three-Month Quota

The first attempt to manage groundfish under the FCMA got off on the wrong foot. Although the FCMA did not come into official existence until March 1977, the NMFS regional administer drew up a management plan for cod, haddock, and yellowtail flounder, sent it to Washington for approval, and urged the council to adopt the draft without allowing time to review it (Dewar 1983). NMFS rationalized this high-handed action by saying it wanted to act quickly because the management authority of ICNAF ceased in December 1976, and NMFS did not want the endangered fishery to be unregulated for several months until a plan approved by the council came into existence. 'The plan was based on quotas, which were set using data from old ICNAF records' (Apollonio and Dykstra 2008:13-14). The NEFMC went along with the NMFS groundfish management plan, but many council members, according to Apollonio and Dykstra (2008:32), 'were outraged'. The actions of NMFS officials raised a key question, namely, which agency was charged with managing the fishery, the NEFMC or NMFS?

Regulations went into effect on March 15, 1977, on cod, haddock, and yellowtail flounder, which were the most important and overexploited species. Management was based on both seasonal quotas and trip quotas (Acheson 1984). That is, the fleet was divided up into three size classes, which had different trip limits. Moreover, the maximum sustainable yield of each stock was determined for a three-month period, and when that amount of fish was taken, fishing was prohibited.

During the first eighteen months after regulations went into effect, the NEFMC and NMFS promulgated a 'flood of regulations' (Apollonio and Dykstra 2008:38). The NEFMC closed the fishery repeatedly. In addition, there were frequent announcements of changes in vessel classes, adjustments to emergency quotas, emergency regulations and amendments to landing restrictions. These changes were designed to fine tune the plan or quell criticism (Donnell 1977; Barlow 1978; Acheson 1984).

If one can judge from interviews, fishermen hated the management plan and did everything in their power to undermine it. Every action of the council, NMFS, or the Secretary of Commerce was greeted with vicious letters to newspapers, vociferous complaints to congresspersons, petitions to officials, tire slashings, and heated hearings (Miller and Van Maanen 1979). In many cases, these activities were successful, and regulations were changed and quotas eased continually and on short notice. The rapid changes, often the result of agitation by fishermen, contributed to the unpopularity of the plan with the fishermen themselves.

Perhaps even worse, the enforcement system broke down completely. Cheating was rampant. When a fishery was closed, many fishermen kept on fishing. Sometimes they sold the forbidden fish to Canadian vessels; in other cases

they landed the fish in the U.S., but filed false reports listing it as another species. In many cases fish were simply discarded at sea. Most of those who cheated were not caught, which motivated others to cheat as well (Acheson 1984; Weber 2002).

By the summer of 1978, the council and many fishermen recognized that the original groundfish management plan was a failure. All progress in the council stalled because the members could not figure out what to do (Dewar 1983:176). The council decided to keep the old plan in place nominally but to stop all closures (Acheson 1984; Weber 2002).

The Interim Plan

After several months of discussion, the NEFMC decided to impose an 'interim plan', which was intended to last only for a short time until a permanent plan could be put in place. Its main features were mesh-size regulations, minimum fish sizes and closed areas on spawning grounds (Barlow 1980; Morrison 1980). It did not have quotas or trip limits since these rules had proven so unpopular and difficult to enforce. The interim plan was designed to be simple and easy to enforce, but its implementation proved to be difficult and contentious. Work on the interim plan began in 1979, but approval of the plan was delayed by the NMFS for almost two years. In the meanwhile, the council and the NMFS were sued by a large fishing company on the grounds that the interim plan, which had not even been adopted, was ineffective, discriminatory, and based on bad information (Apollonio and Dykstra 1988). The suit failed. The interim plan was put into effect in 1982 and lasted until 1986.

Expansion of Fishing Effort in the Gulf of Maine

During the late 1970s and early 1980s the fleet was expanding rapidly. There was an estimated fifty percent increase in vessel tonnage in the groundfishery between 1977 and 1978 (Apollonio and Dykstra 2008). In 1977, 1,200 licenses were issued; in 1979, the number had increased to 2,191, almost an eighty-three percent increase in two years (Acheson 1984). New entry into the industry was stimulated by high prices for fish (Doeringer *et al*. 1986), and the availability of money for new vessels due to federal programs. Moreover, the boats entering the fishery were substantially larger, better equipped, and more versatile than those they replaced (Acheson 1984). This was due to the fact that the management plan created a 'quota race'. The boats that did best under a three-month quota were the biggest and best-equipped vessels that could fish in bad weather when small boats stayed in port. The result was that at a time when NMFS and the council were attempting to limit fishing effort, loans from federal agencies and management actions by NMFS resulted in a fleet that was capable of taking more fish than the one that had existed originally (Acheson 1984).

Changes in the international boundary also increased fishing pressure. When the U.S. and Canada extended jurisdiction out to 200 miles, the Gulf of Maine became an area claimed by both countries. In 1984, the International Court in The Hague drew a new international boundary that excluded American fishermen from waters they had used for centuries, including the Grand Banks, the Gulf of Saint Lawrence, Labrador, the northeast peak of Georges Bank, and

even other parts of the Gulf of Maine (Hebert 1995). This forced many large vessels to crowd into the in-shore waters of the Gulf of Maine. Within two years these boats and the small boats of the inshore fleet had considerably reduced the stocks of groundfish in the Gulf of Maine (Lannin 1988). Observers of the fishery, including fisheries economist Jim Wilson, recall that by 1986, many of these large vessels had left for distant locations and never came back to New England waters.

The Northeast Multispecies Fishery Management Plan: 1985-1990

In 1980, even before the interim plan was put into effect, the NEFMC began to develop a radically different plan that they hoped would be more effective. Since they knew that substantial industry opposition could doom a plan, they deliberately involved many industry people. The plan abandoned the idea of using quotas, which had proven to be impossible to enforce, and proposed rules that promised to have more acceptance in the industry.

In 1985 the Atlantic Demersal Fisheries Plan was proposed by the NEFMC. After passage in 1985, it became known as the Northeast Multispecies Fishery Management Plan. It consisted of mesh sizes, closed areas, and seasonal limits, the kinds of rules that got the most support in the industry (Stevens 1985). It was the result of years of discussion in which NEFMC members were heavily lobbied by various industry groups. There was good support in the industry for this plan although there were also some dissenters.

In March 1986, NMFS 'completely disapproved' this plan and directed the NEFMC to develop a new plan giving 'serious consideration to a quota system, limited entry, and a larger minimum fish and mesh sizes' (Stevens 1986a:1A). The industry was outraged, and NEFMC members predicted that the entire council system was in danger because its authority was being usurped by NMFS. The NEFMC stuck to its guns, insisting that their plan was good. In the summer of 1986, after months of review and politicking, the NEFMC plan won partial approval for one year (Stevens 1986b). At that point NMFS and the Secretary of Commerce began to develop their own groundfish plan (Stevens 1987a); the specifics of that plan were revealed in July 1987 (Stevens 1987b). NMFS officials stated that their plan would not be put into effect if the NEFMC could develop a plan that would conserve groundfish. Immediately the NEFMC began developing Amendment 1 to the ADF, which they hoped would bring full NMFS approval. In October 1987, NMFS approved Amendment 1, but said they did not think the plan was adequate and that more stringent rules were needed to rebuild the stocks (Stevens 1987c).

This situation brought the jurisdictional dispute noted to a head. The NEFMC assumed that it had the authority to manage the fishery; NMFS assumed it had the authority to promulgate rules because the FCMA allowed NMFS to promulgate a plan when it had disapproved a regional council plan or amendment; and the NEFMC plan was certainly inadequate from the perspective of NMFS. The politicians, particularly the congressional delegation from Massachusetts and Rhode Island, sided with the NEFMC and the industry and requested that NMFS cease development of any secretarial plan (Studds and Young 1987). NMFS complied

and ceased trying to foist its plan on the NEFMC, but NMFS was disappointed with the plan produced by the council. One NMFS official said in an interview that the council's plan was 'a very watered down plan'. By this he meant that it would not accomplish what needed to be done.

In the late 1980s and early 1990s, the NEFMC passed three amendments to the groundfish plan, but these did little to curb fishing effort. Amendment 4, passed in 1991, was notable for providing a definition of overfishing for the groundfishery. This was done to bring the plans into compliance with the new '603 guidelines' that had been put in place by administrative fiat by NMFS. These guidelines demanded that an overfishing definition be established for all species.

In 1988, within two years after the groundfish plan was put into effect, evidence began to accumulate that it was not working. The technical monitoring group, composed of six federal and state scientists, said that the groundfish plan was 'falling far short of its objective to rebuild and maintain groundfish stocks' (Stevens 1988a:10). Within weeks, a new stock assessment showed that the cod stock was in serious trouble, and that 'high fishing effort is keeping cod numbers at record-low levels and minimizing the number of fish available to spawn' (NEFMC 1988:15). The technical monitoring group recommended that 'to maintain Georges Bank and Gulf of Maine Cod....that fishing effort would have to be slashed by more than 50%' (Stevens 1989:46). Apparently, at this point, the NEFMC began to realize the seriousness of the situation, but it still acquiesced to the demands of industry for lenient rules and did little to curb effort (Stevens 1988b).

The Northeast Multispecies Fishery Management Plan: 1990-2010

The history of groundfish management in the past twenty years is one in which the Northeast Multispecies Fishery Management Plan was extended by sixteen amendments (major changes in management plans) and forty-four frameworks (minor changes to fine tune amendments). I will describe only those amendments that made major changes in management strategy.

It took years to develop some of these management plans, and all of them developed in response to contentious political battles.

Amendments 5 and 7

After 1992, groundfish management got serious. In 1991, the Conservation Law Foundation and the Massachusetts Audubon Society sued the Secretary of Commerce and officials of the NMFS for 'failing to prevent overfishing on stocks of New England Groundfish, as required by the....Fishery Conservation and Management Act' (Plante 1991:1A). The court ordered the NEFMC to prepare a plan to prevent overfishing by March 1, 1991. This plan, called Amendment 5, was implemented in March 1994, after a series of delays. The regulations put in place were designed to drastically cut fishing effort to rebuild the stocks. Amendment 5 included a moratorium on new vessel permits during the rebuilding period and changes in mesh sizes; two large areas on Georges Bank were closed to fishing. It also included a days-at-sea program, which would limit the number of fishing days each

vessel was allowed to fish (NEFMC 1992). This was to be determined by the vessel history and the size of the vessel. Originally, the number of days-at-sea would be reduced by ten percent per year.

The industry was truly shocked by this action, and its members kept up a steady barrage of criticism and lobbied against it at every opportunity. At least three industry groups filed lawsuits on different occasions in an effort to prevent implementation of Amendment 5 (Plante 1994a). Several groups of fishermen suggested alternatives to Amendment 5 and fishermen of Gloucester wrote a complete plan that they hoped would replace it (Plante 1992). After eighteen years, the NEFMC finally had developed a plan that promised to greatly cut fishing effort.

Unfortunately Amendment 5 did not prevent further reduction of the stocks. The amendment failed to meet its target goals. In 1994, the Stock Assessment Workshop reported that stocks had reached an all time low. NMFS stock assessment scientist Vaughn Anthony said that 'the spawning stock has collapsed'. 'We're at one-tenth of what we should be for total spawning stock' (Plante 1994b:11A).

The federal government reacted strongly. The National Oceanographic and Atmospheric Administration (NOAA) initiated a twenty-five-million-dollar fishing-vessel-buyout program (Plante 1995a) that resulted in removing seventy-eight vessels and 537 permits from the fleet by 1998. NMFS also used its emergency powers to close three areas to all fishing (Plante 1995b).

Most important, the NEFMC put in place Amendment 7 in 1996, which was a far more stringent plan for groundfish than Amendment 5. The objective of Amendment 7 was to cut 'fishing effort for cod, haddock, and yellowtail flounder by 80% from 1993 levels, and cut fishing mortality as close to zero as practical' (Apollonio and Dykstra 2008:63). It reduced both the total allowable catches and trip limits for cod and haddock, accelerated days-at-sea reductions, and revamped permit categories. It also eliminated almost all exemptions that had been allowed under Amendment 5. It was a truly draconian measure.

The industry predicted that Amendment 7 would result in many fishermen going out of business (Plante 1996a). It also resulted in large vessels choosing to fish in inshore waters to minimize days-at-sea and because of the closures on Georges Bank. This brought them into conflict with the smaller vessels that had been fishing close to shore. Fisherman Ted Ames pointed out that it also accelerated damage to coastal spawning areas. Some very nasty confrontations took place.

The implementation of Amendment 7 resulted in another round of industry lawsuits (Plante 1996b). One of the most important was undertaken by the Associated Fisheries of Maine, which represented the interests of large vessel owners. They charged, among other things, that Amendments 5 and 7 imposed more severe cuts on large boats than on small vessels (Raymond 1997). Rep. Barney Frank of Massachusetts sided with the industry in this lawsuit. Not to be outdone, the Gulf of Maine Alliance, which represented small boat owners, initiated a suit against the Secretary of Commerce and NMFS officials over the 'rolling closures' that had been implemented under the groundfish plan known

as Framework 25. The alliance charged that the closures had placed the burden of conservation on the inshore fleet (Plante 1998a, 1998b).

Reauthorizations of the FCMA

The Fisheries Conservation and Management and Act (FCMA) put in place by the U.S. Congress in 1976 has been reauthorized several times since its inception, resulting in changes in the law and also bewildering changes in the name of the various acts. In the 1980 reauthorization, the name was changed to the Magnuson Fishery Conservation and Management Act. In the 1996 reauthorization senator Ted Stevens' name was attached. After 1996, the act was called the Sustainable Fishery Act (SFA) although the formal name was the Magnuson-Stevens Act (MSA).

In the 1996 reauthorization several key changes were made. All stocks would be managed for MSY; overfished stocks were to be rebuilt within ten years; essential habitat would be protected; and strict controls would be placed on bycatch (Stevens 1995, 1996). Perhaps most important, it called for management plans to be implemented in accordance with the National Standards. These eight goals began life as the so-called 603 guidelines (see above) and were incorporated into the SFA. National Standard #1, 'to prevent overfishing', became the guiding light of management from this time forth. This gave the NMFS scientists control over the goals of management.

On January 12, 2007, another reauthorization of the Magnuson-Stevens Fisheries Conservation and Management Act went into effect. This act required that fishery management plans developed by the regional councils be based on in annual catch limits (ACLS). It also required that accountability measures be incorporated in the plans to prevent overfishing in all U.S. commercial and recreational fisheries in 2010 for stocks subject to overfishing (Plante 2007a). This meant, for all practical purposes, fisheries would be managed with a quota in mind, although it was not called a quota. The reauthorizations of the FCMA gave NMFS far more power in the management process. These acts greatly limited the scope of action of the NEFMC.

Amendments 9 and 13

By 1998, groundfish stocks, especially cod, had fallen still further because Amendment 7 did not have adequate effort controls (Plante 1998c). This resulted in a far more stringent management plan being put in effect in November 1999 called Amendment 9. In addition to cuts in effort, this amendment included a new definition of overfishing and set MSY targets for all groundfish species as required by the Sustainable Fisheries Act of 1996 (Plante 1998d).

Still more reductions in fishing effort were needed if the NEFMC was to end overfishing as required by the Sustainable Fisheries Act. In the spring of 1999, even before Amendment 9 was implemented, the NEFMC began planning to implement still another sweeping plan, Amendment 13, which would take years to develop (Anonymous 1999). However, the cod stock was so seriously depleted due to low stock levels, low recruitment, and high fishing mortality that the NEFMC aimed to develop more interim plans with a goal of cutting Gulf of Maine cod landings by eighty percent. Two plans were submitted to accomplish this goal: one by the

Gulf of Maine Fishermen's Alliance and the other by a group of fishermen with the help of the Maine DMR. After much politicking, both plans were submitted to NMFS for approval as part of Framework 27 (Plante 1999a). The final language of the framework called for more closed areas, a daily limit of 400 lbs of cod for the Gulf of Maine, and other regulations. The following year Framework 33 was developed, which maintained the closures put in place in 1999 and added more regulations, including two more closed areas.

In the late 1990s meetings of the regional NEFMC became ugly and threatening. More lawsuits were filed against the Secretary of Commerce and officials of NOAA and NMFS (Plante 1999b).

Efforts to develop Amendment 13 were strongly influenced by a lawsuit initiated in 2002 by the Conservation Law Foundation and three other conservation organizations against officers of the federal government including NMFS on the grounds that it had violated the 1996 Sustainable Fisheries Act because it had used the older biomass and fishing mortality targets of Amendment 7 and not the far more stringent Amendment 9 targets in developing Framework 33. The judge asked that the parties to the suit mediate their differences to develop a solution (Plante 2002a) and she stipulated that the long-awaited Amendment 13 would be done by August 2003 (Plante 2002b). The objective was to produce a plan that would comply with the law. Amendment 13 was to halt overfishing, begin rebuilding the stocks and reduce bycatch. At this point, groundfish management was being driven by orders of the federal court.

Developing Amendment 13 proved to be difficult because different industry factions wanted it to include regulations that would give them a competitive advantage. The NEFMC first developed four alternative plans, and different industry groups developed plans based on these four proposals (Anonymous 2003). At least eight different industry groups commented or lobbied for one or another of these plans. The proponents of these various plans were invited to debate their merits for the judge in her chambers (Hall-Arber 2006).

The negotiations were lengthy, difficult, hostile, and acrimonious. The Gloucester Seafood Coalition and the Associated Fisheries of Maine representing the big boats, got essentially what they wanted. The negotiators from the other Maine groups felt disgusted (to put it mildly) and were certain the cause of conservation had been dealt a blow.

Amendment 13, accepted by the NEFMC in November 2003, was an unbelievably complicated management plan. It called for a new allocation baseline, habitat protection closures, new stock-rebuilding timetables, special rules for the Cape Cod Hook Fishermen's Association, and a number of other rules. Most important, it implemented a new days-at-sea program with A, B, and C days, a new way of allocating days-at-sea among boats of the fleet. 'A days' can be used for any species; 'B days' may only be used for species that do not require rebuilding; and 'C days' may only be used when stocks have been rebuilt (Plante 2003a). The result was a very complicated system. Fisheries economist Jim Wilson (personal communication) said 'no one knows how days-at-sea are calculated'. Amendment 13 also permitted leasing of days-at-sea (Plante 2003b.)

Despite the fact that industry factions had played a key role in framing Amendment 13, many fishermen were unhappy with the new amendment. Maine Senator Susan Collins was persuaded to enter the fray, and she attached a rider to a spending bill that prevented implementation of the amendment for six months in the hope that various aspects of it would be changed (Anonymous 2004a). Five lawsuits were entered against various federal officials by fishermen's organizations challenging provisions of the amendment that would make it difficult to fish, and by conservation organizations contesting other aspects, including habitat overfishing, and bycatch components (Anonymous 2004b).

Within months after Amendment 13 went into effect, the NMFS and NEFMC recognized that more reductions in effort were needed to begin rebuilding the stocks. This would be accomplished by Framework 42. While this framework was being prepared, NMFS announced that rules would be put in place using the emergency powers of the Secretary of Commerce. The proposed rule would promulgate differential counting of days-at-sea for the whole fleet at the rate of 1.4 to 1. That means that every day fished would be counted as 1.4 days. B days would be counted in a different way. At the same time, NMFS approved several requests by the NEFMC for special exemptions for different kinds of vessels, and a special sector for the hook fishery on Georges Bank (Plante 2006a).

The industry responded to this plan with massive opposition and abuse, which caused NMFS to modify the rule so that different areas of the Gulf of Maine and southern New England would have different ratios for calculating days at sea (Plante 2006b). When Framework 42 was announced by NMFS in late summer 2006, it included a 2-for-1 counting in inshore Maine waters and southern New England, and less stringent rules for the offshore areas. Fisherman Ted Ames said in an interview that this was a special hardship for the small boat fleet, which normally fished inshore waters (Anonymous 2006). The Bangor Daily News (Anonymous 2006:17A) pointed out that 'in 2004, the New England Fisheries Management Council reduced allowable days at sea from 88 to 53. This rule, which goes into effect November 22, now cuts that to less than 27 days a year'.

Within two years after Amendment 13 had gone into effect, there was widespread recognition that the plan was not reducing mortality enough to meet stock rebuilding targets. The industry was unhappy with the days-at-sea program; and the absence of fish was alarming (Plante 2006c). George LaPoint, Maine DMR commissioner and member of the NEFMC, called for major changes in management. As a result, work began on Amendment 16, which was to go into effect May 1, 2009.

Amendment 16

The development of Amendment 16 revolved around two issues: sectors and controls on fishing mortality. Management under Amendment 16 would be based on sectors. That is, fishermen would have the option of joining a sector, a group of fishermen who would receive an ACE or annual catch entitlement based on individual landings histories of the sector members. The members of each sector would be able to promulgate their own rules on how to manage how that amount of fish would be caught. The NEFMC invited industry groups to participate in planning

the new amendment, and several responded positively. By August 2007, nineteen groups had put in proposals for sectors of various types (Plante 2007b). The politicking around sectors quickly became intense (Snyder 2010). On several occasions in 2006 and 2007, the NEFMC decided to go forward with planning for sector management, only to change its mind and stop working on the sector issue when the negotiations between factions appeared gridlocked. At one point the director of NMFS bluntly told the NEFMC not to delay action on Amendment 16 or the NMFS would write the plan for them (Anonymous 2008).

A basic issue concerned area management, which would give fishermen from a sector exclusively right to fish in a particular demarcated zone. If they conserved the fish, they would gain the benefit in terms of higher catches, and if they overfished, they would pay the price in terms of poorer catches (Libby 2007). Other fishermen, especially large boat owners from southern New England, wanted no area management and some wanted to be free to join no sector. This would allow them to fish anywhere they chose. Finally, the NEFMC voted to postpone the implementation of Amendment 16 to 2010.

In the absence of a completed plan for Amendment 16, interim rules were established for the groundfishery. They were so draconian that there was widespread opposition from a large number of organizations and individuals concerned with the fisheries, including eleven fisheries organizations, eight U.S. senators, and nine U.S. congressmen. As a result, Jane Lubchenko, the administrator of NOAA, announced a set of scaled back rules (Plante 2009).

Amendment 16 went into effect June 1, 2010, four years from the time that work first started on it. It remains controversial. The rules allow boats to fish any place in the Gulf of Maine. Each sector has quota and the fishermen in that sector are allowed to divide it up any way they see fit, but there will be no area management. From the perspective of small boat operators in Maine, this means that the large boat owners from southern New England have been able to get the rules they wanted again

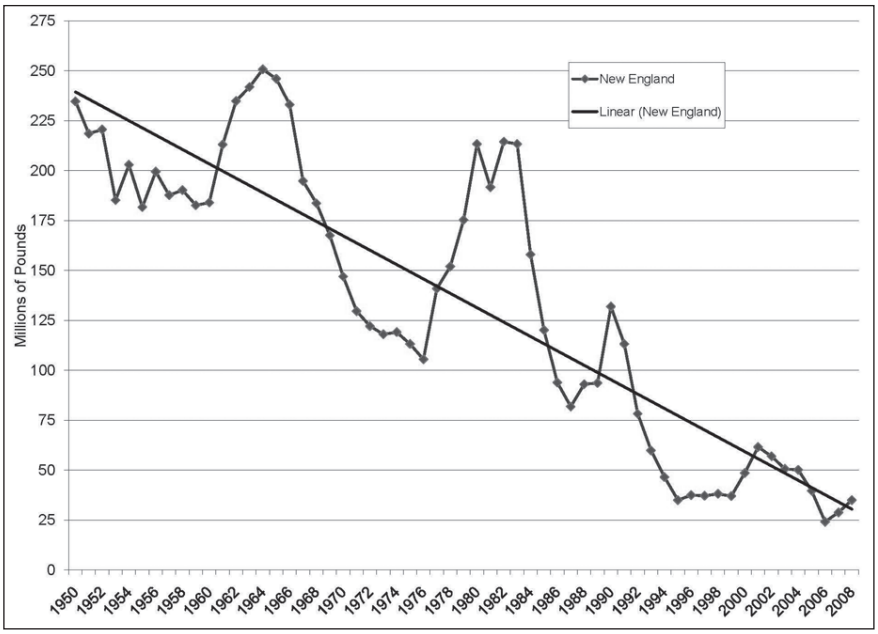
In the spring of 2010, Amendment 16 was not yet in force, but planning for a new management plan was already underway. There was serious talk among NEFMC members about writing Amendment 17, which would manage the fishery through individual transferable quotas (ITQs). The conversion to ITQs was predicted to be relatively easy. The fishery is being managed by quotas and leasing is allowed under Amendment 13. One NEFMC member who is pushing for Amendment 17 does not think that sector management will work well. The real solution, he contends, is ITQ management.

A Declining Fishery

Groundfish catches in New England have trended downward from 1950 to 2008, as can be seen in Figure 1. However, there has been considerable variation in catches over this period. The 1960s saw a resurgence in catches and income. Catches fell from 1964 to 1976 due to decimation of so many stocks by the foreign fleets. Catches were high in the late 1970s and early 1980s for American boats fishing in the

Gulf of Maine. This was due to the absence of competition from the foreign fleet and because federal loan programs were expanding the U.S. fleet. The amount of effort by the American fleet was also increased by because the imposition of the Hague Line made it impossible for many large boats to fish Canadian waters, so they concentrated on the Gulf of Maine. Moreover, the first quota plan (1977-1979) was a failure and the interim plan put no real restrictions on fishing effort.

Figure 1: Catches of Cod, Haddock, and Yellowtail Flounder in New England, 1950-2008 (millions of pounds)



Source: Chart prepared by Ann Acheson, landings information generated from www.st.nmfs.noaa.gov/st1/commercial/landings/annual_landings.html

From 1984 to 1988, there were severe declines in total catches as stocks became overfished. The catches of many species declined thirty to fifty percent between 1982 and 1988 (Lannin 1988). The stocks reached their lowest point in 1994, and remained low from the 1990s to 2010 despite all attempts by the NEFMC and NMFS to revive them. However, efforts to manage may be bearing fruit. In 2007, NMFS scientists were finally able to announce that 'cod were not longer overfished' (Plante 2008:8A). By 2010 all groundfish stocks had increased somewhat. Still stocks are at low levels and stock rebuilding is certainly not done.

From 1976 when the FCMA was established to 2010, the number of groundfish boats increased and then declined. In New England as a whole Dick Allen (2010) reports there were about 600 boats fishing in the 1960s. After the passage of the FCMA the numbers jumped sharply, reaching a maximum of 1,700 boats qualified for limited access permits in 1995 when permits were limited. In

2009, the number of boats with such permits had fallen to 820 (Allen 2010). In 1978, there were 343 groundfishing vessels operating from ports in Maine and New Hampshire (Acheson *et al*. 1980); in 2010, there were only an estimated fifty vessels remaining, and groundfish was not the major target species for many. Most of those vessels are in the Portland area in southwestern Maine; there are no groundfish boats in the entire eastern part of the coast (Mack 2010).

Fishing effort has declined also as regulations became more stringent. In 1960, there was no limit on the number of days that a vessel could fish; by 1994, fleet category boats were restricted to eighty-eight days at sea, and by 2010 some boats were restricted to twenty days fishing per year (Anonymous 2009). A member of the NEFMC staff said that most fleet category boats were restricted to 28 to 40 days per year. He noted that between 1994 and 2010 allocated days at sea went from 160,000 to approximately 20,000.

By the late 1980s, the marketing infrastructure began to decline. In 1988, the Portland Fish Exchange had serious financial problems (Plante 1988), and in the summer of 1995, the venerable Point Judith Fisherman's Coop suspended all operations (Valiere 1995), and it has not reopened.

Historical Factors Linked to Groundfish Management Failure in New England

A number of factors affecting the success of groundfish management are apparent in the historical record.

Industry Opposition

The industry kept up a steady barrage of criticism against NMFS and the NEFMC. Every action of these agencies over a thirty-year period was met with a torrent of abuse, and NEFMC meetings became very ugly (Plante 1999b). But even before this, those involved in management felt threatened. One officer of NMFS, who was the agency's representative to the council during the early 1990s, said, 'Sometimes I was afraid to go the bathroom. I wouldn't want to meet some of those guys in a back alley. They were very ugly'. He was only partly joking.

Every important amendment, including amendments 5, 7, 9, 13 and 16 resulted in lawsuits by fishermen's groups (Plante 1994a, 1996b, 1999b; Anonymous 2004b). Industry factions also tried more subtle tactics such as lobbying the council members. After Amendment 5, they began lobbying to get people appointed to the council who would uphold their interests. In 2002, several people were appointed to the NEFMC to represent various segments of the industry (Anonymous 2002a).

Sometimes these pressure tactics worked. When the first management plan was put in place, quotas were eased due to pressure from industry. When Amendment 13 was being developed, NMFS imposed emergency measures that were changed because of industry opposition (Plante 2006b). During the negotiations over Amendment 13, Maine Senator Susan Collins tried to delay implementation (Anonymous 2004a, 2004b). One member of the NEFMC, who was

a fisherman, admitted that he did not vote for one framework that would have cut more days at sea 'to my everlasting shame', due to intense industry pressure.

Industry Factions

The New England groundfish industry is divided into a number of factions that rarely reach consensus. Each faction would often work for management goals that would benefit them at the expense of other factions. In 1997, for example, a suit was initiated against federal officials by owners of large vessels, who charged that Amendments 5 and 7 imposed more severe cuts on large boats than small boats (Raymond 1997). At the same time, the Gulf of Maine Alliance, which represented owners of small boats, initiated a suit against the Secretary of Commerce and NMFS officials charging that the 'rolling closures', placed an unfair burden on the inshore fleet (Plante 1998a, 1998b:10A). As a result, the industry as a whole could rarely unite to promote or oppose any management measure.

Cheating and Enforcement Problems

Cheating has marked groundfish management. The massive cheating that occurred in response to the first three-month quota plan (1978-1980) was one of the primary reasons that the plan failed. Studies indicate widespread cheating continues today. King and Sutinen (2010:7) estimate that 'from 12 to 24% of the total harvest is taken illegally'. This, they state, has a significant adverse effect on the health of the stock. A study by Olson and Clay (2001:5) showed the vast majority of fishermen surveyed 'believed that at least 50% of commercial fishermen usually or always complied with groundfish laws and regulations', which suggests that they know the other fifty percent do not always obey regulations.

Decreasing Power of the NEFMC

Over the course of time, the power of the NEFMC decreased due to two factors. First, the reauthorizations of the FCMA gave much more power to the federal government.

Second, the two lawsuits initiated by the Conservation Law Foundation and other conservation organizations also reduced the power of the NEFMC. The first 1992 lawsuit forced the NEFMC to quickly produce Amendment 5 (Plante 1991). The second suit in 2002 resulted in the judge playing a major role in the development of Amendment 13 (Plante 2002c). Still, it cannot be claimed that the NEFMC had no volition. Amendments 7 and 9 were produced by the NEFMC with little interference from other organizations.

Control of the NEFMC

A number of observers have argued that the composition of the NEFMC doomed it to failure. The regional councils were designed to have representatives from federal and state governments and the fishing industries to ensure that local-level knowledge was included in the deliberations. This, however, means that council members who are fishermen stand to gain financially from its decisions and have significant conflicts of interest. Some authors say this means that the councils cannot act in the public interest (Dobbs 2000; Weber 2002; Eagle *et al.* 2003). Oth-

ers dispute this assertion (for example, Apollonio and Dykstra 2008). Certainly, the industry tried to influence the NEFMC by lobbying and worked to get industry members on the NEFMC to represent the interests of various factions. These lobbying efforts slowed progress and periodically gave powerful factions rules that they wanted. However, it is difficult to argue that the NEFMC was controlled by the industry, as it certainly did not do what the industry wanted. The fishing industry opposed every plan put forward by the NEFMC, from the first 1977 quota plan to Amendment 16.

In reality, the NEFMC was pushed in many different directions by groups, ranging from industry factions and scientists to NMFS administrators and the courts. Self-interest, loyalty to friends in the industry, scientific data, court orders, the wishes of bureaucratic and political superiors, and genuine concern for the common good all played a role in influencing the decisions of NEFMC members.

Long-Delayed Action

Bureaucratic complexity played a major role in slowing the development of management rules. It typically took several years from when it was apparent that a new rule was needed until that rule was implemented. Apollonio and Dykstra (2008:73) said the 'council had to work in a paperwork nightmare', in which it took years to complete all of the steps required by the law and federal bureaucratic procedures. In addition, the jurisdictional conflict between the council and NMFS delayed the development of the ADF for at least two years.

Opposition by the fishing industry, leading to lawsuits, also contributed to delay. A fisherman member of the NEFMC said in an interview that council members who were fishermen were especially susceptible to industry pressure. The lawsuits made the entire council gun-shy. 'There was often a coalition for taking it easy'. 'Keep things moving in the right direction, but go slow' was their motto. After 1992, the lawsuits brought by the Conservation Law Foundation and the two reauthorizations of the FCMA reduced the council's ability to set its own timetable.

Between 1977 and 1994 effective rules that would cut fishing effort were slow in coming, and it was in this period that stocks fell precipitously (Apollonio and Dykstra 2008). One NMFS scientist said in an interview that delay permitted stocks to fall far more than they would have had stricter rules been imposed earlier. If this is correct, delay itself reduced stock levels.

Other Factors Contributing to New England Groundfish Management Failure

While most of the forces leading to management failure in the New England groundfishery are apparent in the historical record, three other important factors played a role

Technical and Biological Characteristics of the Fishery

The biology of the species and the fishing technology make groundfish particularly difficult to manage. Groundfishing gear is highly unselective. Otter trawls take

all sizes of fish, including juveniles and those with eggs. When groundfish are hauled to the surface from any depth, their swim bladders break, and they die. A high percentage of all fish caught in otter trawls and gillnets, the most commonly used techniques, come aboard dead. (However, mortality rates vary considerably depending on species, depth, and mesh size [see Broadhurst *et al*. 2006]). Moreover, groundfish species generally inhabit the same ecological niches, and several of them can be caught by the same technology. When limits are placed on one species, that species can still be caught by boats targeting other species, resulting in a serious bycatch problem.

Science and the Views of Fishermen

Groundfishermen have little faith in the quality of science behind the management plans. Our 2009 survey of people who held groundfishing licenses in the 1970s contained the statement 'I have faith in the quality of federal science'. Of the ninety-six people responding to this statement, only seven (6.9 percent) agreed; sixty-seven (sixty-eight percent) disagreed. There are two reasons for this. First, fishermen view the ocean differently than do scientists. Groundfishermen see the ocean as a chaotic environment, in which fish stocks change rapidly and unpredictably in response to a variety of factors. Fishing effort is only one factor affecting the size of stocks, and it may not be the most important one. Thus, controlling fishing pressure may not control the size of fish stocks. From their perspective, it is most important to protect fish in vulnerable parts of their life cycle, that is, to protect small fish, gravid fish, and essential spawning and nursery grounds. Thus, they favored mesh-size regulations and closures in 1985 when the MSA was first being formulated. Later they wanted rules to protect small fish. Such rules will not prevent oscillations of fish stocks, but they will prevent a crash (Acheson and Wilson 1996).

Scientists, however, view management in terms of stock-recruitment models, which posit a mathematical relationship between fishing effort, the size of the breeding stock, and recruitment. The size of the stock can be managed by controlling fishing pressure by human beings. Thus, they favor management by quotas, days-at-sea, license limits, and other strategies. From the perspective of fishermen, this approach is doomed to failure because they do not believe limiting the number of fish caught is the solution to the problem.

Second, fishermen do not think that scientists know how many fish there are. Scientists formulate plans with the whole Gulf of Maine in mind. Fishermen have a more local view. In many cases, fishermen come upon concentrations of fish, and judging from those, assume that there are more fish available than scientists say. In addition, fishermen distrust the methods scientists use to collect fish population data. In 2002, when it came to light that NMFS research vessel's trawl survey gear had been improperly rigged, resulting in underestimating the groundfish stock, many fishermen were outraged. This confirmed what they knew all along – namely, that government 'is wrong about how many fish there are out there' (Anonymous 2002b:6A).

Despite fishermen's extreme criticism, the stock assessments behind groundfish management were reasonably good. To be sure, modeling fish stocks

is difficult, but an independent peer-review panel said that the work of NMFS's lab at Woods Hole was 'scientifically sound' (Plante 2003a:11A). With rare exception, scientists have said that most groundfish stocks have been overfished. However, there are serious questions about the rules that have been imposed. Some analysts argue that groundfish stocks would be better served if the rules focused on conserving the fish in vulnerable parts of their life cycle (for example, breeding stock) rather than just cutting effort on all fish (Acheson and Wilson 1996). Others argue that groundfish are concentrated in local stocks so that management efforts need to be at a smaller scale. Rules designed to manage stocks in the entire Gulf of Maine set up the wrong incentives (Steneck and Wilson 2010).

Fishermen's Attitudes toward Management

Framing management plans to garner industry support proved to be no easy task. The reason becomes apparent when we consider the answers we received on a 1978 survey of a stratified sample of groundfishermen in New England. When we asked fishermen, 'Do you approve of the way the federal government is managing the groundfishery of the Gulf of Maine?' not a single person said 'yes'. Many complained bitterly about the groundfish plan and the science behind it. They were convinced that the plan was costly, ineffective, and bound to fail.

When we asked, 'What kinds of regulations would you approve for your section of the industry?' we received seventy-two answers. These were recoded and analyzed in some detail (see Acheson 1984). Several conclusions about the attitudes of groundfishermen can be drawn from these data, which give a good deal of insight into the difficulties the council had to overcome in crafting a plan acceptable to the industry.

First, twenty percent wanted no regulations since none were needed. Second, although the majority admitted that some rules were needed, there was no consensus on what regulations should be devised, and a good deal of variation in answers received from fishermen in different parts of New England. The rules that were favored by the largest percentage of fishermen in New England were mesh sizes and closed areas and seasons, followed by limited entry and rules to limit the efficiency of fishing gear. Only one percent favored a quota, the regulation put in place by the NEFMC in the first management plan. Many of the fishermen interviewed recognized that the stocks were in difficulty. However, they had serious doubts about the ability of the government to address the industry's problems, and they were pessimistic about the future of their industry.

Although this study was done more than twenty-five years ago, the conclusions apply today. Groundfishermen still have no faith that management will be effective; there is still no consensus on what should be done; and the rules put in place by the NEFMC and NMFS are still unpopular.

Our 2009 study of 102 people who were in the groundfishery in the 1970s gave additional insights into the attitudes of groundfishermen. The majority of these people had left the industry; only seven of those in groundfishing in the 1970s were still fishing in 2009. Responding to the question 'Why did you leave groundfishing?' sixty-eight percent said that they could not earn an adequate income in groundfishing.

When we asked these fishermen whether they would like their children to enter groundfishing, only seventeen percent of the ninety-five respondents said 'yes', whereas fifty-one percent said 'no'. Asked whether they agreed with the statement 'I have faith in the quality of federal science', only seven percent of the ninety-eight respondents agreed or strongly agreed, and sixty-eight percent disagreed or strongly disagreed. Asked whether they agreed with the statement that the 'state of the groundfishery is bad', 61.1 percent of the ninety-five respondents agreed or strongly agreed, and only twenty percent disagreed or strongly disagreed. In short, fishermen are pessimistic about the fishery and the state of federal science.

Interviews with key informants indicated that many groundfishermen do not care much about fish stocks in the long run. They want to harvest enough fish to stay in business as long as possible, and they hope the stocks will last. Some fishermen have a more predatory attitude. One said, 'I want to take them [the fish] now. They are not going to be here in the future'.

A study by Olson and Clay (2001) revealed that fishermen in New England as a whole are more optimistic than those surveyed in Maine. 'Most respondents plan to continue fishing themselves.' Nevertheless, only one quarter of respondents 'would advise young people to go into fishing' 'nor are they optimistic about effective changes in future management strategies' (Olson and Clay 2001:5-6).

Synthesis and Discussion

Many different plans have been tried to manage New England's groundfishery. They involve management tools ranging from quotas and gear restrictions to seasons, closed areas, days at sea, and sectors. Unfortunately, for several decades, nothing seems to have succeeded.

Everything worked against the development of effective rules for the groundfishery. There is a long history of declining stocks beginning in the late nineteenth century. From 1960 to the mid-1980s, stocks were further devastated by foreign fleets and the invasion of large boats in the Gulf of Maine after imposition of the Hague Line in 1984. Fishing pressure on the stocks was increased further by the federal loan programs designed to build up the U.S. fleet. Management began in the late 1970s with the stocks already at low levels.

The biology and technology of the groundfishery makes management difficult. The different groundfish stocks mix in different concentrations in different areas, at different times of year, and at different levels of abundance. The unselective fishing technology, combined with the biology of the fish, makes for high mortality rates.

NMFS and its scientists pressed for rules such as quotas and days-at-sea that control how many fish are taken, but do not protect fish in vulnerable parts of their life cycle. The rules that emerged stemmed from a top-down political process that was marked by delays, conflicting goals, jurisdictional disputes, and unusual compromises from a management council pushed in several directions at once. The management process was made even more difficult by the heterogeneous

nature of the industry, which made it virtually impossible to frame rules that all parties considered fair. The result is an unbelievably complicated, constantly changing set of regulations that did not have the full support of fishermen, scientists, or agency officials.

Fishermen are convinced that these rules are too costly, largely unenforceable, and ineffective because they are based on the wrong model of how the ocean work. The industry responded with opposition, lawsuits, and illegal activity. This opposition, combined with bureaucratic complexity and jurisdictional disputes with NMFS, caused the council to stall in imposing effective rules (Apollonio and Dykstra 2008). This delay contributed to stock declines.

Had any of the amendments and frameworks promulgated by the NEFMC increased or stabilized fish stocks, the results might have been different. In the New England groundfishery, there is no assurance that conservation rules will work and lead to higher future catches. Faced with falling stocks and ineffective rules, fishermen respond by trying to take as many fish as possible as fast as possible. Many of them cheat, which further undermines conservation efforts. King and Sutinen (2010) say that many fishermen believe that illegal fishing will prevent them from ever benefiting from stock-rebuilding programs. My interviews with key informants indicate that long-term conservation is not the goal of fishermen. Rather, they are motivated to do whatever it takes to stall off business failure for as long as possible. They have a gold-rush mentality, with all that indicates for a high discount-rate strategy.

Groundfish management often appears to result from a rear-guard action by the industry and regulators. Scientists issue a stock assessment indicating that the stocks have fallen and tighter regulations are needed. The NEFMC and NMFS, after years of deliberations and negotiations, will develop new regulations, which are viciously opposed by the industry. After a time, these regulations prove ineffective, stocks decline further, and the same scenario is repeated. Ineffective regulations, stock decline, and financial failure follow each other in an ever more desperate downward spiral.

Theoretical Issues

The New England groundfishery and the governance structure used to manage it have many of the characteristics that rational choice theory predicts will lead to an inability to devise effective rules to solve collective-action problems. First is the value of future rewards or the discount rate. If individuals do not gain the benefit of norms, they will not support efforts to generate them (Knight 1992). If it is likely that stocks will decline, there is little incentive to sacrifice current harvests for future rewards that may not manifest themselves. Axelrod (1984:109) calls this the 'shadow of the future'. He says that mutual cooperation can be stable if the future is sufficiently important relative to the present (Axelrod 1984). In this case, the future of the groundfish counts for little. Since catches in the New England groundfishery had been falling for decades, there was a lot of cheating

and fishermen were sure the government would not be able to revive the stocks, so they had an incentive to take the stocks as fast as possible.

Second, rational choice theorists have gathered substantial evidence that effective resource-management rules are more likely if local-level communities have a hand in developing them (Ostrom 2000b). The rules in the groundfishery, however, are the result of a top-down process increasingly choreographed by NMFS and the courts. Groundfishermen have sought to change those rules because they are sure they are costly and ineffective.

Third, it is axiomatic among rational choice theorists that small, homogenous communities with a continuous history and shared sense of purpose will be most likely to be able to develop with rules (Elster 1989; North 1990; Ostrom 1990; Knight 1992). Under these circumstances, people know who is likely to cooperate and can sanction shirkers. The groundfish industry has virtually none of these characteristics. Fishermen are scattered throughout New England and constitute a loose social network. They do not form a community with a long history. They are heterogeneous, fishing for different species with different types of gear from different-sized boats in different locations. They also come from different ethnic groups. As a result, it is nearly impossible to frame rules that everyone will consider fair. A rule proposed by one group will almost certainly be opposed by others. The result is conflict, acrimony, and an industry unable to come to consensus on a single plan.

Under these circumstances, as Knight (1992) points out, factions form to get rules that would benefit themselves. The faction that prevails in the conflict is usually the one with the most power. This helps to explain why the large boat fleet from Massachusetts prevailed over the small boat fleet from Maine in developing amendments 13 and 16.

There are a number of factors that play a role in the failure to effectively manage the New England groundfish industry that are not adequately explained rational-choice theory or other social science approaches to institutional failure. Among the most prominent of these are delay and timing problems, technical and biological factors, and the scale at which management is attempted. Last, but not least, are ideational issues. There is a growing conviction that successful management depends on fostering a sense of stewardship or a 'conservation ethic'. The development of conservation ethics is complicated and involves the interaction of several variables over time (see Acheson and Gardner 2010). Certainly no such ethic has developed in the groundfish industry. This suggests that rational-choice theory may need to be extended so it can explain more of the phenomena linked to the development of rules and institutions to manage resources.

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