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Overcoming Transaction Cost Impediments to Resolving the Dilemma of Collective Action in the New England Fisheries

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**OVERCOMING TRANSACTION COST IMPEDIMENTS TO RESOLVING
THE DILEMMA OF COLLECTIVE ACTION IN THE
NEW ENGLAND FISHERIES**

By

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A THESIS

Submitted in Partial Fulfillment of the

Requirements for the Degree of

Doctor of Philosophy

(in Ecology and Environmental Sciences)

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The University of Maine

May, 2002

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Thesis Advisor: Dr. James Acheson

An Abstract of the Thesis Presented
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Management of many global marine fisheries have faltered under science-based government-sponsored management regimes. While the result has often been biological stock failures and consequent socio-economic problems, there are instances where enhanced conservation efforts have led to fishery management success. Studies of New England fisheries reveal that the relative success of fishery management can be explained in terms of the interaction between the fishing industry and the government, the relative power of each in the fishery management exchange, the degree to which information and perceptions about the fishery are comparable, the scale and complexity of the fishery to be managed, and the ability of the parties bargaining for fisheries management to reduce transaction costs that impede efforts to develop control rules.

In large scale highly complex fisheries where asymmetries in power and information exist, the fishery management bargaining process will be marked by high transaction costs that will not be easily overcome, leading to institutional failure. Where

information and perception about the resource is asymmetrical, but where power symmetries exist, it is possible to negotiate effective resource conservation rules, however, transaction costs will remain high thus the bargaining process will be protracted. Where the fishing industry and government have similar understandings of resource status and where symmetrical power with respect to decision-making authority exists, transaction costs can be more readily overcome leading to more effective institutional outcomes. In small scale low complexity fisheries, transaction costs involved as parties negotiate for control rules will be relatively low regardless of symmetries of information and power.

Where transaction costs become too high for negotiating parties to overcome, an alternative management mechanism is necessary. One alternative that holds promise would provide parties to the fishery management bargaining process with equitable standing through a devolution of government's management authority. This co-management approach would utilize nearly independent 'nested' entities to transmit the devolved authority to a more local level of the fishery. Linkages between these entities would enable efficient use of information and feedback mechanisms essential to overcoming the dilemma of collective action in our fisheries.

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Now that I have reached the end of this endeavor, it seems trite to utter a mere thank you. Certainly this paper can not convey the depth of my appreciation, but perhaps it can carry a message of affection and gratitude to my loved ones and to all who have played a role in my success.

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Part I
INTRODUCTION AND THEORY

Chapter 1
THE PROBLEM OF FISHERY MANAGEMENT

We are in an era where significant cause for concern exists about the state of global ocean resources. Virtually every major fishery of the world is subject to excessive harvest levels and global marine resources are threatened with demise. Surprisingly, many of these fisheries have been under scientific management by governmental entities for decades. This means that we are not just witnessing a loss of valuable resources, but a failure of government as well. However, not all management efforts have resulted in failure and there are examples of fisheries that have been managed quite successfully. This thesis contributes to our understanding of this differential by examining the relationship between fishermen and government and explaining why their collective efforts to conserve resources succeed or fail.

A fishery is, by definition, the interaction of fish and fishermen; its management is an effort to control exploitation. Control is typically a function the *State*, thus fishery management is a transaction between fishermen and government in the development of control rules. Success or failure in fisheries management has two components; the manner in which humans establish and enforce controls and the manner in which the controls affect fish stocks. The objective of this thesis is to explore the differential success of fisheries management by examining three fisheries found within the Gulf of Maine: the New England lobster fishery where progress has been achieved in moving

towards institutional and resource success, the Northeast groundfish fishery which is a notorious example of both management and resource failure, and the Maine mahogany quahog fishery which exhibits a robust resource despite a failed management institution.

The differential success achieved in the management of these three fisheries is explainable in terms of the various impediments, principally high and asymmetrical transaction costs, that must be overcome in developing rules to constrain exploitation. The nature and extent of transaction costs are primarily explicable in terms of the institutions, the rules of exchange, governing the fishery. With appropriate institutions, the costs associated with the fishery management transaction can be relatively low with positive resource outcomes. Where high transaction costs cannot be overcome, the outcome is institutional and resource failure. It is my hypothesis that the relative success of fishery management can be explained in terms of the interaction between fishermen and the government: the relative power of each in the fishery management exchange; the degree to which information and perceptions about the fishery are comparable; the scale and complexity of the fishery to be managed; and the ability of the institutions in which they work to reduce the transaction costs that impede efforts to develop control rules. Where this industry/government interaction leads to management failure, devolving a greater role in the management decision-making process to a more local level of the fishery will provide a means of overcoming impediments to success.

The Status of the Resource

Maximum sustainable fishery yields have perhaps been reached in much of the world's ocean. In a single generation, overfishing and poor management have

devastated fish stocks in regions around the world. Between 1980 and 1990 the number of overexploited stocks increased almost three fold (Alverson and Larkin, 1994). In a recent report to the American Association for the Advancement of Science, researchers have revealed that such large-scale extractions of fish from the Northwest Atlantic has occurred over the past 50 years that the ability of the ocean to sustain further catches is undermined (EES, 2002).

Much of the yield from fisheries today are from species at progressively lower trophic levels (Pauly et al., 2000) and unfortunately this trend will not be easy to reverse (Pauly and Christensen, 1995). Major fisheries around the globe are in decline and thousands of fishermen worldwide are out of work. Employment in the fisheries worldwide is not trivial with approximately 200 million people engaged directly or indirectly (Garcia and Newton, 1997). The consequences of overexploitation, therefore, are significant, not just from an economic or socio-cultural perspective, but from an ecological perspective as well. On a global scale, the condition of the environment and its degradation has become a significant societal, cultural and indeed political issue (EPAP, 1999).

Trends observed in several fisheries of the United States would seem to bolster arguments that the potential exhaustion of resources is not just theoretical. U.S. fleets have harvested in excess of 4.5 million metric tons since 1990. Of the 279 stocks of known status, the National Marine Fisheries Service reported in its 1997 Status of the Stock Report that 86 are overfished with an additional 10 approaching that status and others likely to be included in the near future (NMFS, 1997). In the New England region in 1997, 59 percent or 30 stocks were considered to be at a low level of

abundance, 31 percent or 16 stocks were at a medium level of abundance, and only 10 percent or 5 stocks in the region were considered at a high abundance level.

In 1998, the National Marine Fisheries Service reported that two-thirds of the stocks were considered at that time to be overexploited (NMFS, 1998). This report is particularly interesting in that the Service admits that the “vast majority of the (New England) region's resources have been historically mismanaged” (NMFS, 1998), a significant statement attesting to tragic consequences for this region's fishery. But, are all fisheries condemned to play out Hardin's (1968) commons tragedy? In many respects the answer to that questions is an unequivocal yes!

A Two Dimensional Problem

As described above, many global fisheries are in a state of crisis. Yet many of these fisheries have been under scientific management by governmental entities for decades. This means that we are not just witnessing a loss of public resources, but a failure of government-sponsored conservation efforts as well.

While the goal of fisheries management is to affect the biological status of a fish stock, in practice fisheries management concerns the regulation of human activities and, consequently, it presents a two dimensional problem. One dimension concerns fishermen who are in all too many cases motivated to over exploit the resource. The second dimension concerns how rules are generated to modify this behavior.

Rational Self Interest

There has been much academic attention focused on why individuals are motivated to over exploit and our basis of understanding has been refined over the past

fifty years. Hardin (1968) put into the collective consciences a concern that the end result of individual behavior is a detriment to society and that a “tragedy of the commons” can only be averted through government intervention. Economists Gordon (1954) and Scott (1955) saw the propensity towards excessive exploitation in terms of a lack of property rights to the resource, suggesting that proxies for such rights (i.e. licenses or quotas) could overcome economic dissipation. Olsen (1965) advanced the understanding of why public “goods” are subject to unbridled use with his theory of “free riders” who can not be dissuaded from excessive exploitation of *commonly-owned* resources without selective incentives. More recently, Rational Choice theorists such as Elster (1989), Sugden (1989), Coleman (1990), Ostrom (1990), Taylor (1990), Knight (1992), and others have demonstrated that the basic problem that manifests in the fisheries is a communal or “collective action dilemma” where what is rational for the individual leads to disaster for society. It is in the short run best interest of fishermen to over exploit even though this ultimately leads to the destruction of the breeding stock, poor recruitment, lowered catches, and ultimately business failure for many fishermen.

Changing Individual Incentives

The second dimension of the fishery management problem is the question of what social or institutional circumstances are necessary for the development of conservation rules? The propensity to waste resources is not simply a function of inherent human behavior, but rather a response to incentives (or lack thereof) that emanate from institutions. Institutions can be considered in this context to be sets of rules established through a legally constituted process or informal rules and norms of behavior. Under some conditions, institutions will be provided that avert the propensity

towards over exploitation. However, the conditions under which these institutions are erected is not well understood. The second dimension of the fishery management problem, therefore, can be more precisely stated as a question of how we establish or change institutions so as to bring individual incentives in line with societal goals?

Bargaining For Solutions

Much of the work done by the rational choice theorists above focuses upon characteristics of communities that have devised informal rules to address collective action problems. However, because government is very much involved in devising rules for fisheries management, our interest here is in how formal rules or institutions come into being in a process that involves the government and industry. The question of institutions has been explored extensively by economists such as Coase (1937), Williamson (1971), and North (1990b). Although not directly dealing with the collective action dilemma, their work in the field of transaction cost economics provides insight into how organizations are generated in response to various kinds of problems that occur in the market. In this context, transaction costs refer to the effort, time and/or expense to obtain the information necessary to negotiate, make and enforce an exchange of goods or services (Dahlman, 1979). Advancing our understanding of the kinds of institutions (or governance structures) that evolve in response to market failures provides a means of identifying those institutions that may be useful in resolving the dilemma of collective action. By evaluating the costs that occur in association with a transaction, it may be possible to identify the most efficient or appropriate institution to bring individual incentives in line with societal goals for the provision of public goods. The linkage between transaction cost economics and collective action problems is

provided by Taylor and Singleton (1993) who argue that solving these problems necessitates devising more adequate rules than the ones in existence and to do so necessitates overcoming transaction costs.

The Basic Premise

A fish once captured is a private good. A stock of fish freely swimming is a common property resource. Management of this resource is a public service or, in this context, the policies, management plans and rules, etc. are public goods (Coase, 1937; Samuelson 1954; Olsen 1965). If these management institutions are optimized, then no one is excluded from their benefits and any one individual who benefits does not do so at the expense of others. We can think of the collective action dilemma, therefore, as a 'public bad' and that attempts to overcome it by optimizing the public good (policies, plans and rules) will incur transaction costs. Taylor and Singleton (1993: 196) argue that to move an individual, community, or society from an inferior position in policy *space* to a Pareto Superior position necessitates overcoming various transaction costs. The more capable an institution is at overcoming or reducing transaction costs, the closer it moves towards a Pareto Optimum position. Simply put, by reducing transaction costs, the likelihood of reaching a negotiated solution is increased.

Factors that can increase the costs of transactions according to Williamson (1985) include asymmetrical information between parties to the transaction, infrequent use of the good or service to be exchanged or negotiated, and the exchange of assets that are of value only within the context of a specific transaction. Other cost increasing factors to be considered here include the *scale* and *complexity* of the good or service subject to the transaction, and the relative *power* of the parties to the transaction. Power

here is considered to be that as defined by Knight (1992: 41) – it is the ability to affect by some means the alternatives available to others party to the bargaining process. For example, the State can foreclose negotiation through the use of fiat, a fishermen's association or a conservation organization can seek to overturn agency action through congressional intervention or judicial sanction. Scale as used here simply refers to the size of the fishery: for example, the number of participants, the spatial distribution of the resource, the nature of its market, etc. Scale can have a significant influence upon the complexity of the institution to be developed in the bargaining process.

Access to information, the size or scale of the fishery, and the relative decision-making power of parties bargaining for fishery management influences the effort, time and/or expense necessary to make, negotiate and enforce an exchange of the policies, management plans and rules, etc. required to address the collective action dilemma operative within our fisheries. The costs that will be of principal concern here include those associated with scale and complexity, those associated with obtaining information about the status of the resource and the action and motivations of others, and those associated with the relative decision-making power of stakeholders to the fishery, including fishermen, managers, and other involved entities.

Asymmetries

The factor of most significance with respect to information asymmetry is the science that supports the management process. Science in this context is primarily of a biological nature and has both technical and legal implications in that the statute governing fisheries management in this country, the Magnuson Stevens Fisheries Conservation and Management Act (MSFCMA), prescribes action based upon

biological standards. Although current law technically enables the *State* to discharge its public trust responsibility through fiat, in the law's practical application, the administrative requirements of the Act puts the federal government in the position of *bargaining* with fishermen and other stakeholders for management rules that will conserve the resource. Science thus has a significant influence upon how fishermen, managers and other stakeholders perceive the *problem* and the *solution* and the *time* necessary to transact an exchange of public goods necessary to optimize solutions to the collective action dilemma. Costs can be minimized where parties to the fisheries management transaction can bargain with symmetrical information about the status of the resource, the measures necessary for its conservation, and the timing of the exchange. When information asymmetries exist so as to prevent a shared and consistent understanding of the problem, its solution and time horizon, transaction costs can cause less desirable fisheries management outcomes.

The scale and complexity of the fishery and the relative decision-making power of the parties to the transaction have an influence upon the bargaining process and the degree of success achieved in moving towards a Pareto Optimum position. Fishermen operate within a bio-economic system. The size of that system and its spatial distribution can create circumstances where information about the status of the resource and about the actions of others operating within the system can become limited. Government management institutions can also be conceived of as systems organized in a hierarchy of roles and functions where complexity affects the flow of information necessary to the decision-making process. The nature of the linkages within and between fisheries systems and management systems has an influence upon the

transactions that occur including the flow and use of information necessary for effective public policy decision-making.

Diverse conditions of scale and complexity are manifest in many fisheries. Diversity of scale translates into differing levels of access to management institutions for different interest groups. Thus the costs of transaction at the industry/government interface are not equal for all participants, including fishermen, fisheries managers, and other stakeholders. This can be so because the balance of power (including access to information) among different parties is asymmetrical. Where power is not symmetrical and where the management institution has been designed to function only at one scale or where an inappropriate inter-system linkage exists, transaction costs are also asymmetrical and thus higher for some parties to the negotiations than for others. This is so for several reasons including the inherent difficulty in obtaining unambiguous information about the status of the resource, about the actions and motivations of other participants in the fishery, and about the actions and motivation of those within the management institution. In this situation, the lack of shared verified information undermines the conditions necessary for accountability, increasing the costs of transactions and this leads to an impaired public decision-making process.

Information, scale, and power symmetries are important because management of fisheries typically leads to the establishment of rules to constrain the way in which fishing activities occur. Where these asymmetries exist, the various parties to the fishery management negotiation will respond with “self-interested guile” foremost and will thus not be entirely forthcoming with their intentions. Williamson (1985) identified guile in making the argument that “opportunism” dictates in circumstances where

information is asymmetrical and this self-interested behavior increases the costs of the transaction.

In the case of fisheries, fishermen typically respond to constraints by changing their exploitive efforts, sometimes through innovation, and at other times by entering the political arena to influence public policy. The actions of fishermen can, in turn, lead managers to adjust constraints directly via regulation or lead other stakeholders to do so indirectly through the legislative process or through the courts. Over time, the interaction of the parties to the transaction can spiral upwards towards positive results and at lower costs where information and power asymmetries are minimal. This is especially so where scale is small and complexity low or where the influence of large scale/high complexity upon transaction costs is mitigated through some means. In other circumstances, however, a downward spiral of perverse countervailing incentives can create extraordinary costs for all parties to the negotiation, a dissipation of assets (both public and private), and a loss of common property resources. It is possible that initially high asymmetries in transaction costs between parties might lead to aggressive attempts to equalize bargaining positions. This would lead to strategic responses that, depending upon the relative power to affect the alternatives available to other parties, would increase transaction costs of the negotiating partners and, in a game of *one-upmanship*, lead to the dissipation spiral. Where low initial transaction costs exist, there is less need to resort to countervailing action by negotiating parties and a greater likelihood of bargaining success.

Overcoming Asymmetries

One means of overcoming complexity induced information limitations, including those of science and of the actions and behavior of others, is to partition fishery management decision-making authority by scale and location. This is a common organizational response to complexity. It is used in government, industry and almost all large social institutions (Simon, 1969; 1996; Williamson, 1985; O'Neill, et al., 1986; Ostrom, E., 1990; Levin 1992; Ostrom, V., 1994), but it has not been done to any significant degree in fisheries. Compared with our current organization of management, this would mean the addition of more local decision-making, moving this *devolved* decision-making closer to where the fishery occurs. This devolved authority, characterized here as *co-management*, would enable stakeholders at a more local level to develop plans and rules, to impose sanctions for violations, and implement accountability features into the management process.

Given emerging theories about localized stock structure (Hunt von Herbing et al., 1998) and the enhanced ability at a more local level to recognize patterns in complex adaptive systems like fish stocks, this approach provides a means of addressing the limitations of our current principally large scale fisheries science. This integration of fishery science, management, and harvest and the use of a more adaptive approach is recognized as important to the evolving ecosystem-based management system that has been advanced by the federal government (ESAP, 1999). Hennessey and Healey (2000: 210) make the point that the increasing emphasis "on traditional and local knowledge" and its integration with the knowledge of scientists is necessary for the adaptive management that is part of the ecosystem-based management evolution.

The co-management approach has the added benefit in that access to timely information concerning the resource and its management as well as the ability to use this information to evaluate, debate and reach consensus positions regarding the nature of issues of concern to the community can lead to more effective management mechanisms (Ostrom, 1990; Wade, 1992; Pinkerton and Weinstein, 1995). These mechanisms include typical considerations such as rule making, compliance monitoring, and enforcement. But other atypical considerations such as an investment of the time necessary to address issues and to garner support for institutions. A more direct and affirmative role at a local level can develop within a community a conservation advocacy that Hall-Arber and Finlayson (1997) have characterized as a linkage between social and ecological systems; a practical understanding of the connection between the community and the resource it depends upon. This attitude is critically important in promoting a sense of ownership interest in the process and thus in its outcome. In essence, a proxy for property is thus established that encourages a sense of stewardship. A more formalized acknowledgement of "ownership rights for fishers and fishing communities" is thus seen by Hennessey and Healey (2000: 210) as having "the potential to improve fisheries management and help avoid some of the most destructive excesses."

The establishment of *proxy property* or an ownership interest in the resource through the devolved authority to manage the resource at a more local level addresses the problem of over exploitation as it was framed by Gordon (1954) and Scott (1955). In essence, therefore, the devolved authority serves as a form of selective incentive necessary to overcome the free rider problem identified by Olsen (1965). This selective

incentive promotes a sense of stewardship which serves as an institution that alters the nature of self-interested behavior that Rational Choice theorists argue is responsible for the collective action dilemma. Overcoming the dilemma of collective action in this fashion, through co-management, can avert a tragedy of the commons without resorting to government fiat as advocated by Hardin (1968).

The Hypothesis and Sub-Hypotheses

Hypothesis. It is my hypothesis that the relative success of fishery management can be explained in terms of the interaction between fishermen and the government: the relative power of each in the fishery management exchange; the degree to which information and perceptions about the fishery are comparable; the scale and complexity of the fishery to be managed; and the ability of the institutions in which they work to reduce the transaction costs that impede efforts to develop control rules. Where this industry/government interaction leads to management failure, devolution of authority in the management decision-making process to a more local level of the fishery will provide a means of overcoming impediments to successful fisheries management.

Attendant to this principal hypothesis are the following four sub-hypotheses that will be tested in support of the principal.

Sub-Hypothesis 1. In large scale highly complex fisheries where asymmetries in power and information exist, the fishery management bargaining process will be marked by high transaction costs that will be overcome only with great difficulty. In this situation,

there is a high probability that the interaction between parties to the negotiation will spiral downward leading to an institutional and resource failure.

Sub-Hypothesis 2. In large scale highly complex fisheries where information about the resource is asymmetrical, but where power symmetries exist, it is possible to negotiate effective resource conservation rules, however, transaction costs will remain high thus the bargaining process will be protracted. In this circumstance, transaction costs can be more easily overcome if the effects of scale are reduced.

Sub-Hypothesis 3. In large scale highly complex fisheries where the fishing industry and government have similar understandings of resource status and where symmetrical power with respect to decision-making authority exists, transaction costs can be more readily overcome leading to more effective institutional and resource outcomes.

Sub-Hypothesis 4. In small scale low complexity fisheries, transaction costs involved as parties negotiate for control rules will be relatively low regardless of symmetries of information and power.

The Status of Fishery Management

In the New England region, where fishery management was historically a state-level endeavor, it is now principally a federal responsibility as a result of the 1976 enactment of the Magnuson Stevens Fishery Conservation and Management Act. The federal fisheries management program was designed by its framers to vest stewardship responsibility for local resources in the hands of those at the local level. However, the

manner in which the federal program is currently administered is contrary to the intent of its congressional framers due to executive branch interpretation, iterative congressional modification, and recent judicial intervention.

The government-centered approach has proven in some cases to be an ineffective means of managing publicly held resources. This is so because a number of forces are at play that overwhelm the centralized decision-making process and that the extant institutions of governance fail to adequately consider the human element within the fisheries thus ignoring the complexity of the combined human/fisheries system. This failure results in a skewed balance of power, where opportunities for mutual agreement among participants are not present and where principles of self-responsibility and self-governance are lacking (Ostrom, 1997: 4).

The purpose of this thesis is to examine conditions of success or failure of fisheries management in the New England region in relation to the hypothesis that high transaction costs can prevent parties bargaining for fisheries management from arriving at acceptable solutions. This hypothesis will be tested using case study examination of three fisheries found within the Gulf of Maine including the New England lobster fishery where an upward spiral of positive incentives has created an enhanced management institution, the Northeast groundfish fishery which has spiraled downward in response to perverse countervailing incentives, and the Maine mahogany quahog fishery which remains relatively consistent despite faulty institutions.

Success in this context has two separate components: one involves solving the collective action dilemma to get rules, the other involves getting rules that positively affect fish stocks. Consensus, however, is lacking as to how public policy decision-

making success or failure is defined in this context because it is difficult to demonstrate that any management plan succeeds in positively affecting fish stocks due to the *masking* effects of complex environmental factors. While some see success in terms of outcomes that prevent unsustainable exploitation levels, others see success in terms of processes that lead those involved in fisheries and management systems to collectively solve the collective action dilemma. Singleton (1998: 26) points out that defining success only in terms of resource outcomes fails to acknowledge that many factors can affect sustainability, including environmental factors, and that sustainability may or may not be achieved for reasons “unrelated to institutional design.” By way of example, Acheson and Steneck (1997) can come to no certain conclusion about the cause of the “boom and bust” in the lobster industry and hypothesize that environmental factors such as water temperature have had a more pronounced effect upon historic cycles than have measures to constrain fishing activity. While it is possible to demonstrate that participants in the fisheries management bargaining process have agreed upon rules to address the collective action dilemma, it is far more difficult to assess whether the rules are effective in conserving the stocks and thus difficult to demonstrate that the rules alone are responsible for sustainability. Nevertheless, the outcome-based approach is the foundation of current federal law and it colors the way in which stakeholders approach the problem.

This thesis extends the theory of common property governance by extending our understanding of how transaction costs effect the public policy decision-making process. Success or failure is measured here in terms of processes that lead to resolutions of the dilemma of collective action, the basic argument being that the failure

to resolve this dilemma lies in the relationship between fishermen and government. Work done by prior researchers has focused upon questions of why fishermen over exploit or why government failures exist. This thesis contributes by drawing a relationship between the two, linking these to the theory of institutional formation, and thus it adds another dimension to our understanding of why efforts to conserve resources succeed or fail.

The New England fisheries provide a particularly interesting case study of resource conservation because, contrary to popular belief, the conservation movement in this country did not begin among America's elite class, but in the New England region's "petty resource-based economy" (Judd, 1997). A sense of stewardship and a commitment to democratic principles led early New Englanders to actively participate in the management of shared resources. Over time, however, as authority systems shifted from the towns and counties to the state and federal governments, the concept of local stewardship and responsibility for local resources yielded to the Progressive Era concept of centralized resource policy and its reliance upon scientific expertise (Judd, 1997). Reviewing the fisheries of this region in the context of an evolution in stewardship provides a backdrop against which to illuminate and advance our understanding of how fishery management can evolve consistent with evolving societal attitudes towards centralized authorities. Through these case studies, this thesis attempts to demonstrate that success in bargaining for the public goods necessary to address the collective action dilemma requires a devolution of authority to a more local level and the development of institutions that foster stewardship anew.

This case study methodology is supported with research data developed through participant observation, a standard and well accepted research technique utilized in many social sciences (Bernard, 1988). This research data, in addition to archival records, was collected over a period of nearly thirty years of involvement in the U.S. fisheries. My personal field observations provide the unique perspective of someone who has been a fisherman, a state and federal fishery scientist, a congressional fisheries advisor, a fishery regulator, and for the better part of a decade the Commissioner of the Maine Department of Marine Resources.

What follows this introduction are seven chapters that explore the interdisciplinary issues (biological, social, economic, legal, and political) attendant to fishery management. Chapter 2 raises the question of responsibility, addressing the action and behavior of fishermen in the present fishery management context, presents the theory of transaction cost economics, and describes significant informational asymmetries that exist due to scientific limitations. Chapter 3 introduces the extant fishery management program, the role of government and the actions and motivations of its agents, and the public policy tools typically utilized to manage marine fisheries. Chapter 4 concludes Part I of this thesis with an examination of solutions to the collective action dilemma, specifically the institution referred to as co-management and how this institution has been successfully applied to fisheries around the globe.

Part II links the theory presented in Part I to the New England fishery situation through the examination of three New England fisheries. Chapter 5 presents a broad overview of the New England fisheries, their physical and human ecologies to provide a context for the detailed examination of their management in Chapter 6 utilizing an

extended case study method to evaluate where and why fishery management success or failure has occurred in the Maine mahogany quahog fishery, the New England lobster fishery and the Northeast groundfish fishery. Chapter 7 serves as a conclusion, linking theory and case studies in support of the hypothesis that devolving a greater role in the management decision-making process to a more local level of a fishery will provide incentives that serve to establish a sense of stewardship interest in the resource, altering the rational choice behavior that causes the dilemma of collective action in the fisheries. Chapter 8 presents the implications of my theory for additional avenues of research and develops an alternative national fishery management program, describing how this new model would be applied in the New England region, and how existing fisheries would be integrated so as to achieve multiple objectives in a complex fisheries environment.

Chapter 2

WHO IS RESPONSIBLE FOR OVERFISHING?

Why is it that we humans seem incapable of utilizing resources, be they terrestrial, atmospheric or oceanic, in a fashion that will ensure their sustainability? Are we insensitive to the evidence, ignorant of the consequences, is our appetite so rapacious that we are incapable of moderation, are we so profligate in our actions as to destroy that upon which we depend, are we selfish, naïve or just plain stupid? Perhaps as individuals there are those among us who are incapable of moderation. But, can we indite whole components of our society in such a fashion? Why do fishermen over fish – why does the government let them? These are very simple questions to which the only honest response is extremely complex. Yet, as greater public attention is focused upon fisheries through the efforts of advocacy groups and the media, the issues are being framed in this simplistic rhetorical fashion. Indeed, there are fisheries that have not been well managed. Conversely, some have been managed quite well. The question of importance here is less a matter of why fishery resources are abused, but under what conditions does abuse occur and what conditions are necessary for their conservation?

Holding fishermen solely accountable for the demise of fishery resources is wrong. Conversely, the government alone is not fully culpable either. It is at the industry/government interface, in essence the marketplace for the exchange of fishery management incentives, that failures occur and where success can be achieved. The outcome of the bargaining process depends upon the transaction costs encountered in the negotiation and the ability of the parties to negotiate alternatives and devise

institutions. In this regard, all parties to the fishery management bargaining process share responsibility for its success or failure.

Property Rights, Public Goods and Collective Action

“Ruin is the destination toward which all men rush, each pursuing his own best interest in a society that believes in the freedom of the commons” (Hardin, 1968: 20). It is almost a right of passage for a student in the field of resource management to pay *homage* to Garrett Hardin, if for no other reason than that so much attention has been focused upon his parable. More than 30 years after he disparaged the human behavioral proclivity towards ruin for all, interdisciplinary research has shown that Hardin’s thesis contains many flaws. Nevertheless, his work has had a profound effect upon those interested in overexploitation, stimulating many to recognize the importance of integrating social, political, and biological theory. In fact the rate at which his work is cited continues to increase even all these many years after it first appeared in *Science* (Burger and Gochfeld, 1998: 6).

The circumstance that brings about a resource tragedy is not simply one of common property as portrayed in Hardin’s pastoral parable, but one of free and open access to a resource that has no ownership. Fisheries have played a prominent role in the advancement of the theory of common property, which traces its origin to the seminal fisheries economics work of Gordon (1954) and Scott (1955). Common property is not *everybody’s property* because the concept of *property* has no meaning where the possibility of exclusion is not available. Describing unowned resources (*res nullius*) as common property (*res communes*), therefore, is a contradiction (Ciriacy-

Wantrup and Bishop 1975). The problem of managing fisheries is that they are fugitive resources that freely transit political boundaries. Where appropriate institutions can be erected, however, it is possible to provide satisfactory management of common property resources (Ciriacy-Wantrup and Bishop, 1975: 721). Gordon and Scott saw the propensity to over exploit in terms of a lack of property rights to the resource, suggesting that proxies for such rights (i.e. licenses or quotas) could overcome economic dissipation.

Work done by Olsen (1965) prior to the appearance of Hardin's "*Tragedy*" argues that the problem inherent in the abusive use of publicly owned "goods" is that institutions are lacking that would provide selective incentives necessary to bring about moderation in use. It is true that commonly owned *common pool resources* or Olsen's "public goods" are subject to demise, despite the potential benefits from their protection, because of rational individual behavior. Collective goods are those for which exclusion of use is not possible or for which consumption by one person does not exclude use by another. The abuse of such collective goods as rivers, air, and fish, for example has been recognized through the ages. Aristotle observed "(t)hat which is common to the greatest number has the least care bestowed upon it." (quoted in Ostrom and Ostrom 1999: 76). Where these collective goods are available for free and unfettered use, the cost minimizing individual will freely exploit them without contributing a proportionate share of the costs associated with their supply or protection. These "free riders" as referred to by Olsen will freely take advantage of public goods even though their action may ultimately become a detriment to society. Olsen demonstrated that moderation in the use of collective goods will not occur even if

everyone concerned might be better off making the required contribution, that is unless certain “selective” incentives to utilize them in moderation are offered or perceived.

Any one can benefit without realizing the full costs associated with the provision of collective goods. Thus in the fisheries it is rational not to harvest with restraint despite the possibility that society’s goal of a robust resource will not be met. Even where agreement exists about the potential benefits associated with self restraint in the use of collective goods, there is always the possibility of defection from that position given that any fish left by one fisherman today can be harvested by another competitor tomorrow. This individual propensity to defect from a position of mutual agreement concerning mutual benefits has been modeled as the *prisoner’s dilemma*. Elster (1989), Sugden (1989), Coleman (1990), Ostrom (1990), Taylor (1990), Knight (1992), and other rational choice theorists advance a more modern way of framing this problem in terms of a *collective action dilemma* and the fisheries are a classic case. It is in the short run best interest of fishermen to over exploit even though this ultimately leads to the destruction of the breeding stock, poor recruitment, lowered catches, and ultimately business failure for many. What is rational for the individual leads to disaster for society. Where the collective action dilemma is operative, social goals and individual goals are different. It is rational for fishermen to harvest as much of the available resource as possible from the common pool. For an individual fisherman to do otherwise in a competitive market place is too costly.

Extending these concepts to the management of fisheries, we can conceive of the conservation of the resource as a form of *public good* of a kind contemplated by Olsen. Public goods in this context are the policies, plans, and regulations, etc. that

provide a means of securing moderation in the utilization of the collective good (the common property resource). When these public goods are provided, the resource can be conserved such that those who benefit do not do so at the expense of others. In other words, society's goal of a robust resource and the fisherman's profit maximizing goal are both met. Where certain conditions exist or where selective incentives are available, an individual willingness to contribute to the provision of the public good is possible. The process of fisheries management can, therefore, be thought of as a form of negotiation or bargaining process, in which rules are produced. Where incentives to bargain in earnest exist, rational opportunistic behavior can be overcome and lead to more optimum societal outcomes.

There is not a lot of evidence to suggest that collective action problems are easily solved – devising rules to constrain ones self is never easy. Hardin (1968: 29) argues that the means of producing responsible utilization of the commons and common property resources occurs through the creation of some sort of coercion of a kind that can only be exercised through the police powers of the state, variously thought of as autocratic control, command and control, or government fiat, etc. The common property economists such as Gordon (1954) and Scott (1955) argue that responsible utilization can be encouraged through the use of real or simulated property rights. Alternatively, anthropologists McCay and Acheson (1987) and Acheson (1989) have pointed out that local level mechanisms, including a variation referred to as co-management, have been developed to address common property utilization problems.

Solutions are available for common pool resource problems under certain conditions, however, these conditions are not universal. It is clear, however, that rules of

behavior or access to property does not need to be dictated solely by the government as suggested by Hardin. The social science literature focused on the generation of governance structures demonstrates that self-generated rules of organization and property rights systems are practical and possible (Ostrom, 1990). Hardin's thesis is thus flawed in its assumptions that effective institutions cannot or will not be erected, and that only government institutions can arrest a trend towards overexploitation (Acheson, 1989: 357-358).

Much of the work done by the rational choice theorists is focused upon the development of informal rules and the characteristics of communities that enable them to devise such rules. However, the government is very much involved in devising rules for the management of fisheries and our interest here is in the process that occurs between the government and the industry to bring about rules in this context. The formal management rules are produced by negotiations among stakeholders, thus the stakeholders party to the fishery management negotiation are responsible for its outcome. Where that outcome is failure, the parties can bargain for solutions provided that the transaction costs can be overcome. This is essentially a restatement of the Coaseian theorem (Coase, 1937; Williamson and Winter, 1993). Transactions in this context refer to the effort, time and/or expense to obtain the information necessary to negotiate, make and enforce an exchange of goods or services (Dahlman, 1979). Recognizing that all human endeavors incur transaction costs is key to understanding the basis for failures of fishery management. Understanding the disparate interests of those with a stake in the outcome, particularly the government and the industry, and how these interests conflict and overlap is necessary to understanding why the fishery

management process can sometimes produce failure. Understanding why these failures have occurred is fundamentally important to developing successful fishery management alternatives for the future. The theories explaining the development of informal rules for addressing collective action problems are inadequate to the task of explaining how formal rules at the industry/government interface come into being and why they succeed or fail. Transaction cost economics, however, can provide the necessary link to bridge the gap in our understanding of how to devise potential solutions for collective action dilemmas.

The Costs of Transactions

Transaction cost economics provides insight into how organizations or institutions are generated in response to various kinds of problems that occur in the market. It is a field that has increased in interest, particularly to those focused on corporate governance, and it is a field of economics that has generated two Nobel Laureates within the past decade, the theory's progenitor, Ronald Coase, and his disciple, Douglas North. Organizations can be thought of in the conventional sense as business firms or government agencies. Institutions can be considered in this context to be sets of rules established through a legally constituted process or as informal rules or norms of behavior influenced by a set of incentives where motivations are used to influence individual actions. That a particular type of organization is chosen depends upon the value placed upon the article of interest and what is considered most efficient for reducing costs (Williamson, 1975, 1979; North, 1990). Where the article of interest is something that society places a high value upon such as the right to harvest a public

resource or concepts such as property rights, rules of common and acceptable understandings (institutions) develop sometimes as a result of “fights” over “distribution” (Knight, 1992). Often times, these distribution fights play out in the regulatory and legislative arenas incurring high transaction costs.

From an economic perspective, institutions are generated to compensate for problems in the market. If all goods and services required are available at acceptable acquisition costs, then institutions or “firms” would be unnecessary (Coase, 1960). Institutions, therefore, provide a means of addressing market inefficiencies by lowering the cost of transaction between giver and taker, regardless of the specific nature of the transaction. This can relate to the acquisition of tangible goods and services available in the marketplace as well as intangibles such as information, which has attributes of both a good and a service.

Transaction cost economics can be traced to Coase’s classic (1937) article on the theory of the firm in which he tried to explain hierarchically arranged (business) firms in terms of market failures. He questioned the need for firms if Adam Smith’s *market* works so well to meet the needs of all consumers and producers alike. The answer according to Coase was that markets do not always function well because of the differential costs of exchanging (transacting) in the market place. Conversely, Coase asked, if hierarchical arrangements within firms have advantages over the market, then why is all production not carried on within the firm. The response to this was provided by Oliver Williamson (1971; 1975; 1985) who pointed out that exchanges in firms involve transaction costs too and that it was thus sometimes more efficient to use

outside firms. The internal workings of the firm, therefore, was seen as more than just a production function, but as a governance structure as well.

Whether or not entrepreneurs use exchanges in markets to get the goods and services they need or whether they expand their own firm depends on the balance of transaction costs. Transaction cost economics assumes that firms are profit maximizing and cost minimizing organizations operated by rational managers. In this regard it falls within mainstream economic theory. Where it departs, however, is in stressing that a firm's costs are beyond those of production and include all other exchanges that occur within the firm to reduce its efficiency. By way of simple example, transaction costs can be thought of as friction, which is a force that retards an object as it slides along a surface. The total cost in energy necessary to move an object includes that necessary to move the mass of the object as well as that necessary to overcome friction. In the operation of a firm, total cost is greater than the cost of production alone and includes all other sources of *friction* that tend to retard progress towards total efficiency. For example, lack of information about alternative suppliers or of a customer's trustworthiness can lead a firm to pay too much for supplies or to incur additional costs to service bad debt. In a fisheries context, lack of information about a competitor's willingness to fish in moderation or about the declining status of the resource could lead an individual fisherman to continue fishing despite a decline in revenue and a loss of supply. The goal of an efficient firm is to minimize total cost including those of transaction.

Williamson contributes significantly in putting forth the assumed conditions that incur transaction costs and the variables that determine what level of organizational (or

institutional) hierarchy will lower them in various circumstances. He assumes first that all *actors* have “bounded rationality” in that, no matter how knowledgeable they might be, they can not consider all possible alternative courses of action. The complexity of decision-making in this condition is compounded by the fact that they must account for potential reaction by competitors. Metaphorically, bounded rationality can be thought of as the obstacles present in the game of checkers. Despite the relative simplicity of the game, no one can faultlessly analyze all possible moves, not just because of the number of possible permutations the board presents, but also because the actions of the opponent are unpredictable (Holland as cited in Wilson, 2001). Williamson also assumes that “opportunism” dictates that actors will operate with self-interested “guile” foremost and will thus not be entirely honest and truthful about their intentions. He does not assume, however, that this behavior will be present all of the time, but that because people will act opportunistically some of the time, it is impossible to determine in advance whether opportunism is at play.

In determining whether transaction costs will be lower in a hierarchy (vertical organization) or in the market place, Williamson suggests that there would not be a situation in which a firm would integrate vertically to bring in-house the provision of a good or service it rarely uses, thus “frequency” of use is one important variable. Another important form of transaction cost is that of “uncertainty” and the difficulty of foreseeing the eventualities that might occur during the course of a transaction. This is so not just because of bounded rationality and opportunism, but also because of *information asymmetries* whereby one party to a transaction has less information about the transaction than does the other party. A third condition identified by Williamson as

contributing costs to the transaction is “asset specificity” which occurs in transactions that involve *assets* that are only valuable (or much more so) in the context of a *specific* transaction. In this condition the costs will tend to be reduced by vertical integration.

Douglas North (1990b) extended the study of transaction costs and governance structure beyond the business firm to that of the internal workings of the political process and, specifically, its participants. His focus was upon what he referred to as “instrumental rationality” causing a failure of informational feedback necessary to convey to participants a “correct theory of how their world operates.” Instrumental rationality affects their decision-making process, the information the process generates, and ultimately the outcome of the process (Dixit, 1996: 45). North’s work led him to conclude that transaction costs are much higher in the political *market* and that this market operates even less efficiently than do economic markets, largely as a result of information asymmetries.

Taxonomically, the basic unit of consideration in transaction cost economics is the contract which involves a single exchange between two parties in an economic transaction. In a political setting, the contract can be conceived of as a promise of a policy or program. The parties to this political transaction are individuals or interest-groups on one hand and politicians, elected officials, and/or agency administrators on the other. Beyond this simple economic/political contractual parallel, the contrasts between transactions in the economic market and in the political market differ considerably. For example, political contracts do not occur between two individual actors, but rather between multiple parties. Furthermore, the terms of a political contract are often vague and leave significant room for interpretation. Consequently,

contracts in the political market, which are of particular concern in this thesis, are far more complex than are those that occur in the economic market.

To safeguard against factors tending to increase transactions costs (bounded rationality, opportunism, and information asymmetry) institutional arrangements are selected to mitigate some of the anticipated costs. These institutional arrangements vary with respect to their adaptive abilities because of differences in incentives, administrative controls, and the *legal* regime. The movement from the market (considered here to be non-governmental communities) to a hierarchy (considered here to be vertically arranged institutions of governments and government agencies) involves a trade-off of power and autonomy for the added safeguards that a centralized coordinating entity is assumed to provide.

Different modes of governance are supported by differing legal regimes and enforcement capabilities, from informal sanctions to contract law to even government fiat. This is the avenue through which I intend to explore the transaction costs associated with the fishery management process. The feature of transaction cost economics that is of particular relevance here is that it provides an explanation of why a particular organizational or decision-making structure exists and posits why failures occur in some structures. It recognizes that where transaction costs exist, exchange agreements must be governed and that some forms of governance are better than others. Williamson (1985) says that this perspective can be extended beyond economics into non-business related fields including political science, law, and other social sciences, although developments in this regard are limited.

It is used here to address the costs that accrue where scales of complexity are mismatched in the decision-making process, the tenet being that complex modes of organization are appropriate for complex transactions; simple modes of governance suffice for simple transactions. To mismatch complexities of scale using a simple mode of governance to manage a complex transaction, for example, can lead to contractual failures. On the other hand, costs are incurred without gain where a complex mode of governance is used to manage a simple transaction. Both of these outcomes are manifest within the New England fisheries.

Taylor and Singleton (1993) provide the significant linkage between transaction cost economics and collective action problems thus providing a means of leveraging possible solutions to the fishery management problems in New England. They argue that solving the collective action dilemma necessitates devising more adequate rules than the ones in existence and to do so necessitates overcoming transaction costs. That moving an individual, community, or society from an inferior position in policy space to a Pareto Superior position necessitates overcoming various transaction costs. The more capable an institution is at overcoming or reducing transaction costs, the closer it moves towards a Pareto Optimum position. Simply put, by reducing transaction costs, the likelihood of reaching a negotiated solution is increased.

The transactions that are of most interest here relate to the costs of obtaining information about the status of the resource, the action and motivations of participants in the fishery, the action and motivations of other stakeholders, and the actions and motivation of those within the government (management) hierarchy. This thesis argues that where these transaction costs are high, the lack of shared verified information and

the absence of conditions necessary for accountability lead to an impaired public decision process.

Rationale for Pursuing an Alternative Management Approach

Feeny et al. (1996) have critically examined assumptions that a government centered management regime is necessary for successful resource management and that new arrangements of behavior are impossible to create. New institutions can and have been established to better manage many fishery resources. Where obstacles to the creation of new institutional arrangements were found, however, it was typically related to poor communication between fishermen, managers and biologists (1996: 195). Their work provides additional evidence of the costs associated with information asymmetries and further demonstrates that government action taken in the social interest does not always lead to better outcomes.

Despite the fact that fisheries were among the first natural resources to be brought under governmental control in the late 19th century (1996: 195), history since that time is replete with examples of fishery management failures under government centered regimes. As discussed in the next chapter, reasons for this are as complex as are the institutions themselves and include the nature of the legal/political processes and the tenure and commitment of regulatory authorities, including their cultural attitudes and value systems.

It is not a foregone conclusion that a government-centered approach to fisheries management is the most effective means of dealing with the very difficult collective action dilemma operative within our fisheries today and there are a number of reasons why greater fisherman involvement in developing and implementing management in

this region is necessary. For one, the waters are simply too vast to be either understood or managed centrally and fishermen can far too easily undermine management measures that they do not support. In this regard, Shelley et al. (1996: 239) state that “managers need the fishermen as their eyes and ears on the resource every day, and they need them as their partners in meeting the management objectives.”

The command and control form of management characteristic of the government-centered approach utilized in the New England region has not proven to be an especially successful model for resource conservation. Although there are certain public services for which a centralized governmental organization is perhaps appropriate (mass transit, sanitation facilities and airports for example), consolidation and centralization of services has typically resulted in government failure. Several researchers have explored the failings of large centralized government entities in responding to the needs of the citizenry in a variety of settings, including the provision of services in large metropolitan areas. Perhaps the most critical examination was done by Wunsch (1999) who found nearly a “consensus level” of criticism of the “centralized, bureaucratic, hierarchical organization strategy.” In several studies he reviewed, Wunsch found that centralized systems continue and even worsen severe asymmetries in power and perpetuate top-down authoritarian approaches to problems that require a genuine partnership. Other significant problems he documents include the development of projects and programs which poorly fit local needs and conditions, an increase in coordination and managerial costs, and a discouragement of local learning and innovation (Wunsch, 1999: 243).

The poor performance of most centralized administrative structures can be explained, according to Wunsch, by the “patterns of incentives and disincentives in the context of given goods and services” (1999: 263). Ostrom, Tiebout, and Warren (1999: 41) argue that a “single dominant center of decision making is apt to become a victim of the complexity of its own hierarchical or bureaucratic structure. Its complex channel of communication may make its administration unresponsive to many more localized public interests ...” Economies of scale are not necessarily always present in large government organizations (Ostrom, 1999: 256) and where community control is available, communication is enhanced thereby enhancing citizen support of the government and increasing the government’s responsiveness (Ostrom and Whitaker, 1999a: 224). Within more localized levels of government jurisdiction, where greater communication and responsiveness with the local community exists, more successful governmental output is achievable (Ostrom and Whitaker, 1999b: 196). My own experience as the head of a cabinet level state agency supports these conclusions, albeit only anecdotally, that a dominant center of decision making loses touch with localized public interests.

Power Asymmetries

When individuals or groups of individuals have similar interests, arrival at a commonly agreed upon social principle would seem relatively simple. However, observers of the fisheries would come to recognize that there are many competing interests at play within the fisheries and, importantly, significant power asymmetries exist between individual actors or groups of actors, including fishermen and the government. Knight (1992) provides a general theory that rules develop in a society as

a result of “fights” over “distribution” of an article of interest such as rights to harvest a public resource or any other article that society places a value upon. Institutions come about to distribute these articles of interest and, thus, “make life easier” by generating common and acceptable understandings about concepts such as space and time, property rights, marriage and family, economic production, and politics, etc. Institutions, therefore, are sets of rules that structure social interactions; they provide rules to guide future actions. But how these social institutions come about is not universally agreed upon. In Knight’s theory, social institutions are a result of the efforts of some to constrain the action of others. Institutions are not explained as a response to collective goals or benefits as suggested by several theorists but, rather, they are created as a by-product of conflicts over “distributional gains” (1992: 19).

Knight’s theory of bargaining holds that institutions come into being as a result of a “contest” among actors, a game of power where strategic decisions are made about the relative power of others. Knight argues that the condition necessary for this to occur is that the actors are engaged over time in an ongoing relationship; a bargaining process of conflicting preferences (1992: 128). Asymmetries between the actors with respect to the credibility of an actor’s commitment to a future course of action, how risk averse a particular actor is, and the length of the time horizon within which a particular actor can operate determines the nature of the contest (1992: 129). Opposing social actors with an ongoing relationship (i.e., knowledge of the relative power of the other) know who has the edge in terms of resources, time, and commitment and realize who will win the contest. Through these power asymmetries, social actors come to realize that, although

they may not have initially agreed to a particular rule, they can do no better than to adhere to the rule established through such a contest.

Those with more power will attempt to establish rules that advantage them at the expense of others. Where rules are forced upon a weak party in the aftermath of a power struggle over resources, the result is apt to be constant agitation on the part of the weak party to change the rules, to escape from the rules, or to raise the costs for the victor. This circumstance of social interaction is exactly what drives the fisheries. The collective action dilemma attendant to the fisheries is that “fishers cannot or will not generate rules to conserve the resources upon which their livelihood depends” (Acheson, 1998: 43). That is without some selective incentive to do so, either positive or negative.

Power as used here and as defined by Knight (1992:41) is the ability to affect by some means the alternatives available to others party to the bargaining process. In the fisheries, significant power asymmetries exist between the industry and government; the distribution fights being efforts to devise or change the rules or to escape from the rules altogether. For example, fishermen exert power by innovating in their fishing practice or by violating rules as a means of circumventing the effect of a control and, in so doing, undermine the putative benefits of the rule. These actions affect the alternatives available to the government which must either revise the rule or increase enforcement as a countervail. Fishermen as well as other stakeholders can affect the alternatives available to a government agency by seeking legislative intervention to press for change or to overturn agency action via statutory amendment. Of course, all stakeholders have

available and do pursue judicial intervention to compel government action and, in so doing, affect available alternatives.

The government for its part, has significant power via its legislative and rule-making authority. Where it has the authority to effect change via fiat, its power to influence alternatives is significant, especially where it has the necessary enforcement capability. But even where it is subject to a protracted administrative process, the government still wields significant power in that it controls the administrative apparatus. All of these actions by industry, government, and other stakeholders party to the fishery management bargaining process raise the costs of the transaction.

Information Asymmetry

Among the most significant source of costs in the fisheries management transaction context is information asymmetry. This can be a matter of one party to the negotiation having less information than another party as suggested by Williamson (1975, 1979). This type of informational asymmetry can be exacerbated by complexities of scale and information transfer within large organizations and between organizations that are mismatched as to size. Information can also be asymmetrical in the way that parties to a negotiation perceive their *world* and how it operates, an informational asymmetry North (1990b) refers to as "instrumental rationality." This asymmetry of perception is particularly problematic in the fisheries with respect to the definition and assessment of risk, the way in which risk is perceived by stakeholder groups, and the response of stakeholders to the assessed risks. Simply put, fishermen and scientists have differing perceptions of and understandings about the ocean and its

resources, thus their respective prescriptions for its management differ. Where these differences are significant and can not be resolved in the management process, negotiation costs can be high. For the purposes of this thesis and unless indicated otherwise, all information-based transaction costs, including those of unequal amounts of information, those induced by mismatches of scale, and those of incongruent perceptions, are characterized here under the rubric of symmetry.

In defining risks, fishery managers are compelled by provisions of current law to define objective and measurable criteria to indicate a fish stock's well being, whether it is overfished or in the process of becoming overfished. To achieve this, criteria such as fishing mortality or spawning potential are determined through stock assessments. However, biological stock assessments are generally considered imperfect and stock assessment scientists must routinely "extrapolate beyond the levels of precision for which the science is designed" (Hanna et al., 2000: 131-132). The science attendant to fisheries management is principally a product of models that treat natural systems mathematically. It is theorized that a relationship between fishing and spawning stock can be used to describe a relationship between that stock and the number of fish predicted to recruit or subsequently become susceptible to a fishery. Developed in the middle of the last century, the modeling approach used today treats species of fish as if they exist in isolation and that the future size of a fish stock is dependent only upon the size of the spawning stock. Typically the models assume that recruitment will continue at or about the same level as previously observed, and that a relationship to environmental factors does not exist.

Unfortunately from a fisheries management perspective, this relationship between spawning stock and recruitment has proven to be generally unknown except in limited cases at very low population sizes and then only over the short run (Myers, et al., 1995; Hall 1988). As recently as December 2001, the Scientific and Statistical Committee of the New England Fishery Management Council, upon review of the scientific basis of stock assessment advice the Council had received through the federal stock assessment process, concluded that “the relationship between stock biomass and subsequent recruitment is poorly understood and it is difficult to confidently identify what biomass would correspond to maximum sustainable yield” (SSC, 2001). Maximum sustainable yield is the theoretical level at which a stock of fish can be maintained under certain assumed (equilibrium) conditions.

The fundamental weakness of the model is that it ignores the tendency of the oceanic environment towards instability and oversimplifies the differing behavioral characteristics of fish stocks. The complexities of species interaction in the marine ecosystem is disregarded and the model fails to account for technological innovation and human behavior (Symes, 1996). Nevertheless, the fishery science utilized to support management in this country is founded upon the theory that population sustainability is dependent upon spawning stock biomass. Ecological interactions are assumed to be minimal and managers are provided with scientific advice prescribing desirable catch rates. This “best science available” is typically subject to error rates of 30 to 50 percent (Walters, 1998; Hilburn and Walters, 1992) and as Bill Fox, a former chief federal scientist explains, “there’s a bit of experience involved, not something that

can be repeated by another scientist. It's not really science; it's like an artist doing it—so a large part of your scientific advice comes from art" (Appell, 2001).

Symes (1996) draws attention to three notable examples of where resource depletions have occurred as a result of natural events coupled with the effects of excessive exploitation and casting doubt upon the equilibrium model. In the early 1970s, Peruvian anchovy catches were dramatically reduced as a result of the combined effects of an inherently unstable species, significant fishing pressure, and El Niño induced elevation of water temperature causing a reduction in primary productivity (Caviedes and Fik, 1992). In the late 1980s, Barents Sea cod catches declined precipitously under heavy fishing pressure when the winter ice front migrated southward, disrupting the recruitment of capelin upon which cod depend as its principal prey species. During the same period, in the northwest Atlantic a collapse of the cod stocks occurred and while a complete explanation has not as yet been developed, water temperature effects upon spawning, recruitment, growth or migration coupled with intense fishing pressure is implicated. What is particularly interesting about the northwest Atlantic cod case is that government scientists wrongly predicted an increase in stock abundance contrary to fishermen warnings about poor catches and low growth and weights (Finlayson, 1994).

Despite the fact that most fisheries scientists are aware of the shortcomings of their tools and that the scientific community has raised serious questions about the Maximum Sustainable Yield principle as a fishery management approach (Larkin, 1977; Sissenwine, 1978; Cady and Gulland, 1985; Glantz, 1992; Symes, 1996), the Magnuson Stevens Fisheries Conservation and Management Act (MSFCMA) codifies

this principle as the basis of fishery management in this country. Because the management measures that have been developed pursuant to this principle typically attempt to control catch rates and harvest levels, the fishing community has been skeptical of the underlying science. It is not simply that fishermen do not understand the science, but the scientific results have not reflected what fishermen have seen on the fishing grounds. As a result, a tremendous gulf exists between what fishermen and scientists believe they understand about the ocean and how it should be managed.

The scientific community has discounted the industry's skepticism as merely a strategic effort to undermine management. One representative of an environmental organization, in defending government scientists as the best available, suggested that "(s)tock assessment science is a tricky business that is best left up to the professionals." (Fordham, 1996: 126). Faith, however, is not fact and as a society it is our responsibility to question the conclusions derived through the science enterprise. The noted philosopher scientist J. Bronowski (1956: 5) argues that "(t)here is no more threatening and no more degrading doctrine than the fancy that somehow we may shelve the responsibility for making the decisions of our society by passing it to a few scientists armored with a special magic."

That a gulf exists between fishermen and stock assessment scientists is understandable. Unlike virtually every other sector of the economy involved in natural resource utilization, professionals in the field of science or management have not typically represented the fishing industry in the management arena during most of the history of federal fishery management. The fishery management endeavor has been principally the domain of government scientists (Symes, 1996). The development of

management advice has been controlled by the government and most of those with training in the field have, until very recently, been government employees. Fishermen and scientists are both convinced that their perspective is correct, yet there is little absolute evidence to dispute either given the complex adaptive nature of the resource and the masking effects of environmental factors.

Fishery management has been practiced in this country almost since its founding. Today, the rules under which fisheries operate are extremely complex, costly and difficult to enforce. The monitoring requirements necessary to measure management effectiveness are equally complex, expensive and are difficult governmental undertakings. Management objectives are often stated in terms of reductions in fishing induced mortality which translates in practical terms into a reduction in fishing which is an objective not often embraced by the fishing community. Implementation measures tend to focus almost exclusively on controlling the activities of fishermen, and the management institutions have not incorporated the fishing community, to any meaningful extent, in the development of management measures or in monitoring activities. This failure of government has created a general feeling of disenfranchisement within the fishing community; a societal attitude that has significantly increased the cost of transactions within the fishery management arena.

To be effective, fishery management measures must be adhered to if not embraced by those whose activities are managed and the principles upon which these actions are based must be seen as credible. If fishermen are convinced that management prescriptions are inefficient, ineffective and costly, they will innovate, evade or seek a political means to circumvent them. Unfortunately, government organizations have not

fostered credibility nor instilled confidence within those whose participation is crucial to the success of management efforts. Managers often overestimate the utility of the tools that are available and fail to appreciate that the fundamental principle of fishery management is not, as the phrase implies, the management of fish, but rather, the management of people. Our fishery management effort is built upon a scientific and, as codified in the Magnuson Stevens Fishery Conservation and Management Act, a legal proposition that, despite the extreme complexity of the oceanic ecosystem, the human command and control form of management is sufficient to effectuate significant positive change in the environment. The scientific and legal underestimation of oceanic complexity and the administrative institutions we have erected to implement these concepts greatly compounds the problems caused by the failure of management to address rational human behavior within the fishery. The Magnuson Stevens Act is designed to be applied broadly, throughout the range of a species for example, and is not designed well to enable managers to react to industry's efforts to overcome costs imposed by management proscriptions. This has profound implications because the remote nature of most fisheries prevents direct observation of fishing activities and the incentives to abuse common property resources can be very alluring in today's competitive society.

Our governing institutions are inappropriate to manage complex systems and our process of learning about the ocean has been hobbled by our institutional approach to scientific uncertainty. This has been extensively studied by Wilson (2001) who argues that a redesign of the common pool institutions is necessary to manage these complex resources for sustainability. The government-centered top down form of management of

which the New England region is characteristic has not been successful in addressing the inexorable trend towards overfishing despite years of scientific management.

Government can not eliminate the transaction costs that cause failures in our fisheries.

A government-centered solution is only reasonable where transaction costs are lower than would be available through alternative institutions.

Chapter 3

THE ROLE OF GOVERNMENT IN MANAGEMENT

The objective of this thesis is to explore why humans destroy fisheries resources and what conditions are necessary for their conservation. There are two dimensions to the problem of fisheries management; the actions of fishermen and the provision of rules to modify their behavior. Chapter 2 presented the first dimension; that overfishing is traceable to collective action problems in what is rational for the individual fisherman leads to disaster for society. Altering this behavior requires that selective incentives be changed (perhaps offered in some cases) and this requires a change of institutions. It can be very difficult to overcome collective action problems where government has the capacity and will to foist rules on an industry that is convinced that the rules are poorly conceived. Where a shift in the balance of power with respect to access to information and decision-making authority is possible, new institutions with lower transaction costs can be erected to overcome the propensity towards a *tragedy of the commons* and the attendant demise of resources. This shift in power asymmetries can come about more easily where the costs associated with the time and/or expense obtaining the information necessary to negotiate, make and enforce a fishery management *bargain* are minimal. Where these transaction costs are high, particularly in cases of scale imbalances, resolution of the collective action dilemma is very difficult.

The purpose of this thesis is to extend the theory of common property governance by extending our understanding of how new management institutions come into being; the basic argument being that the failure to resolve this dilemma lies in the relationship between fishermen and government, the two most significant stakeholders

in the fishery management exchange. Extending the Coasian theorem to fisheries, it is argued here that stakeholders bargaining for fishery management are responsible for the outcome and that where the outcome is failure, the parties can bargain for solutions provided that the transaction costs can be overcome. This argument draws upon the work of Taylor and Singleton (1993) who see a clear connection between policy and transaction costs with respect to the collective action dilemma. Prior research has largely focused upon questions of why fishermen over exploit or why government failures exist. An attempt is made here to draw a relationship between the two and thus add another dimension to our understanding of why efforts to conserve resources succeed or fail to resolve the collective action dilemma.

The purpose of this chapter is to frame the fishery management regulatory context and explain the role of government and the actions and motivations of its agents. Most importantly, the purpose here is to demonstrate that government is not free of transaction costs. That there is in reality a collection of interests at play in all government actions and that these sometimes intersect creating costs that are difficult to defray in the fishery management context. This serves to support the argument that a government-centered approach is not, in all cases, the preferred means of resolving the collective action dilemma and that an alternative lower cost approach may be necessary to provide successful fishery management outcomes.

The Context of Federal Fishery Management

Federal control over marine fisheries is a relatively recent phenomenon. In 1945 President Truman unilaterally proclaimed jurisdiction over the continental shelf and a

Fisheries Conservation Zone. However, the fishery proclamation was imprecise and not recognized or enforced (Wenk, 1972). Fisheries management outside the territorial jurisdiction and beyond 12 miles of the coast was to be accomplished through international agreements. In 1949 the United States entered the International Commission for Northwest Atlantic Fisheries (ICNAF), the first multinational agreement covering the northwest Atlantic (Mangone, 1988, 157). ICNAF, however, proved ineffectual as a forum for fishery management, particularly with respect to the control of foreign fishing fleets. The failure of this and other multinational agreements lead the Congress in 1976 to extend the fisheries jurisdiction of the United States to 200 nautical miles via the Fishery Conservation and Management Act and, thereafter, to withdraw from ICNAF (Hennemuth, 1987). Since that time, the Act has been modified several times, including amendments to name the Act for its principal sponsors, Senators Warren Magnuson and Ted Stevens. The Act is hereafter referred to as the Magnuson Stevens Fishery Conservation and Management Act (MSFCMA, 1976).

The Public Trust

The basis of the management authority for fisheries proclaimed by the government through the Magnuson Stevens Act is not simply founded in law, but in the philosophy of government as well. It represents a fundamental demonstration by the founding fathers of how the new democratic principles would differentiate the United States from its European predecessors. Unlike feudal England where access to resources such as wildlife was restricted to the privileged class, free access to hunting and fishing and the right to bear arms were rights guaranteed to all citizens. The resources were not owned by individuals but were held in trust for the people by their

government (Lund, 1980). Over time, the concept of the public trust has evolved significantly in this country. With respect to marine waters, and the resources therein, the courts have emphatically affirmed the government's public trust obligation. This public trust doctrine constrains both legislative and executive action procedurally and substantially; control of resources held in trust is a burden that cannot be abrogated by the government: "(t)he control of the state for the purposes of the trust can never be lost ... or can be disposed of without any substantial impairment of the public interest in the lands and waters remaining" (Illinois Central Railroad Co. v. Illinois, 1892).

As exploitation of common property increased, many states have declared a trusteeship over resources, including fish and wildlife, for the benefit of the people. This movement has led to the adoption of comprehensive schemes for wildlife management and, over time, the ancient principle of *res nullius*, that wildlife is the property of no one until captured, has been largely repudiated. In our contemporary society, wildlife and fish are the property of the people and held in trust by their government (Warner, 1980). Over the past twenty five years, the federal government has expanded the public trust doctrine to provide protection of natural resources via the Endangered Species Act (ESA, 1976), the Marine Mammal Protection Act (MMPA, 1972) and the National Environmental Policy Act (NEPA, 1976). Under NEPA this doctrine of the public trust has been advanced significantly placing a burden upon federal agencies to take into account the public interest in resource protection. The Magnuson-Stevens Fishery Conservation and Management Act brought this concept of the public trust to the management of fish off the coasts of the United States, the highly migratory species of the high seas, the species which dwell on or in the Continental

Shelf appertaining to the United States, and the anadromous species which spawn in the United States rivers or estuaries (MSFCMA, 1976).

The Doctrine of Delegation

The basic premise of this thesis is that some degree of authority for the management of marine fisheries must be shared with stakeholders to reduce transaction costs that thwart efforts to overcome the collective action dilemma. It is, therefore, appropriate to explore briefly the legal issues attendant to a devolution of authority in the context of the public trust doctrine.

The U.S. Constitution states, "(a)ll legislative powers herein granted shall be vested in a Congress of the United States ..." (Constitution of the United States). With similar intent, the Constitution of Maine states, in pertinent part, that ... "(t)he Legislature, ... , shall have full power to make and establish all reasonable laws and regulations for the defense and benefit of the people of the state ..." (Constitution of the State of Maine). Similar language can be found in the constitutions of all municipal states. Clearly, the legislative bodies at both the state and federal levels have been imbued through their respective constitutions with authority to make laws for the benefit of the people. It is also clear that Congress can delegate certain authorities to the executive branch, the courts having held many times that Congress is not prevented from seeking assistance from its coordinate branches. However, while it can delegate to an administrative agency certain authorities including the ability to make regulations, Congress cannot delegate legislative power. Furthermore, in delegating authorities to the executive branch, Congress must circumscribe the granted authority through

enabling statutes that provide guidance to administrative officials. This guidance must articulate a certain course of procedure and rules of decision and lay down sufficient principles and standards to ensure conformance by the authorized agency with the legislative intent of the enabling act (*Brown v. O'Connor*, 1943; *Jeager v. Simrany*, 1950; *Trouby v. U.S.*, 1991).

Although the actions of an executive branch administrative agency must comport with the delegating statutes (*U.S. v. Park Motors*, 1952), the agency so delegated does have a certain level of discretion to interpret the intent of Congress. For example, where implementation of a Congressional program necessarily depends upon changing conditions, Congress need only state an intelligible principle, delegating authority to an agent charged with determining whether and to what extent a factual situation requires application of the law (*Carroll v. Finch*, 1971).

Generally, this so called delegation doctrine is applicable at the state level as well and, like the Congress, the Maine Legislature, for example, has the power to delegate proscriptive responsibility to administrative agencies (*State v. Boyajian*, 1975). Although the Legislature may not constitutionally delegate general legislative authority, it may delegate authority to a governmental agency charged with the duty to administer an act, provided the legislation sets up sufficient standards to guide the administrative body in the exercise of its discretionary functions (*Opinion of the Justices*, 1970). As federal case law demonstrates, so too does state case law show that the doctrine of delegation requires that legislative authority must declare policy or purpose of law and set standards or guides to indicate the extent of and prescribe limits for the discretion delegated (*State v. Boynton*, 1977).

While it is clear that authority can be delegated to administrative agencies, can authority also be delegated to non-executive branch agents and, if so, to whom and to what extent? While it is true that the state cannot alienate its public trust obligation, the state can share that responsibility where a direct public interest is served (*People v. Chicago Park District*, 1976). But, can local management units comprised of representatives of the fishing community be established as agents of the state and be legally delegated responsibility to discharge aspects of the state's public trust obligation? This question is of critical importance to the establishment of the alternative fisheries management institutions. In this respect, the power of delegation to a subsidiary of an administrative agency also appears clear and when delegated to such a subsidiary or board, the exercise of the power so granted remains within the board's discretion (*Walling v. McCracken County Peach Growers Asso'n*, 1943). Furthermore, the courts have ruled that statutes may grant certain authority to those on whom the statutes impinge (*Rochester Gas & Electric Corp. v. McGowan*, 1940), provided that such authority is not delegated to trade or industrial associations or other groups so as to empower them to enact measures that are of narrow self interest and without a broader beneficent purpose (*A.L.A. Schechter Poultry Corporation v. U.S.*, 1935). Essentially, federal case law with respect to the question demonstrates that, although the legislative body cannot delegate to private corporations or anyone else the power to enact laws, it may employ them in administrative capacity to carry laws into effect (*Crain v. First Nat. Bank of Oregon*, 1963). Although this issue has not been as extensively tested in Maine courts, the general principles applicable at the federal level appear to hold in state courts as well and, accordingly, state legislatures appears to have the constitutional power to

entrust certain responsibilities to instruments of its choosing provided that they are duly constituted (Crommett v. City of Portland, 1954).

Public Policy Considerations in the Regulation of Fisheries

Clearly, the biological status of a stock or the economic status of the fishery are important in assessing the need for change and in measuring the effectiveness of the institution erected to bring about that change. But these metrics fail to characterize the status of the management institution itself, whether the institution is functional with respect to human interaction, and whether or not the costs of transactions within the institution are reasonable costs for society to bear. Too often, we focus upon the beginning and the end points and neglect what transactions have taken place in between. The purpose of this thesis is to examine conditions of success or failure of fisheries management in the New England region in relation to the hypothesis that high transaction costs can prevent parties bargaining for fisheries management from arriving at acceptable solutions. Success in this context has two separate components: one involves solving the collective action dilemma to get rules; the other involves getting rules that positively affect fish stocks. Consensus, however, is lacking as to how public policy decision-making success or failure is defined in this context. While some see success only in terms of outcomes that prevent unsustainable exploitation levels, others see success in terms of processes that lead those involved in fisheries and management systems to collectively solve the collective action dilemma. Singleton (1998: 26) points out that defining success only in terms of outcomes fails to acknowledge that many factors can affect sustainability, including environmental factors, and that sustainability may or may not be achieved for reasons “unrelated to institutional design.” While it is

possible to demonstrate that participants in the fisheries management bargaining process have agreed upon rules to address the collective action dilemma, it is far more difficult to assess whether the rules are effective in conserving the stocks and thus difficult to demonstrate that the rules alone are responsible for sustainability. Nevertheless, the outcome-based approach is the foundation of current federal law and, as such, it effects the way in which public goods are exchanged in the fishery management *market place*.

To provide an understanding of what transactions take place within the fishery management arena, this section describes how management institutions are devised within the government-centered fishery management arena, how risks are defined, what public policy tools are available, and how the public is involved in the decision-making process. These are customary measures by which to evaluate the process of establishing public policies.

Institutions

Fishery management responsibility in the New England region is held by federal and state organizations or derivatives of governmental agencies. At the federal level, management authority is exercised by the National Marine Fisheries Service (NMFS), which is a subsidiary of the U.S. Department of Commerce. The Fisheries Service is charged with the administration of marine fisheries matters beyond the state 3-nautical mile territorial limit, although it can exercise management prerogatives within state waters under certain conditions. The development of management strategies for fisheries under federal jurisdiction is performed by the New England Fishery Management Council. This is a quasi-state/federal/private entity that functions in an advisory capacity to the Commerce Secretary (MSFCMA, 1976: § 302 & 304) and is

one of eight regional councils established under the 1976 Act. During the early development of the MSFCMA, the Senate version of the bill that eventually became law, provided for only seven regional councils and did not provide for a separate New England Council. Out of political considerations and because of the complex nature of the region's fisheries, the Senate ultimately acceded to the House position and agreed to a separate New England council (U.S. Congress, 1976: 87).

At the state level, management authority is held typically by a natural resource, economic development, or environmental protection agency, many of which were created at the turn of the last century (Judd, 1997: 263). In some circumstances, management is coordinated with the Atlantic States Marine Fisheries Commission (ASMFC), a compact of eastern seaboard states, created by act of Congress in the 1940's and ratified thereafter by the states. The purpose of ASMFC, one of three such commissions nationally, is to encourage better management of transboundary marine fisheries occurring within the territorial limits of member states. These commissions operate to develop joint programs of fisheries promotion and protection, however, they have no enforcement authority other than that exercised through the member states. In addition to these federal and state entities, other bodies have conservation and management responsibility for U.S. fish stocks that are highly migratory between areas under the jurisdiction of two or more councils or move across international boundaries.

Although the federal government has historically been involved in marine fisheries, its role had been primarily non-regulatory and limited to the collection of statistics and the provision of services to the industry either directly through loans and subsidies or indirectly through tariffs and other forms of import barriers. It was not until

1976 with the enactment of the *200-mile law* that federal management authority over marine fisheries was established and vested in the Secretary of Commerce. Thus, prior to 1976, management of fisheries in U.S. waters was, for all intents and purposes, exclusively the domain of state agencies and enforcement was largely restricted to those areas within three miles of the coastal states. As a practical matter, extra-territorial enforcement by a state, although permissible, was generally infrequent and limited in scope to those citizens licensed by the state. Control upon fishing activities occurring beyond state waters was primarily accomplished through the use of landing laws developed unilaterally by a state or via a commission's interstate management program and adopted by individual states as statute or regulation.

The Magnuson Stevens Fisheries Conservation and Management Act established exclusive authority for the United States over all fish, anadromous species, and living resources of the continental shelf within a newly created fishery conservation zone. It thus marked a new era for the federal government with respect to marine fisheries, expanding the federal role beyond one of service to one that encompasses the management and conservation of resources. This was to be accomplished through four major features of the MSFCMA including: 1) the extension of jurisdiction over 2 million square nautical miles of ocean; 2) the promulgation of new national standards for managing fisheries; 3) the creation of a complex two-tiered management decision-making system; and 4) the elimination of foreign fishing except that which would occur under specific bilateral agreements (Cicin-Sain and Knecht, 2000: 78). In 1980 the Act was substantially amended, strengthening foreign fishing provisions to encourage the expansion of domestic harvesting and processing. Again in 1986 it was amended to

establish new requirements for habitat conservation and revising the fishery management plan decision-making process. And in 1996 it was again amended to incorporate significant language changes including key provisions to prevent or end overfishing and to rebuild depleted stocks. Cicin-Sain and Knecht (2000) provide a very informative table of the numerous amendments to the Act through 1996.

Adoption of the Magnuson-Stevens Act came about due to a confluence of a number of issues, both domestic and international. Little or no progress in the Law of the Sea Treaty forum, the global overexploitation of ocean resources and the consequent decline of U.S. fisheries caused by foreign harvest adjacent to U.S. shores were the paramount impetus for action. These issues provided policy entrepreneurs both within government and representing interests outside of government with the opportunity to bring to closure a debate that had ensured for several years (Cicin-Sain and Knecht, 2000: 77).

The management decision-making process established under the Act is found within Title III and it is here that the federal government is placed in a role as trustee of fishery resources. It is through this Title that the Act seeks to ensure that fish are harvested responsibly according to management plans based upon specified standards. It is a complex multi-tiered system of management which delegates initial responsibility to eight semi-autonomous regional fishery management councils, functioning in a form of partnership with the federal government, a partnership that William Rogalski (1980) calls a unique form of federalism. Passage of the Act changed the character of fishery policy in this country dramatically, shifting management away from state purview toward one more dominated by the federal government. Executive branch interpretation,

subsequent congressional modification and judicial intervention have tended to consolidate more of the fishery management authority at the federal level than intended by the Act's framers. Congress envisioned at the time that primary management decisions would be lodged in the regions using the best information available and that this regional approach would "have the support of the fishermen who are regulated" (U.S. Congress, 1976: 455). It is of interest to note that during the debate that presaged the 1976 Act, the United States argued the need to wrest greater *local control* from the international community by unilaterally claiming jurisdiction over 2 million square miles of what, theretofore, had been international waters. Today the federal government appears to oppose the *local benefit* argument as it would apply domestically.

Title III is the lengthiest portion of the Act and, despite the intent of Congress, it is the portion that has caused the most consternation within the industry. Fishermen who originally supported enactment of the MSFCMA were primarily interested in establishing a 200-mile limit, excluding foreign fishermen from valuable fishery resources. Following implementation and a fuller appreciation of what federal control of the fisheries would mean to their activities, fishermen quickly began to argue that the Act went well beyond its original intent, subjecting them to severe encumbrances (Cicin-Sain and Knecht, 2000: 132). The magnitude of the domestic regulatory regime was extraordinary to a fishing industry whose harvesting activities had been virtually ignored by the federal government for the first 200 years of nationhood. In the New England region, where a multi-species multi-gear fishery exists, management problems began to manifest almost immediately upon implementation.

Ultimately, a key question with respect to any institution is the manner in which it operates; do decisions emanate from the top of the institution or from bottom? Does the institution operate in a cooperative or collaborative fashion and have appropriate and necessary authorities been delegated. Beyond formal rules and management tools, what is of particular importance is whether management institutions have been developed and are functional with respect to the human interaction necessary to bring about meaningful controls upon the human endeavor that is a fishery. As we shall see, decidedly different institutions have evolved in the three New England fisheries to be explored in the following chapters. One of these is the institution of stewardship.

Beyond the institutions that arise out of the statutory or regulatory process, institutions can also arise in the fishery management context as a result of where a particular fishery is practiced; specifically if it occurs inshore (within the territorial seas) or offshore (within that area considered high seas prior to the Magnuson Stevens Act). Although the problems of managing fishery resources in territorial waters as well as in the high seas have similarities in that they are fugitive resources, the institutions of governance are vastly different (Ciriacy-Wantrup and Bishop, 1975: 715). There is a condition of ownership (*res communes*) via the public trust to fisheries resources within the territorial seas. This is an ownership interest that has been in effect since the founding of the nation. Extension of jurisdiction into areas previously considered high seas established ownership to resources that, prior to enactment of the Magnuson Stevens Act in 1976, had been considered *res nullius* (owned by no one). Vastly different cultures have evolved in our fisheries as a result of where a particular fishery has been predominately practiced. Where fisheries have been pursued under the

doctrine of the public trust, a sense of ownership and indeed stewardship has evolved among the practitioners. Where *res nullius* fisheries have been pursued, ownership did not and could not exist until these fugitive resources had been captured and actually rendered as property.

Definition of Risk

Of the national standards established in the Magnuson Stevens Act, the Congress in 1976 considered the first standard to be of particular importance. This standard requires that management measures shall prevent overfishing and achieve the optimum yield from each fishery (MSFCMA, 1976: § 301 (a)(1)). Optimum in this context is considered to be the amount of fish prescribed on the basis of the maximum yield sustainable from the fishery (a biological measure) taking into account relevant economic, social, or ecological factors (U.S. Congress, 1976: 86). Although the Act stipulates that economic and social factors be taken into account when prescribing an optimum yield, these factors are considered only advisory in nature with respect to language in the Act's national standards section (Sec. 301) and the Act's required provisions section (Sec. 303(a)). Defining risks to a fishery is prescribed by law to be according to a biological measure first and foremost.

In 1996, the Congress underscored the preeminence of the Maximum Sustainable Yield (MSY) concept as a means of assessing risks to a fishery when it redefined optimum yield, requiring that it must be based upon MSY and only revised downward, not upward, by other relevant factors (SFA, 1996). To support this risk assessment determination, the Congress stipulated in the second national standard that

“conservation and management measures shall be based upon the best scientific information available” (MSFCMA, 1976: § 301(a)(2)).

In 1989 the National Marine Fisheries Service developed guidelines under provisions of the Magnuson Stevens Act (16 U.S.C.1851(b)) to provide guidance as to the Service’s interpretation of the national standards and how the Service envisioned fishery management plans to be developed (50 C.F.R. § 602.1-17). These new “guidelines” require councils to develop objective and measurable definitions of overfishing and to develop comprehensive recovery plans for stocks found to be overfished. Each FMP or amendment developed from that point forward is required to include a definition of overfishing and a recovery plan for stocks exceeding specified thresholds.

The language in the Act regarding guidelines explicitly states that such guidelines shall be “advisory” and shall “not have the force and effect of law”. When these guidelines (referred to as the 602 Guidelines in reference to the pertinent section of the U.S. Code of Federal Regulation) were promulgated as regulation of the agency, there were cries of derision from several sectors of the fishery management community who argued that the agency had exceeded its authority. Nevertheless, the manner in which these guidelines came about became moot when they were incorporated into the “required provisions” section of the Magnuson Stevens Act (16 U.S.C. 1853 (10) as part of the Sustainable Fisheries Act.

Public Policy Tools

From a functional perspective, fishing induced mortality is related to the number of units (i.e. fishermen or vessels) participating in the fishery, their catching power,

their total fishing time, and their spatial distribution. The policy tools available to manage biological aspects of marine fisheries are of two types; those that affect fishing mortality working through one or more of these four factors and those that reduce the impact of fishing by changing the age (and thus size) at which fish become susceptible (recruit) to the fishery. Tools that attempt to affect fishing mortality can be those that control the number of fishing units, or those that affect the efficiency of the units through spatial or temporal restrictions or by affecting the catching power of the gear. Also in this category are tools that limit the amount of fish that can be harvested. Tools that affect the age and size at which fish recruit to the fishery can also be based upon spatial or temporal restrictions (seasonal closures of nursery areas for example) or required selectivity of the gear (for example mesh size enabling escapement of fish below a certain size). Obviously, there is significant overlap between the tools available and the manner in which they are used to achieve management objectives.

Fishery management in one form or another has been practiced in this country almost since its founding, primarily attempting to regulate efficiency in the fishing enterprise through restriction on gear and fishing methods. Ostensibly for the purposes of conservation, most science-based fishery management controls (the public policy tools) are, in reality, politically expedient devices to allocate resources among fishermen (Wenk, 1972: 302). Management approaches that have been utilized include quotas and other biological controls described above, as well as corrective taxes, limited entry, and a variety of transferable allocations.

A quota system can be an effective means of reducing fishing mortality while preserving the common property nature of the fishery. However, quotas can not

eliminate the propensity to overcapitalize an open access fishery. Furthermore, quota-based management becomes very complex in situations where catching power of the various fishing units differs and there is always the tendency to increase a quota in response to political pressure. Other types of biological controls can also effectively address fishing mortality, particularly spatial and temporal closures, however, measures that effect the efficiency of the gear are often complex, difficult to enforce and can often be ingeniously circumvented.

Taxes can be used to achieve fishery management objectives and can be applied to control inputs (effort) or outputs (landings). Although the same outcomes can be demonstrated, as a practical matter, input taxes lead the fisherman to substitute effort while output taxes lead to selective landings, both of which lead to waste. More problematic, however, is that to effectuate meaningful biological outcomes, the tax applied would have to be substantial which is not politically palatable.

Limited entry programs are used to rationalize a common property fishery by placing value on a license to fish (harvester license or boat license for example) and thereby create a property right to the fishery. However, these programs have typically been applied after the fishery has been over harvested and generally the political will to limit the number of licenses has not been sufficient to bring about meaningful reductions in effort. Allocating these rights is particularly difficult from a political perspective and consequently the time consumed in the political arena attempting to allocate rights often comes at the expense of the resource. Furthermore, simply limiting the number of participants does not necessarily reduce the overcapitalized condition of the fishery or the ability of the participants to increase individual effort.

To overcome the problems inherent in allocating rights, transferability features have been incorporated into limited entry programs. When used in conjunction with quotas or shares of the available resource, these programs can address the underlying economic inefficiencies in a fishery and the consequent waste of natural resources. These individual transferable quotas, however, have not been universally accepted because of the concern about consolidation of rights and the consequent impact upon the fishing community.

From a strategic perspective it is reasonable to assume that the correct suite of management tools can be selected by targeting the factor to be controlled (growth or mortality for example), determining the basis for those controls, the type of regulation necessary to effect the control sought, and the appropriate enforcement mechanism to ensure compliance. From a practical perspective, however, making a determination about which management approach to utilize can be very difficult given the disparate goals and aspiration of the people involved, the economics and social forces at play within the fisheries, and the extremely complex nature of the fishery resource. The three New England fisheries to be examined in chapters to follow clearly demonstrate the practical difficulties managers confront in selecting appropriate public policy tools in complex fisheries and that strategic policy decision-making often gives way to reactive evolutionary choice.

Involving the Public

The Magnuson Stevens Act contains very explicit provisions for the involvement of the public beyond those appointed to a council as voting members. The Act stipulates a procedural means by which councils and their committees are to

conduct business so as to ensure that the public is aware of and has an opportunity to participate in the fishery management process (16 U.S.C. 1852 (I)). In addition, the Act requires that each council shall “establish and maintain” a scientific and statistical committee and advisory panels as necessary including a fishing industry advisory committee to “assist in the development of fishery management plans and amendments to such plans” (16 U.S.C. 1852 (g)). However, the Act is quite clear that decisions and recommendations made by committees and panels shall be considered to be only advisory in nature (16 U.S.C. 1852 (g)(5)).

Pursuant to these requirements under the Magnuson Stevens Act, the New England Fishery Management Council has established a Scientific and Statistical Committee to assist in the development, collection, and evaluation of biological information relevant to the development of management plans and a separate Social Sciences Advisory Committee to provide assistance with respect to social and economic information. In addition, the council has established a number of advisory panels composed of individuals who are either actually engaged in the harvest of, or are knowledgeable and interested in, the conservation and management of the fishery or group of fisheries to be managed.

Beyond these formal provisions for public involvement in the federal management process, each state involved in the process as well as the Atlantic States Marine Fisheries Commission has its own set of formally constituted rules of procedure and advisory bodies through which members of the public have an opportunity to engage in the fishery management process. In addition, there are numerous organizations operating within the New England region and nationally that provide the

public with an opportunity to influence management decisions. But involving the public in the management process requires more than just structure (committees, panels, organizations, etc.) and administrative procedures to ensure that the public has a meaningful opportunity of being heard. Involving the public in the management process also requires that the public be adequately and appropriately informed about the complex matters at hand. This relates to the type of data collected, the data that is actually released, and the format in which it is presented. It also relates to the information that accompanies data that makes it usable and understandable.

Scientific information has a significant influence upon how fishermen, managers and other stakeholders perceive the 'problem' and the 'solution' and the 'time' necessary to transact an exchange of public goods necessary to optimize solutions to the collective action dilemma. Costs can be minimized where parties to the fisheries management transaction can bargain with symmetrical information about the status of the resources, the measures necessary for its conservation, and the timing of the exchange. When information asymmetries exist so as to prevent a shared and consistent understanding of the problem, its solution and time horizon, transaction costs can become exorbitant while the parties bargain for what often becomes less desirable fisheries management outcomes.

The public referred to throughout much of this thesis is the fishing public, however, the public involved in the fisheries now includes a number of other interests including environmental organizations, conservation groups, and public policy advocates, etc. The broader public is involved – they are stakeholders and have a legitimate interest in the outcomes of the management endeavor and, accordingly, the

government has an obligation to ensure that they are provided with the means of making informed decisions. But a thorny question has been raised by fishermen about the degree to which these *new* stakeholders should be involved in the decision-making process. Certainly they are involved in the public policy/public choice process and they have gained considerable influence in this arena. Traditional participants in the management process have viewed the participation of new stakeholder groups as adversarial and, unfortunately, in some instances this is not without cause. However, there are institutions that can ameliorate the adversarial posture and there are stakeholders that have a legitimate and ultimately helpful role to play in the management decision-making process.

The Government ...

There has been much academic attention focused upon why individuals are motivated to over exploit resources and our understanding has evolved significantly as a result of research that has built in sophistication over the past fifty years. In contrast, the literature examining the failure of government is quite disparate and does not all collate well to advance a concise understanding. The failure of government in the fishery management context has received much less emphasis in the fisheries related literature than have issues of collective action. Nevertheless, it deserves scrutiny considering that many failing fish stocks have been under some form of government-sponsored management for decades. The intent here is to describe aspects of government, its structure and function, and the actions of its agents responsible for transaction costs in the fishery management exchange. Because the attendant theories

do not all emanate from a single locus but from a variety of disciplines seeking answers to unrelated questions, this section is structured to present the government as it is variously perceived; as monolith, as a collectivity of individuals, as a culture, as a collection of interest groups, and as a political environment. The government, because of all of these various *personalities*, is subject to an institutional inertia that *is* the cost of transaction within the public sector.

... as Monolith

The government stands in the minds of many as a monolith – the Hobbesian Leviathan. The government, however, is not an entity but a collective of individuals with a host of individual interests and aspiration, all of which conspire unwittingly to influence the business of government, sometimes even to overwhelm it. From outside the institution of government, these disparate interests and aspirations are not readily discernable and to the individual fisherman the business of government often appears abstract. It is understandable, therefore, that government appears to a fisherman and to many others in the civil society as a single massive whole exhibiting a solid uniformity of action, a Gargantuan (Ostrom et al., 1999) metaphorically conceived of as just *The Government*.

The purpose of government is not easily determined or described because governments do many things and the relative importance of these functions is a matter of debate. To some in our society, government is seen as an opportunity, its purpose is to provide goods and services. To others, government is seen merely as an obstacle. Our political parties are at least nominally defined by the way in which they perceive government, and there are even those in our society who dispute the legitimacy of

government; any government. This thesis considers the purpose of government to be the provision of public goods of the kind necessary to solve the collective action dilemma. Public goods in the fishery management context are the policies, laws, management plans and rules that facilitate or impose constraints upon the harvest of marine resources. Theoretically, the reason for regulation, used here to describe any form of government sponsored control, is to make someone better off, the standard theory holding that regulations grow out of a need; that regulations are taken for the public interest. However, this view has been largely discredited by researchers who have demonstrated that many forms of regulation do not help and may actually have hurt the general public (Breyer, 1982: 10).

... as a Collectivity of Individuals

Regulations do not arise as a result of spontaneous generation but out of a collection of interests including the self-interest of the regulating community (Crew and Rowley, 1989). That these public and private interests intersect is in large measure why the government-centered fishery management process often becomes overwhelmed by ancillary objectives. Indeed, with respect to regulatory approaches to problem solving, many historical, political, administrative, and economic forces are at play. Often times this *colors* the way in which people within the public sector *see* issues such that some *directions* in the approach taken towards problem solving are pre-ordained. This can lead to standard approaches designed to be applied broadly so as to reduce administrative burdens, but which actually create other costs. At the federal level, there is a propensity “to standardize activities or programs. Federal regulations ... are typically designed for the average state or locality, and thus never fit well anywhere”

(John, 1994: 194). This has led some researchers to conclude that *regulation* in and of itself, *is* the problem and thus explaining why criticism of regulation has grown apace with the growth of regulation (Breyer, 1982).

In the fishery management arena, the attitude of individual public officials has a significant influence upon outcomes, therefore, the interests and aspirations of those within the public sector can not be overlooked. Collectively referred to as the bureaucracy, public sector employees are the intermediaries that translate legislative concept into programmatic action. Laws enacted through the legislative process are often vague, therefore, the implementation of measures envisioned in the legislation is left in the hands of public employees. Their role is to interpret the intent of the framers, to design a practical means of executing the principles articulated in the legislation, and to manage programs such that the legislative goals are met. In this fashion, the public employee gains considerable power and influence. Although perhaps well intentioned, public sector employees are none the less motivated by their own self-interest. There is a tendency (perhaps even a “metabolic urge” as claimed by a popular newspaper columnist (PPH, 2001)) for bureaucracies to maximize their missions. Some social scientists have argued that government agencies and the laws they must interpret have been deliberately designed by their framers to be inefficient so as to keep the balance of power in check (Moe, 1990) and to ensure that those who are in power, remain in power (North, 1990).

Despite the relish with which the public disparages its public employees, a government can not function without a bureaucracy. It serves as the interface between a people’s aspiration for their government and the government’s discharge of its

responsibility to the people. The bureaucracy also serves to provide continuity in government, its tenure generally exceeding that of elected officials. However, because government is a collectivity of individuals with a collective decision structure, it is unrealistic to view *The Government* as having no interests of its own; that it is neutral and benign. The notion that public employees benevolently serve the public interest, passively fulfilling the desires of the electorate and its representative, is wrong.

Bureaucrats are subject to the same human frailties and self interests as are all others in our society and their individual motivations are equally complex. In the worst case, self interest can lead to corruption, however, self interested behavior is generally far less contemptible and typically motivated by no more profound a human desire than wishing to gain favor. Regardless of how mundane the variations of self interested behavior might be, several authors believe that it can have a profound effect upon the operation of government (Cook and Levi, 1990; Moberg, 1994; Shleifer and Vishny, 1998).

... as a Culture

William Niskanen (1968: 1971) has done seminal work on the decision-making environment of the public sector bureaucracy, showing that agents of government tend to maximize their agency budgets and their own sphere of influence at the expense of society. Later Niskanen (1971) provided some insight about the motivations of bureaucrats and their goal orientation, comparing the parameters operative in the public sector of the economy to that of the private sector. Whereas the individual in the private sector can attempt to advance through the expenditure of effort that leads to success of the firm and ultimately to an increase in the individual's remuneration,

opportunities for monetary gain in the public sector are minimal. Consequently, bureaucrats tend to focus on tenure and perquisites of the office including public reputation and power. It is not that the people in the bureaucracy are ill motivated, it is that the incentives for effort are different. A public sector employee in essence has made a trade off, accepting long-term compensation in lieu of high compensation. Unfortunately, where there is little reward for effort but penalty for error, there is a tendency to be risk adverse. This *culture* within the bureaucracy tends to foster the *bureaucratic* or *lethargic* approach to problem solving, using the very deliberate nature of the rule-making process as a means of and perhaps as an excuse to delay and even thwart change.

This proclivity of the public sector culture is often disparaged but the factors that lead to this behavior are systemic. Both Niskanen in the works cited above and Breyer (1997) have demonstrated that in many circumstances, regulation itself is the problem in many governmental programs. Once regulation comes into play, there are forces that constrain government agents to a pre-ordained course of action. Sometimes, flexibility and common sense must, by dictate, take a back seat to prescriptions of law and regulation at the expense of successful accomplishment of programmatic goals.

As a culture, the bureaucracy can be insular and lacking the feedback systems necessary to ensure that its actions are indeed taken in the public interest. This asymmetry causes information to become distorted as it is transmitted within the organization; sometimes to cover mistakes or incompetence (Miller, 1992; Williamson, 1970; Tullock, 1965). But regardless of the cause, the effect of asymmetrical information is often faulty decision-making. Where the culture has become insular and

inward looking, bureaucrats tend to think of themselves as being *in charge* of the public's business as opposed to being *charged* with conducting the public's business. Regulators in this environment can behave as autocrats sometimes leading the public to accept schemes that it does not comprehend. Carried to the extreme, particularly where a breakdown in informational feedback exists, regulators can foist upon a powerless public highly modernistic or pseudoscientific schemes that can ultimately lead to disaster (Scott, 1998).

Williamson (1963) refers to the power asymmetry between the regulator and the public as the principal-agent problem. Agents or employees of principals or owners in power (for example government bureaucrats who are agents of the electorate), act to pursue personal interests that differ from those of their principals. The principal-agent problem occurs when bureaucrats have different goals than the legislature on one hand and the public on another. The principal-agent problem is operative in the private sectors but thought to be most serious in government where ownership of the apparatus of government (its agencies and enterprises) can not be transferred and where output is largely intangible services that can not be easily quantified (Jordan, 1972; De Alessi, 1980; Zeckhauser and Horn, 1989). In this circumstance, the electorate has little incentive to oversee its agents thus bureaucrats have little incentive to operate efficiently. And because government agencies operate essentially as monopolies with respect to the services they provide, there is a tendency on the part of bureaucrats to maximize their budgets (including their staff as well as their own non-pecuniary benefits) which occurs at a net loss to society as demonstrated by Niskanen (1968). Edwards (1994: 260) reports that a number of studies of natural resource agencies,

including fisheries agencies in the United States, demonstrate evidence consistent with the principal-agent problem and that examples exist of these agencies undercutting stakeholders so as to maintain authority.

... as a Confluence of Interest Groups

The government, however, is not just a bureaucratic endeavor. The process of governing, its outcomes and the *public choices* that result, emerge from a political environment. People do government and the business of government is about the goals, aspirations, and behavior of the people involved. A democratic society does not necessarily make consistent decisions (Arrow, 1951) and it sometimes makes poor decisions because the emphasis of the political apparatus of government is primarily focused upon value-based objectives. James Buchanan (1975) argues that the behavior of voters, politicians and political institutions play crucial roles in the formulation of policy, i.e. in “public choice” decisions. In our society, making public choices is complex because the feasibility of unanimity is remote given the disparate needs and desires of individuals.

The process of marine fisheries management in this country aptly demonstrates the complexity of a democratic and representative form of society. The groups involved in the process include elected officials from both the federal and state level and, to a lesser extent, the municipal level, employees of governments, and representatives of special interest groups. These special interests can include fishermen organizations be they commercial or recreational, the processing sector and other shoreside interests, environmental organizations, and other stakeholder groups with a direct or indirect interest in marine fisheries matters. Considering that the management of marine

fisheries has become much more litigious of late, the role of the judiciary can not be overlooked nor can the role of the media given its ability to bring issues to public attention. It should also be recognized that individuals, participating on their own behalf as effected fishermen or as expert in a particular field of relevance for example, can exercise significant influence in the aggregate.

Interest group politics is always prominent in the process of regulating, particularly where cohesive groups are able to effectively lobby regulators for preferential treatment. In some instances, choices can be advanced by the public for the purposes of reducing competition, a situation Stigler (1971) refers to as capturing. That is to say those who are within the regulated community in essence become part of the regulating mechanism, their interests being to advance regulation for the purpose of preventing new entrants into a field of competition. This is a form of rent seeking whereby people use the government to make themselves better off. In its most abusive form, an interest group “colonizes a government bureau so that the bureau promotes specific interests of the organized group at the expense of the public as a whole” (Bickers and Williams, 2001: 194) in an effort to seek or secure *rents*.

Rent seeking is an effort to redistribute income through the regulatory process as interest groups compete for gains artificially created by the government (Buchanan, 1980). Efforts to capture such contrived transfers have a social cost (Tullock, 1971) and the process to secure a resource artificially created by the government can result in the squandering of scarce resources (Tollison, 1982). Rent seeking can be particularly wasteful where rivalry in the political arena is focused on a government-protected

monopoly or license, for example. Much of what goes on in the public process is essentially a form of rent seeking and the fisheries are certainly no exception.

... as a Political Environment

Should the government lead or should the government follow? This philosophical question is at the heart of the fishery management dilemma. The government, as monolith, is not a nimble beast yet the ponderous risk adverse nature of the government caused by the interplay of forces (individuals, cultures, and interest groups) tends to maintain stability. It also tends to ensure that the response of government to any issue reflects the preference of the majority of the electorate. Although a source of frustration to people on either side of the median, this inertia does, in reality, serve the interests of a democratic and representative society. While the government does have an obligation to ensure that the resources it holds in trust for the people are managed responsibly, the government will sometimes align itself with a powerful interest group. However, because the government is risk adverse, it tends to err on the side that reflects the preferences of the majority in society. The deliberative nature of the rule making process, for example, is designed to ensure that all interests are heard. It is this fundamental aspect of a political process manifest within our fishery management arena that has become such a source of frustration to all because in many instances it clear that more affirmative action must be taken to avert a resource crisis.

In many respects, a significant effort is expended in the public sector to maximize the minimum outcome; a process referred to in our society as *red tape*. It is an *institutional inertia* that, perhaps vectored in the same direction as the rest of society,

causes the government to be a few steps behind where some in our society feel it should be. This institutional inertia is a cost of transaction in the public sector. Design inefficiencies, self interest, risk aversion, information asymmetry, principal-agent problems, rent seeking and a host of other inherently *bureaucratic* aspects of the process of individuals making public choices are the costs of transaction that occur within the government-centered fishery management system. These are costs that are extremely difficult to defray despite well meaning aspirations to “reinvent government.” Where the government has a *monopoly* position with respect to the management apparatus (data collection, enforcement, and decision-making, for example) gross inefficiencies can abound, particularly where vertical integration isolates the decision-makers. Where the cost of transaction within the organization becomes too great, new institutions must be created to compensate.

The National Marine Fisheries Service

The case studies that follow in Part II present comparative examples of federal management institutions established for three fisheries. Several aspects of these case studies relate to the action of the federal government management agency and the behavior of its agents, specifically the National Marine Fisheries Service. It is appropriate, therefore, to provide a characterization of the agency that New England fishermen have come to know as *The Government*.

At the advent of the Magnuson Stevens Act, most of the National Marine Fisheries Service personnel were fishery biologists and most of the agency’s personnel resources were located in its regional research centers (Cicin-Sain and Knecht, 2000: 131). Their role was to conduct assessment studies and advance scientific knowledge of

the fisheries. Cicin-Sain and Knecht (2000: 131-132) make the point that: “much of the challenge of implementing the FCMA thus lay in how to move the agency away from its traditional research and service mission to a new management and regulatory role. Much of the time would be spent reorganizing the agency – several times – in an attempt to achieve this shift. ... Another major implementation challenge lay in the changing relationship between NMFS and its major client group – commercial fishers. This relationship, originally very amicable, underwent considerable change after 1976. ... Acrimonious relationships followed in the initial period of implementation as commercial fishers strove to control the new decision-making roles established by the FCMA”

Perhaps because of personal interest and the difficulty the agency encountered coming to understand its new role, an insular attitude developed within NMFS that affects its behavior to this day. An unpublished report prepared for the Assistant Administrator of Fisheries in 1978 found that communication and coordination problems in the agency were widespread. The agency had taken a very legal posture in its dealings with the councils and handed down administrative prescriptions to them without adequate consultation. There was a significant disagreement over the authority status of the councils and an effort to garner for the federal government a greater role in the decision-making process. Consequently, the Service foisted upon the council process a number of administrative procedures such that the councils became “hamstrung” by unnecessary and irrelevant requirements. This led many to feel that the councils had been “sandbagged” and that NMFS was attempting to prove that the council process embodied in the Magnuson Stevens Act was a failure (Schoning, 2000).

The effort to change the decision-making balance in favor of the professional biologists continued into the next decade, being most prominently displayed in the NOAA Fishery Management Study (NOAA, 1986). This so-called Calio report (named such because it was prepared at the request of Dr. Anthony Calio, Administrator of NOAA) recommended that fishery management decision-making be separated between conservation and allocation with the agency setting biological targets and the councils, subject to agency oversight, determining the allocation. The report stated that, "council allocations could not exceed an ABC (acceptable biological catch), would be based on a redefined optimum yield, and would be the cornerstone of fishery management plans." Despite the fact that the framers of the Magnuson Stevens Act intended that fishery management be a shared responsibility between the government and a public knowledgeable about the fisheries, the agency's attitude was that of being "in charge" of the public's business as opposed to being charged with "conducting" the public's business.

In its draft report to the Secretary of Commerce, the federally mandated Marine Fisheries Advisory Committee (MAFAC) found evidence that insular behavior still exists within the National Marine Fisheries Service today. The Committee reported that there is "insufficient external and internal communication and outreach" and that this is "the basis for many of the problems faced by NMFS. ... (that) science is a major function of NMFS; however improvements need to be made in fostering cooperation, integration and syntheses among data gathering groups, within NOAA and among states, universities and other NGO's. ... (and that) management of living marine resource is the most important responsibility and challenge facing (NMFS), yet this

important function of the agency is being driven by crisis and litigation. By integrating stakeholder views; using interdisciplinary science; assessing its performance and correcting deficiencies; and valuing people, communications, and education, the agency's ability to manage effectively would be enhanced" (MAFAC, 2000).

A Note on Accountability, Costs, and Social Welfare

Perhaps the most significant deficiency in the national fishery management program is a lack of accountability. Managers are not held accountable for the manner in which the public trust responsibility is discharged despite the fact that national standards exist and must be obliged. Indeed, the Secretary of Commerce is required to report annually to Congress on the status of fisheries under each Council's jurisdiction (MSFCMA: § 304(e)), the Secretary can remove jurisdiction of a Council where it fails to act (MSFCMA: § 304(c)(1)), and the Secretary can remove for cause any member of a Council (MSFCMA: § 302(b)(6)). However, the only real accountability for failure to manage responsibly is that which is brought about through Congressional *rebuke* or through action in the courts. The Marine Conservation Network claims that it was just such a rebuke that led to passage of the Sustainable Fisheries Act (Zeman, 2001). And when the Conservation Law Foundation and the Massachusetts Audubon Society sued the Secretary of Commerce and other NMFS administrators for what they considered a violation of the MSFCMA's national standards, they did so to "provide some judicial spine" (Shelley et al., 1996: 227).

The industry also escapes accountability for what is essentially usufructory rights. Yes permit sanctions and penalty schedules are available for fishermen who

violate management regulations and indeed, *in rem* action can be taken against fishing vessels used in violation of management regulations (MSFCMA: § 308(d)). However, by law (MSFCMA: § 304(d)), users of the resource are not assessed fees commensurate with the value of the extracted resource and are only minimally burdened with fees for permits that can not exceed the administrative costs incurred in their issuance. In this regard it is valuable to consider for a moment, the costs of our national fishery management program, the principle of cost recovery, and the concept of social welfare.

It can not be taken for granted that in each case of government intervention the public interest is best served because the benefits of any positive outcomes may not transcend the cost of their achievement. This may be particularly true where the cost of intervention yields failure. Proper and effective management of marine fisheries may indeed produce benefits for the whole economy and for society in general, however, to the average citizen the potential gain is insufficient to warrant their active involvement in the public policy debate about fishery management.

On a national scale, the commercial fishing industry's contribution to the national economy is relatively minor. For example, in 1980 the ex-vessel value of the domestic catch equaled \$2.24 billion (USDOC, 1981: 95) or approximately 0.08 percent of the \$2.79 trillion GDP produced in that year (USDOC, 2001c). The net earnings of the EXXON Corporation alone equaled approximately as much as the value of the catch in 1980 (Moody's, 1981). In 1983 the ex-vessel value rose to \$2.37 billion, however, its percentage of the GDP declined to 0.07 percent. In 1983, federal expenditures in support of marine fisheries related activities including the National Marine Fisheries Service, the fisheries sanitation program of the Food and Drug Administration, marine

fisheries programs of the Departments of State and Interior, and the fisheries enforcement activities of the U.S. Coast Guard was \$318 million (Buck, 1985), an amount equal to 13 percent of the total ex-vessel value of domestic landings in that year. By the year 2000, the ex-vessel value of domestic fisheries landings had risen to \$3.50 billion (USD OC, 2001a), however, the cost of government has risen as well. The budget of the National Marine Fisheries Service alone (\$417 million) was equal to approximately 12 percent of the Year 2000 ex-vessel value (USD OC, 2001b) while, as a percentage of domestic product, the value of U.S. fisheries has declined to little more than 0.03 percent of the \$9.87 trillion GDP.

While the federal costs associated with marine fisheries services and support are relatively high as compared with the value of the catch, cost recovery is negligible as a function of federal law. The Magnuson Stevens Act stipulates that any fees established by the Secretary pursuant to any permits required of fishery management plans may not exceed the administrative costs incurred in issuing the permits. Although some regions do assess administrative permit fees and fees are assessed for permits to fish for highly migratory species such as tuna, no fees are assessed in the New England region for permits and logbooks etc. associated with fisheries under management by the New England Regional Fishery Management Council or the Atlantic States Marine Fisheries Commission. While all states assess a variety of license fees (the Maine lobster license fee is \$118 and fees for other Maine licenses such as groundfish, scallop and mahogany quahog are \$89 each), these fees are not intended to offset operating expenses of the state agencies. During my tenure as Commissioner of the Maine DMR, license revenue

(which was directed towards the general fund and not the agency) typically generated an amount less than 10 percent of the agency's annual operating expense.

Clearly this is a very contrived examination and intended to be considered in only a qualitative sense for the purpose of setting up the following argument. Federal expenditures in support of marine fishing related programs should be made in such a fashion as to assure efficient utilization of resources, both fiscal and biological. At a minimum, the cost of some of these expenditures should be recovered from those who utilize the resource including the commercial and recreational harvester as well as the processing sector. In the face of continued waste of resources and in the absence of cost sharing by the direct beneficiaries, further expenditures of fiscal resources for federal intervention in the New England fishery should not occur. The fishery should be permitted to operate in response to its own internal market and biological forces, a laissez-faire approach. While the former aspect of this argument has merit, particularly the importance of assuming and sharing costs related to management, the latter aspect does not. Uncontrolled fishing effort will create serious biological consequences leading to economic dislocations that may have serious negative ramifications for discrete sectors of the economy.

The fisheries have been declared under the Magnuson Stevens Fishery Conservation and Management Act to be a valuable resource, contributing to the food supply, economy, and health of the nation and thus warranting a national program for their conservation and management (MSFCMA, 1976: § 2). However, it is reasonable to question whether the best interest of society is served by federal expenditures in support of the Magnuson-based management approach of these public trust resources if

this approach leads to failure, particularly if one considers the federal monies in support of Magnuson-based activities are a form of public resource as well.

History is replete with examples of governmental failure to effectively discharge management responsibilities. In virtually every sector of the U.S. economy and in programs as disparate as housing for the poor, petroleum price controls, pesticide regulation, and the grading of processed fruits and vegetables, the government has failed to meet public expectations (Peirce, 1981). Traditionally, the government has been called upon to intervene so as to avert a resource disaster. However, it is not a foregone conclusion that greater governmental intervention and control will lead to sustainability and the opposite outcome is perhaps just as likely. The government can not simply regulate away externalities. The government can not unilaterally eliminate or bargain away the transaction costs that cause failures in our fisheries. A government-centered solution is only reasonable where these costs are lower than available alternatives.

Commercial fishing provides a primary source of income for many, it supports a variety of ancillary businesses and it is important to local economies in several regions of the country. It therefore remains an important consideration of the federal government despite its relatively insignificant contribution to the national economy. It has become abundantly clear, however, that fisheries like those in the New England region can not continue on their present course. Overcapitalization, overfishing and the consequent marginal returns on investment have led to a destabilization that does not bode well for the industry's future. We have witnessed a failure of the government-centered approach to fisheries management. An alternative approach is now required.

Chapter 4

SOLVING THE COLLECTIVE ACTION DILEMMA

Garrett Hardin (1968) argues that the means of producing responsible utilization of resources occurs through the creation of rules reinforced by the police powers of the state. However, problems associated with overfishing are not simply a matter of appropriate harvest levels as is implicit in Hardin's parable, nor is the human condition so devoid of the capacity for self-restraint as he so pessimistically portrays. We as a democratic society are certainly capable of managing resources in the public good; and fishermen, under some conditions can and do generate rules to constrain their own exploitive effort. Furthermore, it is not abundantly clear that the interventionist form of government Hardin advances will ensure that common property resources will be responsibly utilized. One need look no further than the condition of the North Atlantic fisheries to confirm this.

Successful resolution of the collective action dilemma requires the development of rules. In fisheries, these rules will be difficult to negotiate if there is substantial disagreement about the science, including information about the status of the resource, and about the actions and motivations of other stakeholders. Our current governing institutions are inappropriate to manage complex systems because our process of learning about the ocean has been hobbled by our institutional approach to scientific uncertainty. A redesign of governance institutions is necessary to manage these complex resources for sustainability. But how then do we manage complex resources in an environment of uncertainty and mistrust? How do we ensure that our publicly owned resources will indeed be utilized responsibly?

Characteristics of Successful Management Systems

To control exploitation of natural resources requires groups to develop rules and be able to enforce them. But under what conditions will groups devise rules to manage resources? What are attributes of successful structures of management, and what are the processes that would be used to create new management institutions? These are not easy questions to answer. After all, it is not easy for people to agree to willingly constrain themselves.

In a wide variety of tribal, peasant and modern societies, rules have been generated at the local level to conserve resources (see, Johannes, 1978, 1981; Berkes, 1981; Acheson, 1975; McCay and Acheson, 1987; Pinkerton, 1988; McGoodwin, 1990; Albrecht, 1990; Dyer and McGoodwin, 1994; Jentoft and Kristoffersen, 1989; economics Bromley, 1989; Klee, 1980; Ruddle and Akimichi, 1984; McEvoy, 1986; Ostrom, 1990). These studies demonstrate that alternative management institutions are not just theoretical, but practical and possible.

There is a sizeable body of literature on these successful management systems and a number of authors have attempted to list their characteristics. Unfortunately, there is not a clear consensus on what those characteristics are. Pinkerton and Weinstein (1995: 181) offer common features of sustainably managed fisheries including 1) accountability, 2) effective management, 3) equitable representation, and 4) adaptiveness. Accountability features include access to timely information concerning the resource and its management as well as an ability to use this information to evaluate, debate and reach consensus positions regarding the nature of issues of concern to the community. Effective management mechanisms include typical

considerations such as rule making, compliance monitoring and enforcement, but atypical considerations such as an investment of time necessary to address issues, the garnering of support for the institution and the promotion of stewardship for the resource. Equitable representation, not surprisingly, refers to that which would be provided to various user groups, but it also suggests that members of a larger community, those who may have a non-user interest in the resource, be afforded some level of representation. Lastly, adaptiveness refers to the transfer of information in the form of feedback channels, responsiveness to changing circumstances and, importantly, the ability to accumulate knowledge about cause and effects.

Robert Wade (1992: 222) presents principles of organizational design which include: 1) need, 2) existing authorities, 3) non-privitizable tasks, 4) core focus, and 5) simplicity. The perception of need drives the creation of arrangements, or more specifically joint rules or organizations, to address concerns ordered in a hierarchical fashion from defense of production, to income enhancement, and subordinately to issues of education, nutrition, health and civic consciousness for example. Wade's second principle suggests that successful generation of authority stems from or is built upon existing structures of authority, which typically are dominated by the local elite. That the organization, dominated by the local power elite, avoids excessive consumption is reflected in Wade's third principle which suggests that the scope of the arrangement be restricted to only those matters for which benefits or costs cannot be privatized. In essence, this principle relates to his fourth which holds that a successful arrangement will remain so only to the degree that focus is kept upon essential tasks, or that less essential tasks are performed only to the extent that primary functions and

obligations are adequately discharged. Wade's last principle of organizational design is one that should be considered fundamental to any organization, but one that surprisingly is not; keep the rules and control techniques simple.

Similar to Wade, Elinor Ostrom (1990: 90) refers to attributes of successful management structures as design principles that have evolved in long-enduring Common Pool Resource (CPR) institutions. These principles include: 1) clearly defined boundaries; 2) congruence between appropriation and provision of rules and local conditions; 3) collective choice arrangements; 4) monitoring; 5) graduated sanctions; 6) conflict resolution mechanisms; 7) minimal recognition of rights to organize; and where larger systems are in existence; 8) nested enterprises. Defining boundaries is, to Ostrom, the first step in organizing to address CPR issues and is almost a self evident concept. Collective choice principles would ensure that individuals affected by adopted rules or restrictions have the opportunity to participate in forums for rule modification. Congruence on the other hand is less evident and suggests that rules or a restriction affecting the manner in which extraction of resources occurs should be related to local conditions and capabilities. This is particularly important given the need to recognize patterns in complex adaptive systems.

Ostrom considers monitoring and sanctions to be the crux of the problem to be addressed through local level institutions in that both activities typically are exercised by outside authorities external to the CPR. It is her contention that both activities must be undertaken by those who are accountable to the appropriators within the CPR. The condition of the CPR and appropriator behavior should be actively monitored and sanctions for transgression should be graduated in context to its seriousness. When

conflict arises, both appropriators and their officials should have access to a resolution forum, one that is provided expeditiously and at low cost.

The final two principles Ostrom puts forward are, to some extent, linked in that they refer to the actions of external authorities relative to the CPR. The right to create or only minimally so by the external authority and, in larger more complex CPRs, enterprises such as monitoring, enforcement, conflict resolution and other governance appurtenances should be nested, one level upon another. This is similar in concept to Simon's (1969) loosely-linked nearly decomposable subsystems with boundaries that control the rates of interaction in complex adaptive systems, discussed below

Contrasts and complements between these studies focus attention on elements of particular importance in organizing for collective action. Ostrom's "clearly defined boundaries" and Wade's "need" principle are both self evident concepts and yet deserve attention here. Ostrom states that defining boundaries and those authorized to operate within those boundaries is the first step "in organizing for collective action" (Ostrom, 1990: 91). To ignore boundaries, she implies, is to facilitate free riding and thus, to develop interest in the institution that would be created, an exclusionary capability must be established through the identification of appropriate boundaries. Wade's principle of need is perhaps the most important first step in organizing for collective action. He points out that individuals "are likely to follow joint rules and arrangements only to achieve intensely felt needs that could not be met by individual responses" (Wade, 1992: 222). In this, Wade hearkens back to Olsen's (1965) theory that action will be taken if the losses or gains from failure to do otherwise (the selective incentives) are

large enough to justify collective action. A common interest group's recognition of need is of first order importance in organizing for collective action. Where there is not common agreement on the need for action, there is no basis to assume that rational individuals will choose to collaborate to address some issue collectively. Without a common understanding of the status of the resource and of the actions and motivations of others, this recognition of need may not be possible within a community. Therefore, altering conditions that give rise to information asymmetries is of first order importance in solving the collective action dilemma.

Pinkerton and Weinstein, Ostrom, and Wade demonstrate that, under certain circumstances, fishermen can and will generate informal rules that lead to resource conservation. The problem is to determine what conditions are necessary to generate these alternative institutions. Transaction costs associated with negotiating, making and enforcing an exchange stands in the way of realizing the gains possible from cooperation. The solution to this problem lies at the local level where an agreement on need, clearly defined boundaries, and an expectation of the action of others is more readily available and it is through this avenue that we find a linkage between rational choice, institutional economics and the transaction cost hypothesis.

Taylor and Singleton (1993) see a clear connection between individual actors and transaction costs with respect to the collective action dilemma. Their hypothesis is that failure to resolve collective action problems results from too little "community" which they describe as a group of actors that share or "possess certain characteristics ... (that) in a fairly weak sense of the word ... does not require, inter alia, any particular feelings between members, including altruistic feelings of any sort" (1993: 199). This

community concept is analogous to principles put forward by Pinkerton and Weinstein, Ostrom, and Wade, particularly, accountability, clearly defined boundaries and need and is effected by conditions of scale and complexity. Where community exists, characterized by stability of relations, multiplex and direct relations, and by shared beliefs and preferences, the uncertainty that causes transaction costs such as “search costs,” “bargaining costs,” “and monitoring and enforcement costs” are reduced (1993: 199-200).

Where the collective action problem is solved, Taylor and Singleton (1993: 202-204) see attendant approaches dependent upon five possible conditions of the community concept. The first two conditions are those with sufficient community to establish endogenous solutions because the transaction costs are low. Where community is strong but “larger and more heterogeneous” thus tending to increase transaction costs, certain specialized roles for individuals within the community (for example “headmen, field guards, monitors,” etc.) can facilitate cooperative agreements. In conditions where there is insufficient community for the development of “wholly endogenous” solutions, a third party “political entrepreneur” can be used to overcome transaction costs by facilitating “coercion” thus strengthening the community. Where capacities greater than that available through an entrepreneur are needed due to scale or complexity for example, “centralized” coercion through the use of an “existing state” in a collaborative approach is possible. Finally, in situations with no or very little community available in the whole but where “pockets” of community exist, these “subgroups” can provide the basis for “hybrid” solutions to the collective action problem, also utilizing third party coercion. In this situation, Taylor and Singleton

(1993: 211) point out that the real choice is not between “anarchy and the state but between different forms of dual control” of a kind that resembles co-management. This condition of co-management exists where some degree of control is devolved from a centralized organizational condition to a localized condition and while transactions at this lower level are not cost free, the costs as Taylor and Singleton point out are reduced and more readily overcome.

Self Governance: Linkage Between Informal and Formal Rule-making

In the social science literature focused on the generation of governance structures, self-generated rules of organization and property rights systems are demonstrated to be practical and possible (Ostrom, 1990). Applied to fisheries, such an approach would integrate the users of the resource directly in management activities such as regulation; allocation; data collection; monitoring, control and enforcement; habitat protection; and planning and policy making (Bellibeau et al., 1995: 36). Indeed, this approach has been applied to situations analogous to the fisheries and, interestingly, where this approach has been applied, the resulting institution exhibits features that are both public and private in nature (Ostrom, 1990) and characterized by Taylor and Singleton (1993) as a hybrid solution or dual control. It is a linkage of informal and formal rule-making. The premise which undergirds this approach, and one which is specifically applicable to the needs of the fishery, is that stewardship can and will be embraced and effectively discharged if it can be delegated and that this is a preferable alternative to exclusively state-centered or private market solutions to the commons problem. Achieving this condition of stewardship is necessary for resolving the collective action dilemma.

This approach recognizes the necessity of incorporating the fishermen into both the decision-making and program implementation aspect of what is, in reality, a social-political problem and not solely a technical biological problem as customarily approached by government-centered management institutions. Fishermen thus would devise rules to motivate fishermen to conserve. Essentially, where a sense of ownership interest in the decision-making process (including its outcome) can be established, there is less incentive to *defect* from an agreed upon position to harvest with moderation. The promise of this *co-management* approach is that rules developed by local level units of resource users are at a scale more closely reflecting localized conditions of the resource. Furthermore, rules developed at this level will be more readily embraced as having legitimacy. There will be a tendency on the part of individuals to adhere to rules so developed and a greater expectation that others in the local unit will embrace these mutually agreed upon rules as well. In this situation of *community* the transaction costs associated with negotiating, making and enforcing an exchange of rules can be reduced making it possible to realize the gains possible from cooperation.

While it is very possible that rules developed at a more local level can resolve collective action dilemmas, there are nevertheless transaction costs at the local level that must be reduced to achieve success. In some circumstances, these costs can not be overcome. Acheson and Taylor (2001) point out that in the literature on fisheries co-management four obstacles to success are recorded including: conflict between groups within the community, residual opposition of governmental officials, a devolution of too little authority, and the inability of prior competitors to embrace a common cause.

Co-management: A Definition

In our fisheries today, there is clearly a recognized need for new and more effective rules to conserve resources. This will require more clearly defined institutional boundaries which can only be achieved through the development of new institutional alternatives to the government-centered approach currently employed. The approach advocated here is one conceived of along lines similar to that formulated by Ostrom, Tiebout, and Warren (1961; see Ostrom, 1994: 225) as “polycentricity” with many autonomous units formed independent of each other but acting in ways to take account of each other through a process of cooperation and conflict resolution (Ostrom, 1994: 225). Constitutionally, a government can share its public trust responsibility with agents of its choosing, provided that these agents are not delegated law-making authority and are given sufficient standards to guide them in the exercise of their discretionary duty. The legal tools necessary for the adoption of self-governance exists. What is lacking, however, are the societal tools, in essence the principles necessary to guide the industry and government as they attempt to bring about enlightened and restrained self interested resource utilization through a dual industry/government approach.

The term co-management has broad meaning when applied to fisheries and is variously used to imply differing degrees of industry involvement in management institutions from that of merely consultation, to compliance with generally acceptable management measures, to comprehensive participation in policy formation and implementation, including formal rule-making. As applied here, co-management is considered to be active involvement and occurs when the fishing community not only

plays a decision-making role, but also has authority to make and implement regulatory decisions and establish and enforce accountability measures. A distinction must be drawn here, however, relative to the delegation of rule-making authority. While certain authorities can be delegated to non-executive branch agents of the government to assist in an administrative capacity to carry laws into effect, there must remain a nexus between the administrative rule-making process and the government. In this regard, therefore, agents of the government, such as a fishing community or stakeholder groups, can only have penultimate authority to promulgate rules. Nevertheless, stakeholders can be thus empowered to manage the resources while the government would maintain authority to set the guidelines (Edwards, 1994: 260).

Participation of stakeholders in this model is more symmetrical with that of the government. Whereas current institutional models have faltered at the intersection of government and industry, especially where management measures have been imposed by government fiat, the co-management model suggests that effective management may evolve from a combination of public and private decision-making. Co-management, therefore, takes into account the politics of people and society and is not simply a technical matter as typically addressed under large-scale government-centered management. In essence, the environment as a complex ecological system and our uncertainty about our own actions is emphasized, thus the creation of appropriate fishing constraints through a public-private cooperative approach rather than handed down by technical experts is the preferred alternative (Wilson et al., 1998). The creation of these appropriate constraints would occur through a democratic process and,

thus created, could be characterized as "mutually agreed upon coercion" as recommended by Hardin (1968).

Instituting a co-management approach to fishery management will not be an easy undertaking, there will be many obstacles to overcome and institutional inertia dictates that this change will come about slowly. This is particularly so because co-management requires a significant commitment by the users of the resource; much more so than does the current government-centered approach. It will also require a government willing to let fishermen manage and be empowered to participate in the process more fully. Implementing a co-management approach will undoubtedly bring about a cultural change in the fishing community; it can also change the status of the fisheries, making sustainable productivity a practical reality and not just theoretical.

Overcoming the Uncertainty of Complex Adaptive Systems

A significant advantage of localizing the management decision-making process is that it provides a means of reducing the informational asymmetries associated with science-based transaction costs. Customarily, the scientific-based approach to management attempts to quantify uncertainty by seeking the smallest confidence interval around a parameter estimate. If the governance institution is appropriately structured and nimble enough to learn and react rapidly to changing circumstance, this statistically based approach to uncertainty is not problematic. However, a fishery is a complex adaptive system that is influenced by a large number of factors, any one or combination of which can influence very different outcomes (Ulanowicz, 1997). It is a system that acquires information about its environment and about its own interaction with that environment. It models regularities it identifies in those interactions, and it

adapts to changing circumstance based upon those models (Gell-Mann, 1994). In essence a fishery changes in response to the dynamics of its own change and, unfortunately, we remain unsure about the causative agents of change in the fisheries. The equilibrium condition theorized in conventional fishery science is elusive in this complex adaptive system, thus the predictive approach is very difficult if not impossible to apply successfully to fisheries.

Despite this predictive difficulty, there is a basis upon which to build effective management institutions. That basis is in the order or patterns exhibited by complex adaptive systems over time and at varying scales (Pahl-Wostl, 1995). If we are able to discern these patterns and scales and, importantly, if we can perceive the relative positions or hierarchies that emerge (Simon, 1969, 1996; Holland, 1998) we have a means of overcoming uncertainty; of learning how to generate rules that make it possible for people to operate in a chaotic environment. By way of simple example, the permutations (complexity) of checker arrangements on the board and the reactive (adaptive) behavior of the opponents create in the game of checkers a complex adaptive system. John Holland (1998) uses this game as a pedagogical device to explain that the learning process used in computers and by humans to address complexity is really dependent upon the recognition of patterns. Although the actual configuration of checkers on the board at any given time may be unique to the players, patterns of configuration experienced during previous play become discernable and facilitate hierarchical decision making (yes/no -- better/best).

In a similar fashion, the fundamental basis for learning and prediction in complex natural environments is the ability to recognize patterns (Wilson, 2001).

Seasonal patterns, for example, are discernable and within these time steps are events, spawning periodicity for example, that are also discernable. Similarly, other patterns emerge, changes in salinity or temperature for example, that may be discerned to have linkages and perhaps causative relationships. Although the causative relationships may not be stable, they may exhibit more or less influence upon outcomes and can thus be discerned to exhibit a relative configuration or hierarchical pattern.

Wilson (2001: 17-20) likens the fisherman familiar with the Gulf of Maine ecosystem to Holland's checkers player who "has learned to recognize system patterns and has some sort of vision of the future including a sense of what effects humans have on the system. ... (However), the complexity of these (fisheries) systems – their size, spatial distribution, continuous change, etc. – create circumstances in which no one individual or group could hope to adequately address the learning problem." This is in essence another facet of the collective action dilemma, that without the ability to learn about the effect that others have upon the fisheries system, it is not rational for the individual fisherman to unilaterally harvest with restraint. "The problem is a collective problem (learning enough to develop a convincing rationale for individual and collective restraint) and, as such, is dependent upon social organization and process." (Wilson, 2001: 20). This learning problem contributes to the cost of the fishery management transaction.

A Hierarchy of Roles and Functions

How complex systems are organized is important to how learning is achieved, both about the system and within the system. Herbert Simon (1969, 1996) conceives of systems organized in a hierarchy of roles and functions that are loosely linked into

nearly independent or “decomposable” subsystems with boundaries defined by the rates of interaction. Several authors have addressed this concept of hierarchy in a variety of natural and social systems; O’Neill, et al. (1986) in terms of ecosystems, Levin (1992) in relation to ecological patterns and scales, and Elinor Ostrom (1990) in social systems she refers to as nested enterprises. Oliver Williamson (1985) addresses linkages within business firms and Vincent Ostrom (1994) address the concept as a key element of the Federalist system of government, describing his own theoretical formulation as polycentricity. In all of these complex systems, the linkages form the basis of efficient operation and use of information including the feedback mechanisms essential for learning, and for reducing transaction costs.

These works argue directly and indirectly that the scale of the organization should match the scale of the activity in question such that the decision-making is delegated to that level of the system (organization) with the most pertinent knowledge. Where this has the effect of reducing information asymmetries, it will tend to minimize transaction costs. Interestingly, it is exactly this basis upon which the Magnuson-Stevens Act is founded. The evolving view at the time was that the international community was not sufficiently localized to effect meaningful protection of coastal areas. Management of marine resources within 200 miles of a coast, it was argued, should be scaled appropriately and delegated to the local (nation-state) because it has more pertinent information than does the international community. As pointed out previously, the intent of the Act’s framers was to extend the localizing benefit further. However, that has not occurred as a result of executive interpretations, subsequent congressional modifications, and judicial interpretation. A resolution of the collective

action dilemma necessitates movement away from the administrative constrictions of the Magnuson Stevens Fishery Conservation and Management Act towards a venue that provides greater stakeholder participation. Further delegation of authority to a more local level of the system with pertinent knowledge is necessary in the New England region to reduce the transaction costs associated with learning within this fishery system.

Practical Applications

The interdisciplinary studies catalogued by Pinkerton has yielded a general theory of institutional design (Pinkerton, 1989, 1991, 1992, 1994b, 1994c; Berkes et al., 1991; Smith, 1994) including self-management, government-community co-management, and multiparty co-management. Self-management or community-based systems typically evolve in response to culturally distinctive attitudes regarding access, sustainable harvest, habitat, and other norms related to production distribution and consumption and include a link to areas that persists over generations where the ability to exclude, monitor and regulate is assured. Joint government-community systems are those that have typically evolved from local or community-based management systems that have become incorporated, essentially unchanged, into a modern institution. Multiparty systems are a relatively more recent approach to management. These systems recognize different levels of interests that exist among groups of stakeholders and come about where goals and equitable standing are agreed upon and where the government facilitates the sharing of management resources, including information (Pinkerton, 1994a: 2367-2369).

Given the complexity of the New England fishery, its extant management institutions and, importantly, the government's public trust responsibility and ability to delegate only penultimate authority to local management units, the multiparty systems are of most interest here. If the balance of power can be shifted such that symmetry with respect to authorities and responsibilities can be achieved, the industry-government interface can bring about positive management outcomes. This is particularly so where a closed set of users is defined and, as Townsend (2001) has argued, a joint private-public decision-making mechanism may achieve a greater efficiency than can be achieved by government-centered command-and-control regulation alone.

Where success has been achieved in multiparty systems, Pinkerton has found that certain logistical issues such as clear boundaries, clear criteria for participation in the management unit, units of appropriate scale to the human resource and the ecology of the area, and a clear understanding of how benefits accrue, must be resolved as a prerequisite. Essentially, the conclusion to be drawn is that management areas need to be of a size such that the participants in the management unit interact frequently. In addition, the administrative logistics of management must be addressed through the establishment of a board or council etc. composed of local stakeholders and a coordinating role for a region-wide board must be provided. Pinkerton has also found that certain costs related to local management activities must be assumed and shared by stakeholders, and that certain political conditions, including a degree of local control and a clear definition of local power, must be met in order for success to be achieved (Pinkerton, 1994a: 2372-2374).

A number of examples exist of co-management systems developed to address particular fishery resource needs. Acheson has compiled, in a report prepared for the State of Maine (Wilson et al., 1998: Appendix E), case studies of co-managed fisheries that includes: the Australian Fisheries Management Authority, the Japanese Fisheries Cooperative Associations, the Gitskan salmon fishery (Canada), the Lofoten cod fishery (Norway), the Mitchell River sea bass fishery (Australia), the San Miguel Bay fishery (Philippines) and the Saint Lucia sea urchin fishery. In these cases, four common elements were determined to be essential for the generation and maintenance of the fishery systems; essentially the same elements identified by Pinkerton above. Boundaries must be established around the territory to be managed, the number of participants must be relatively small, the fisheries brought under co-management must be relatively homogenous, and the central government must be willing to cede some degree of management authority to the local level.

Townsend (2001) has identified six additional fisheries including the Northwestern Hawaiian Islands lobster fishery, the Pacific whiting fishery, the North Pacific pollock fishery, the Canadian Bay of Fundy purse seine fishery, the Matjes herring fishery in the Kattegat, and producer organizations in the United Kingdom as ones that exhibit many of these same attributes. In these cases a form of private-public decision-making has enabled participants to deal with the inherent inefficiencies of fisheries exploitation. In Northwest Russian fisheries, researchers have found that a considerable degree of co-management exists (Honneland and Nilssen, 2000) and in the Barents Sea Norwegian fisheries, participation in the management process has become a part of the fishermen's social life (Honneland, 1999).

Closer to home, Fegley et al. (In Review) have found that in the New Jersey Delaware Bay oyster fishery, oystermen, researchers and state regulatory agencies act cooperatively to manage this resource. In New England, an adaptive approach utilized by the Atlantic States Marine Fisheries Commission to manage lobster has many co-management attributes. The benefit of this approach as a management forum has led representatives of the New England scallop industry to attempt emulating many of its features in their alternative management strategies. And perhaps the most significant example of co-management in the region is the zonal management approach utilized in the Maine lobster fishery; a system that exhibits all essential elements necessary for continued success including boundaries, a limited set of participants, homogeneity of species, and a government willing to cede some control to the local level.

These New England examples are examined in more detail in the following chapters, however, it is appropriate to draw attention here to the Zone Management Law for the Maine lobster industry. It has enabled fishermen to successfully generate rules to constrain exploitative efforts, but not without the costs of overcoming problems such as those of distributional conflicts, constitutional issues, boundary disputes, governmental intervention, and scale. Acheson and Taylor (2001) point out that not all of these problems were anticipated and that some have been more successfully overcome than others. Co-management is not free of transaction costs – every bargaining process entails costs in the exchange of goods or services. However, where decision-making authority has been devolved to a more local level as provided in the co-management model, transaction costs that are encountered in the exchange can be more readily overcome.

Summation: Theoretical Tools and the Hypotheses

In the chapters of Part I, four theoretical propositions that are particularly valuable in explaining and interpreting the data concerning the industry-government interaction are presented. These are: (1) the argument that a singular or large scale government-centered management approach fails because it is scaled inappropriately to the human and resource ecologies of the fisheries; (2) the idea that power struggles and information asymmetries create obstacles in the development of rules to reduce excessive exploitation; (3) the idea of transaction costs as a link to the creation of policies that solve collective action dilemmas; and (4) the idea of polycentricity and the use of co-management principles to reduce transaction costs.

I present four sub-hypotheses that will be tested using data from the fisheries of the Gulf of Maine. These fisheries are of particular importance because existing case studies from other parts of the world do not have sufficient cross cultural data to demonstrate that:

- 1) in large scale highly complex fisheries where asymmetries in power and information exist, the fishery management bargaining process will be marked by high transaction costs that will not be easily overcome, leading to institutional and resource failure;
- 2) where information about the resource is asymmetrical, but where power symmetries exist, it may be possible to negotiate effective resource conservation rules, however, transaction costs will remain high thus the bargaining process will be protracted;

- 3) where the fishing industry and government have similar understandings of resource status and where symmetrical power with respect to decision-making authority exists, transaction costs can be more readily overcome leading to more effective institutional and resource outcomes; and
- 4) in small scale low complexity fisheries, transaction costs involved as parties negotiate for control rules will be relatively low regardless of symmetries of information and power.

The fisheries examples above demonstrate that alternative decentralized management systems are utilized in fisheries around the globe. Some of these systems are based upon informal institutions while others are dependent upon a mix of informal and formal rules and private/public governance arrangements. How these various systems fare with respect to overcoming transaction costs in the fishery management bargaining process is unclear. To test my hypothesis, therefore, Part II of this thesis examines the four propositions or sub-hypotheses presented above in the case of three New England fisheries; the New England lobster fishery, the Northeast groundfish fishery, and the Maine mahogany quahog fishery.

Part II
CASE STUDIES, SYNTHESIS, AND CONCLUSION

Chapter 5
NEW ENGLAND FISHERIES: PHYSICAL AND HUMAN ECOLOGIES

The causes for failure of management in New England are not simply institutional and structural in nature, but are as complex as is the culture and society of the region and the environment and ecology of its fishery resources. In order to appreciate marine resource management in the region and why alternative institutions are advocated for here, one must have some understanding of the fisheries of the region and their physical and human ecologies. This chapter presents the New England fishery in overview, including a brief historical perspective of its development, and brings focus upon three vastly different sectors including the lobster fishery, the groundfish fishery, and the mahogany quahog fishery.

The New England fishery is located in the Gulf of Maine, Georges Bank region of the Northwest Atlantic. This sub-arctic region is marked by the convergence of the northerly flowing warm waters of the Gulf Stream and the southerly flowing cold waters of the Labrador Current. The mixing patterns created by these currents are responsible for a high nutrient concentration, a high primary productivity as compared to other oceanic ecosystems and, consequently high productivity throughout the food chain (NAS, 1979: 2). This productivity accounts for significant diversity in the New England commercial fisheries. There are more than 40 edible finfish species of varying

value, 12 shellfish species of commercial value and 5 commercially important crustaceans. The principle species harvested in the region have traditionally been cod, mackerel, hakes, flounders, haddock, scallop, and lobster. Other important species include herring, whiting, pollock, hard and soft shell clams, menhaden, and more recently sea urchin, quahogs, squids, and goosefish.

The Gulf of Maine / Georges Bank region is essentially a bight bordered on the east by the Bay of Fundy and Nova Scotian coast; on the north by the coast of Maine; and on the west by the coasts of New Hampshire, Massachusetts and Rhode Island. Although the New England fleet operates out of virtually every small port and embayment along this coast, the principal fishing ports in the region include: Rockland and Portland, Maine; Gloucester and New Bedford, Massachusetts; and Point Judith, Rhode Island. Commercial fishery landings in these five ports represented 36 percent of the quantity (213.6 million pounds) and 58 percent of the value (\$379.3 million) of all fish landings in the New England region in 1999 (USDOC, 2000: 6-7). Not incidentally, in these same ports are located the major processing facilities in the region. Fish landed in one of the smaller ports is generally transported to a principal port for processing and distribution.

Early Development of the Industry

The codfish grounds of the Northwest Atlantic were reputedly discovered by John Cabot in 1497 although fish curing stations have been found in areas of what is now Canada dating well before that time (Kurlansky, 1998). Clearly the region was of early importance for its fisheries with evidence of fishing settlements found in what is

now Maine and New Hampshire that predate the establishment of the Plymouth Colony (McFarland, 1911). Fishing played such an integral economic, political, and social role in the development of the New England colonies, that its importance was symbolized by the 'sacred' wooden codfish that has hung in the Massachusetts House of Representatives since the 1700s.

By 1630 the fishing industry in the region had become quite profitable. New England cod, which was generally salt cured in the winter, was considered a high quality product valued on European markets where it commanded a higher price than European fish. To protect this industry, the Massachusetts General Court established a commission in 1635 to maintain quality control of the product and to manage trade. Only the highest quality cod reached Europe. The lower quality product was shipped to the West Indies where it was used to feed slaves. Vessels returning from the islands brought sugar and molasses that supplied the rum distilleries in Newport and Boston. Thus the fish trade between the New England colonies, Europe and the West Indies formed the basis of what became known as the 'Golden Triangle' trade route (Jensen, 1972).

The fishing industry prospered in New England during the early 1700s. In Massachusetts between 1765 and 1775, twenty towns along the coast were devoted to fishing with 605 boats, 4,175 fishermen and 9,600 men involved in curing, packaging and transporting of fish (McFarland, 1911: 124). The industry, however, was devastated by the Revolutionary War due to the disruption in the international trade and losses of boats, fishermen and shoreside facilities. One of the most important issues to be resolved during the treaty negotiations following the war was the right for American

fishermen to pursue fisheries on the traditional fishing grounds of the Northwest Atlantic. These rights were secured and embodied in Article II of the Treaty of Paris, signed on September 3, 1783 (McFarland, 1911: 127). Nevertheless, disputes over U.S. / Canadian fisheries continued. As recently as 1984 the International Court of Justice rendered a decision in a U.S. / Canadian fisheries dispute related to the boundary line in the Gulf of Maine / Georges Bank region (ICJ, 1984).

While the New England fishing industry suffered due to the direct effects of the Revolutionary War, it also suffered as a result of foreign retaliation following the war. Many European nations imposed import duties and other barriers to restrict entry of American fishery products while British and French fishermen were paid government subsidies in an effort to more fully develop the European industry (McFarland, 1911: 132). In 1789, to assist the New England fisheries, the second act passed by the new Congress of the United States provided bounties of five cents for every quintal of dried or pickled fish exported to another country. On February 9, 1792, an act was passed which provided allowances to be paid to the fishing vessel based on vessel size, amount of fish caught and time spent fishing. In 1819 these allowances were increased under the stipulation that a logbook be kept and that, in lieu of wages, fishermen were to be compensated by a share of the proceeds from the sale of the catch (McFarland, 1911: 133-162). This was the basis of the *lay* system that continues today.

By the 1860s the fisheries in the United States had been stabilized. Salt cod was still an important product, however, mackerel (pickled or salted) had increased in value and had become a much more important fishery in the region. In 1859 there were 3,036 vessels and 22,703 fishermen involved in the New England cod and mackerel fisheries.

The European trade, which was never fully regained, was replaced by demand from the expanding western states. Gloucester, Massachusetts became the center for salt cod, mackerel and halibut, surpassing landings at all other New England ports (McFarland, 1911: 174). In the State of Maine, the cod and mackerel fisheries were insignificant prior to the War of 1812 and only moderately so until 1840. However, from that time through the years of the Civil War, cod and mackerel supported fisheries that became of major importance to the State (O'Leary, 1996: 9).

Cod and mackerel have historically supported the most significant fisheries practiced in this region. These are considered the *sea fisheries* in that they occur well beyond the territorial limit of the states by relatively large vessels generally twenty-ton or more in size. By comparison, inshore activities like lobstering were largely irrelevant, even in Maine, prior to 1880 with fewer than a half dozen towns having a lobster fishery prior to the Civil War. The difference in scale and complexity is significant, both in terms of geography and in terms of economics. Whereas the sea fisheries were relatively sophisticated in terms of the integration into the economic and transportation centers of New England, the inshore activities operated as part of what Judd (1997) refers to as the petty resource-base economy. This situation quickly changed at the end of the 19th Century, with the lobster fishery growing from a subsistence level activity with fewer than 200 men and 20 vessels at the end of the 1870s to more than 3,000 men and 130 vessels by the turn of the century (O'Leary, 1996: 258).

The turn of the century also brought dramatic change to the sea fisheries. The steam engine and the development of the otter trawl enabled a more efficient and

effective harvest, increasing catches and decreasing the time spent fishing. Most important, these developments enabled the landing of fresh fish and the consequent development of this market. As demand for the fresh product increased, Boston became the leading New England fishing port because it was the marketing and transportation center of the region. Gloucester, which was dependent on the salt cod fishery, suffered from decreased demand and cheaper imports in the 1920s. However, its processing industry adapted and flourished, largely due to the development of freezing methods and by improving filleting techniques and the ability to process greater quantities of imported fish (Boeri and Gibson, 1976).

The New England fishing industry experienced great hardship during the depression that followed the stock market crash in 1929. Landings of fish declined by nearly 200 million pounds from 1930 to 1931 with a decline in value equaling \$7 million. By 1933, only 500 million pounds of fish valued at \$13 million were landed in all of New England. Fishermen who had jobs earned less than employees in virtually every other industry; only farm workers made less (USDOC, 1975). Fishermen were subject to the same financial difficulties that forced those in other sectors of the economy out of business. Consequently, many fishing vessels had to be sold, decreasing employment opportunities in the industry. Those that were able to keep their vessels fishing were barely able to cover operating expenses (U.S. Congress, 1934: 5-20).

World War II significantly changed the conditions influencing the supply and demand functions for fishery products. The U.S. Navy appropriated many of the larger fishing vessels while material shortages made it difficult for other vessels to operate. In

addition, because of the number of able-bodied men drafted into the services, it became hard to crew those vessels that were still fishing. However, while harvesting became more difficult, the demand for fish products increased. The U.S. government purchased almost all canned fish available at guaranteed prices thus enabling a great expansion of the sardine industry. Furthermore, civilians substituted fish for meat, which had become scarce. The net effect was an increase in the demand for the landings of fewer vessels that brought about higher prices and incomes throughout all sectors of the industry (Dewar, 1983: 14). By 1944 New England landings had increased to 714 million pounds accompanied by a dramatic increase in value (USDOC, 1975). Yearly earnings for many fishermen working on large trawlers were as much as \$16,000 compared to a prewar high of about \$2,500 (USFTC, 1945: 36). The shoreside sector of the industry also prospered with an expansion in the number of processing plants in the region and an increase in earnings for both dealers and processors.

These trends created great optimism in the industry that prosperity would continue. However, after the war contract buying ceased and operating costs rose with postwar inflation. In an effort to increase prices, fishermen began to reduce landings, however, this forced the more capital intensive processing sector to secure lower cost product from Canada and Iceland. Between 1938 and 1948, imports of fish had increased nearly six-fold and by 1953, with the introduction of frozen fish blocks that could be processed into fish sticks, a boom in the retail market had been created. Because New England fishermen were engaged primarily in supplying fresh fish and did not harvest fish that was destined for the frozen block market, virtually all frozen

fish was imported, leaving New England fishermen restricted to supplying a limited market place.

In 1961 Russian fishing ships began appearing on Georges Bank. By the early 1970s there were more than 300 large trawlers from as many as ten foreign nations fishing off the New England coast (Sedwick, 1977: 161-165). Although initially, these highly efficient vessels harvested only what was considered in New England as non-traditional market species, effort was eventually directed towards more traditional species such as haddock. This heavy foreign fishing pressure led to a reduction in the size of many fish stocks, creating supply problems for the domestic industry, further exacerbating economic conditions. As domestic fishermen and foreign fleets continued intense fishing pressure, results from research surveys conducted by the National Marine Fisheries Service indicated a 90 percent reduction in haddock and a 74 percent reduction in finfish biomass generally between 1963 and 1974 (Clark and Brown, 1977).

The International Commission for Northwest Atlantic Fisheries (ICNAF) had management responsibility for fisheries beyond the United States 12-mile contiguous zone, however, its management efforts proved to be ineffective largely because it lacked an enforcement mechanism. With serious declines in stock levels and an ineffective international management regime in place, New England fishermen began a concerted drive in 1973 for legislation that would exclude foreign fishermen from access to fishery resources within 200 miles of the U.S. shore. On April 13, 1976, this effort culminated in the enactment of the Fisheries Conservation and Management Act (FCMA). Through this vehicle, the United States extended its jurisdiction over the

ocean by more than two million square miles, claiming exclusive management authority within what was referred to as a Fishery Conservation Zone (FCZ), a 197 mile wide band of ocean extending from the 3-mile territorial sea. Although the U.S. had been involved in the management of fisheries as a member of the Pacific Halibut Commission, enactment of the FCMA represented the first time in U.S. history that the federal government assumed a direct role in the overall management of offshore fishery resources (Warner and Finamore, 1980). The scale and complexity of the challenge foisted upon the National Marine Fisheries Service in this regard was enormous. It was also a challenge the agency was ill prepared to assume at the time.

The Fisheries at the Time of Extended Jurisdiction

Participation in the fisheries during the period immediately following enactment of the Magnuson Act had been somewhat difficult to determine due to the amount of overlap between sectors and the method used to tabulate fisheries data. In the early 1980s the most comprehensive information available pertaining to fishermen and vessels employed in the groundfish and scallop fisheries was compiled by the International Trade Commission from unpublished statistics of the National Marine Fisheries Service (USITC, 1984). For the lobster fishery at that time, the most comprehensive data base was compiled by the New England Fishery Management Council as part of the American Lobster Management Plan (NEFMC, 1983).

The harvesting sector of the industry in the early 1980s included several thousand fishermen working aboard hundreds of vessels that ranged in size from small outboards to those over one hundred feet in length. The range in size and capability of the vessels in the fleet was significant and efforts to categorize them for management

purposes have proven to be extremely difficult. Generally these vessels are grouped into an inshore and offshore fleet, depending upon size, and characterized by the tonnage, fishing method and gear type used including mobile gear such as otter trawls and dredges, and static gear such as lobster traps. Other gear types include seines, weirs, longline, gillnets and a variety of clam rakes.

The otter trawl is the primary gear used to harvest groundfish or bottom dwelling species like cod, haddock and flounder. It is essentially a large bag made of netting which is towed behind the vessel. The mouth of the net is held open on a horizontal plane by use of *doors* attached at an angle to each wing of the net. Water pressure acting on the doors provides the outward force necessary to spread the month opening. The vertical opening is established by the use of floats on the upper edge of the mouth opening and a weighted bottom edge. The portion of the net where fish is entrapped is referred to as the *cod-end*.

The trawling operation on a groundfish vessel is a continuous sequence of setting out the gear, towing the net for one or more hours and then hauling it back on board, emptying the catch from the cod-end and setting out again for the next tow. On vessels that work the offshore fishing grounds, where the time spent fishing is generally several days, harvested fish are eviscerated and packed on ice below deck. Vessels that fish inshore grounds generally make only day trips, therefore, the catch may not need packing on ice depending upon species and time of year. When the otter trawl was first developed, it was designed to be set and retrieved over the side of the vessel and towed from a block on the vessel's stern. Although there remain *side trawlers* in the fleet,

since the 1950s *stern trawlers* have become much more popular due to the increased stability of the vessel and ease of operation.

While the otter trawl fishery has long been important to the region, the scallop fishery has increased in importance during the years leading up to extended jurisdiction and thereafter. The scallop dredge is the principal gear used in this fishery. It consists of a steel frame rectangular *mouth* to which is attached a steel towing arm. To the underside of the mouth is attached a heavy *tickler* chain that scrapes the bottom to lift the shellfish. To the mouth and tickler chain is attached a bag of constant width which is held out by a steel bar or *clubstick*. The underside of the bag is made of steel rings that can withstand bottom abrasion. The top of the bag is generally made of netting. Dredges may vary in width from 5 feet to as much as 16 feet, depending upon the size of the vessel and the area in which it is being used. A scallop dredge is towed on a single wire cable and is set and retrieved over the side or stern of the vessel depending upon the ship's configuration. Some of the larger vessels are capable of towing several dredges at the same time.

Scallops are lifted from the bottom and held in the bag until the dredge is brought aboard the vessel. As with otter trawl trawling, scallop fishing is a continuous sequence of setting, towing, retrieving and resetting. Once the scallops are brought aboard the vessel, the shells are opened or *shucked* and the meat removed and packed on ice or refrigerated below decks. In both the groundfish and scallop fisheries, vessel size is similar. The inshore fleet, on average, consists of vessels in the 5 to 50 net ton range which are typically operated by one or two fishermen. Offshore vessels are generally in the 60 to 125 net ton range. Crew size on offshore groundfish vessels is

generally between five and seven while scallop vessels generally carry a larger crew due to the labor intensive nature of shucking scallops at sea.

The lobster fishery, now the predominate fishery in terms of value, developed relatively late. Lobster was not harvested commercially until 1840 when demand increased due to canning technology and flowing sea water *smacks* made it possible to ship lobster to restaurants in cities along the eastern sea board.

This crustacean is principally harvested by means of traps or *pots* that lie on the sea bed, although there is some offshore harvest of lobster using mobile trawl gear. Lobster traps are designed in such a fashion that the lobster can not easily escape once it has entered it in pursuit of bait. The lobster is eventually removed when the fisherman retrieves the trap. The inshore trap fishery is conducted from vessels ranging in size from small outboards to vessels of 30 feet or more in length. One or two fishermen who tend several *trawl* lines strung with one or more traps usually operate these vessels. This fishery is very localized given constraints of boundaries, both formal and informal.

The offshore fishery is a relatively recent phenomenon with rapid expansion having occurred following the widespread adoption of the hydraulic trap hauler in the 1970s. Traps in this fishery are fished in trawl lines from as few as 20 to as many as 100 traps each. Vessels in the offshore fishery are larger than those used inshore, however, generally not as large as those used in the offshore groundfish and scallop fisheries. Nevertheless, the diversity of scale and operational complexity is significant between the inshore and offshore fisheries.

Although many of the offshore vessels in the New England fleet in the early 1980s had the capability to pursue various fisheries during different seasons, for the

most part, offshore fishermen were engaged in one fishery throughout the year. The inshore fleet was quite different in this respect with fishermen alternating fisheries on a seasonal basis. This flexibility and adaptability has been an extremely important aspect of the inshore fishery. It has enabled fishermen to maintain viable economic enterprises despite variations in resource availability.

In 1983 there were 986 vessels utilizing otter trawl gear during at least part of the year, 275 of which utilized this gear as the principle gear type. There were 291 vessels utilizing scallop gear during 1983, 108 of which utilized the scallop dredge as the primary gear. Ninety-four percent of the primary-gear scallop fleet in that year were vessels in excess of 100 tons. On vessels utilized primarily for scallop fishing in 1983, 1,086 fishermen were employed, however, on vessels utilized at least part of the year for scalloping, there were 2,821 fishermen employed (USITC, 1984: 16-18).

Participation in the lobster fishery was far greater than that in the groundfish and scallop fisheries at that time. As the decade following enactment of the Magnuson Stevens Act commenced, there were 10,513 vessels and 12,484 fishermen engaged in this fishery during at least part of the year. The majority of this participation (10,325 vessels and 11,467 fishermen) were employed in the coastal trap fishery (NEFMC, 1983: 12).

In 1983 the New England region ranked fourth in quantity of fish landed and third in value nationally. Landings of mollusks (clams and scallops) and lobster in the region equaled 711 million pounds with a value of \$435 million (USDON, 1983: 3). Vessel owner average income at that time had begun to show a downward trend due to a variety of factors including an increase in operational expenses and a decrease in gross revenue (USITC, 1983: 32-46). Crew remuneration throughout virtually the entire New

England fleet in the early 1980s, as it is today, was based on the lay system whereby each crewman is paid a share of the value of each trip's landings, minus a certain percentage of trip expenses. Because the lay system enables the vessel owner to transfer some of the financial risk of fishing to the crew, the crewman's net share also exhibited in 1983 a downward trend similar to that of the vessel owner's (USITC, 1983: 32-46).

Fish landed in port is generally subjected to two shoreside activities, fish buying and fish processing. As with the harvesting sector, the shoreside sector exhibits significant diversity of scale and complexity, from enterprises that can be considered part-time seasonal or sole proprietor ventures to multi-national corporations. The fish-buying sector unloads, sorts, ices, boxes and ships fish to processors or directly to markets depending upon species. During the late 1970s, Boston and New Bedford, Massachusetts utilized an auction system as a means of transferring landings to buyers. A display-type auction was established in Portland, Maine in the mid 1980s. Although these auctions were not the exclusive outlet for landings, daily auction transactions tend to establish the daily price for all fish sold in the region. Other marketing opportunities available to fishermen other than direct sales to consumers included cooperatives owned and operated by fishermen.

Fish processing at the time was generally of two types, primary processing or filleting of fresh product and secondary processing of frozen product. Fish packed on ice is a perishable product thus the length of time a vessel spends on the fishing grounds effects the quality of the fish and, consequently, whether the product is channeled to primary or secondary processing. Because frozen fillets are of lower demand and

require packaging and storage which lowers the financial return on the product, the fresh fish market was predominate during the period following extended jurisdiction. (Hu and Whitaker, 1983: 6). Although most of the fish handled by primary processors came from within the region, a significant amount was imported from other regions and countries.

Secondary processors operate large plants with sophisticated machinery handling a raw product in the form of fish slabs and blocks. These processors produce frozen portions, sticks and dinners not identified by species name. Due to the proximity of the New England fishing grounds and the ready access to the higher priced fresh fish market, New England fishermen do not harvest fish for blocks or slabs. Raw product utilized by the secondary processors is, therefore, virtually all imported. Other types of processing conducted in the region include sardine, industrial and shellfish.

In 1983 there were 221 processing plants of all types in New England which employed 6,923 individuals on a yearly basis and as many as 9,427 individuals during the seasonal high (USDOC, 1984, 87). This represented a decline of 9 percent in the number of plants and a 14 percent decline in the number of employees from the previous year. The production of groundfish fillets declined by 11 percent, from 73.6 million pounds in 1979 to 65.3 million pounds in 1983. Production of frozen groundfish fillets also declined during this period from 16.6 million pounds in 1979 to 15.9 million pounds in 1983.

The Cod and Lobster Fisheries: Comparative Features

Although codfish is harvested today as part of a mixed groundfish fishery, from an historical perspective, the codfish is the most important fish of the Northwest Atlantic and a superb representative, for the purposes of this exposition, of the changes that have occurred in the New England fishery. Although lobster today is considered to be the most valuable marine resource taken in the region, as we will see that has not always been the case. Circumstances affecting these resources have changed over the past 300 years and the relative importance of these species on a resource basis are dramatically different today. Cod have become less abundant as the stocks throughout the range of the species have declined. Lobsters stocks on the other hand, which were in decline during the earlier part of the 20th Century, are now harvested in record volumes with attendant record values. The vastly different scale and complexity of the fisheries and the manner in which resources have been utilized, the different management approaches that have consequently been applied, and socioeconomic diversity have contributed significantly to these shifts.

Cod and lobster resources are managed differently. One important reason is the fundamental physical and behavioral differences between these organisms. Although it has mobility, the lobster is a far more sedentary creature than is the codfish and thus it is harvested principally by means of fixed trapping gear. While a variety of techniques have been used to harvest codfish over the years (Kurlansky, 1997), cod are today harvested principally by means of mobile ensnaring trawl gear.

Technological advances over the years such as the development of refrigeration, the steam and internal combustion engines, hydraulics, the invention of plastics, the

development of and expansion in the field of electronics, etc. have brought about changes to all fisheries. Many of these technological developments have changed the spatial distribution of both the cod and lobster fisheries. For example, the introduction of the steam engine and otter trawl had the effect of virtually eliminating the U.S. salt cod fishery on the Grand Banks and supplanting it with a fishery for fresh product in the relatively nearby Georges Bank area, reducing the geographic scale of this fishery somewhat. The geographic dimension of the lobster fishery, on the other hand, has been broadened, particularly over the past twenty years, by the development of the hydraulic pot hauler that enabled the expansion of the lobster fishery into deeper offshore waters.

Despite technological advances, the lobster fishery today is still principally a 'day boat' fishery in which fishermen operate within or relatively close to home harbors. The cod fishery, by contrast, is still by and large considered an offshore fishery prosecuted at greater distances from home ports and over greater spans of time. This spatial difference in operational characteristics is a direct function of the physical and behavioral differences between the species pursued in these two fisheries. As we shall see, this difference in scale and complexity has had a significant impact upon the resource management approaches utilized in these two fisheries.

Biological Features

There are obvious morphological differences and, although perhaps not as obvious, significant biological differences between lobster and cod. Both species are affected by a host of environmental factors including water temperature, salinity, and

ocean currents, for example, and by inter- and intra-species competition for food and space, etc. However, the differing reproductive strategies of the organisms are considered here the most significant biological differences between cod and lobster. While both organisms are relatively fecund or capable of producing significant amounts of reproductive material and while in both cases fecundity increases with organism size, the fertilization process differs significantly between lobster and cod. The strategy employed by lobster ensures a per egg rate of survival that is much greater than that of cod. Cod fish spawning occurs in localized areas where reproductive fish concentrate seasonally following spawning migrations that can be extensive in range. Reproductive material is discharged into the environment and fertilization occurs external to the organism. Fertilized eggs and hatching larvae are planktonic for significant periods of time and post larval stages remain within the water column. Lobster, on the other hand, reproduce through sexual copulation and fertilization occurs within the female. Egg development occurs while the egg is attached to the female's abdomen and larval release occurs following a relatively significant period as compared with that of cod. Although the larval phase is planktonic, post larval lobster development occurs with bottom settlement where some degree of protection from predation is afforded (Wahle and Steneck, 1992).

Although seasonality and locational factors play an important role for both lobster and cod reproduction, because all reproductive activity in the cod occurs external to the organism, environmental conditions can have a far more deterministic effect upon the reproductive success of cod. Furthermore, while location is a factor in the reproductive strategy of both organisms, spawning aggregations of lobster are not as

intense and discrete as are those of cod, thus the effects of predation and fishing can be far more pronounced if coincident with cod fish spawning. These differences in reproductive strategy have a significant bearing upon recruitment into the respective fisheries and, consequently, have a bearing upon management strategies and the degree of success achieved in management of cod and lobster. Management approaches for both fisheries over the years have recognized the importance of maintaining a strong spawning stock (Gulland, 1974) however, as will be presented below, it has been easier to successfully apply techniques to protect reproductive lobster than it has been to protect spawning fish such as cod.

Reproductive differences between cod and lobster is important from a conservation perspective as well. One can readily observe the reproductive state of a female lobster and this feature has played a large role in management measures. However, such can not be easily determined for that of cod fish. Moreover, a lobster can be pulled to the surface and then returned to the bottom unharmed due to the nature of trapping technology. Cod fish, on the other hand, are generally killed by trawls and those that may survive the nets die as a result of pressure change induced rupture of swim bladders.

Brief History of Landings

In the tenth century, Vikings were eating dried codfish harvested from the waters of the Northwest Atlantic (Kurlansky, 1997: 21). A half a millennium later, following Cabot's *discovery* of these same codfish grounds in 1497 and prior to the establishment of the Plymouth Colony, fish curing stations were built in what is now

Maine and New Hampshire. These archeological findings led one historian to credit the fishing industry as being largely responsible for the settlement of Maine (McFarland, 1911). By 1635, the salt cod industry in the New England colonies had become a vitally important component of the region's economy (Jensen, 1972). The economic, political and social role played by the fisheries in New England continued to increase over the next two centuries, becoming pivotal to certain communities along the coast. By way of example, in 1860 the wealth of the town of Castine, which was at that time the greatest per capita in the State of Maine, was directly related to fishing and principally for cod fish (O'Leary, 1996).

The lobster industry, on the other hand, was irrelevant in Maine until well into the 19th century with only about 200 fishermen from a handful of towns engaged in the fishery prior to 1876. The status of the lobster industry changed dramatically after 1880, growth which O'Leary describes as phenomenal and largely due to the simple and inexpensive gear requirements, the development of tourism in Maine, and coupled to tourism, a significant increase in the price paid for lobster (1996: 258-59). This latter point had a significant bearing upon the relationship between the cod and lobster fisheries. O'Leary posits that as a result of the price increase, many of the deep sea cod fishermen were drawn to the new lobster fishery, explaining much about the decline in Maine's sea fisheries towards the end of the last century. By the 1920's and 30's, however, the status of the lobster industry changed significantly and, as Acheson and Steneck (1997) describe, lobster catches were at such disastrously low levels that hundreds of fishermen went out of business. Both the cod and lobster fisheries have undergone periodic economic change since the early history of the New World and yet

there is no period of change more dramatic than that which has occurred since 1950.

Over the past 50 years the relative importance of these two species as a percentage of the total landings of all fisheries products along the Atlantic coast has reversed (Figure 1).

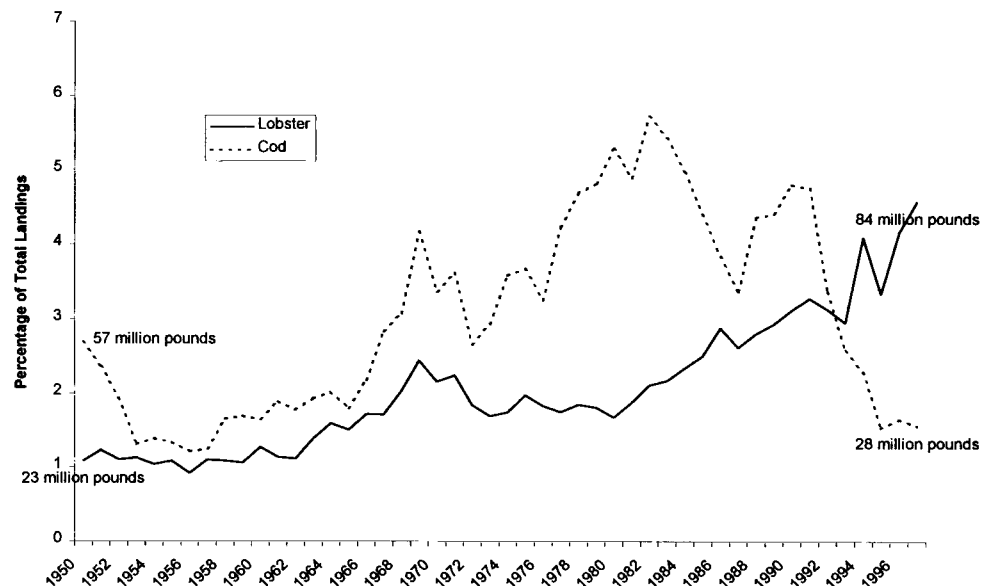


Figure 1: Landings of cod and lobster as a percentage of total Atlantic coast fish landings from 1950 to 1997 (source of data: National Marine Fisheries Service).

Value, which was approximately equal in 1950, had by 1997 diverged more than 90 percent (Figure 2). The value of lobster landings today ranks this fishery as number one in New England and Atlantic Canada. Codfish landings, on the other hand, have become a relatively insignificant component of the overall harvest of groundfish.

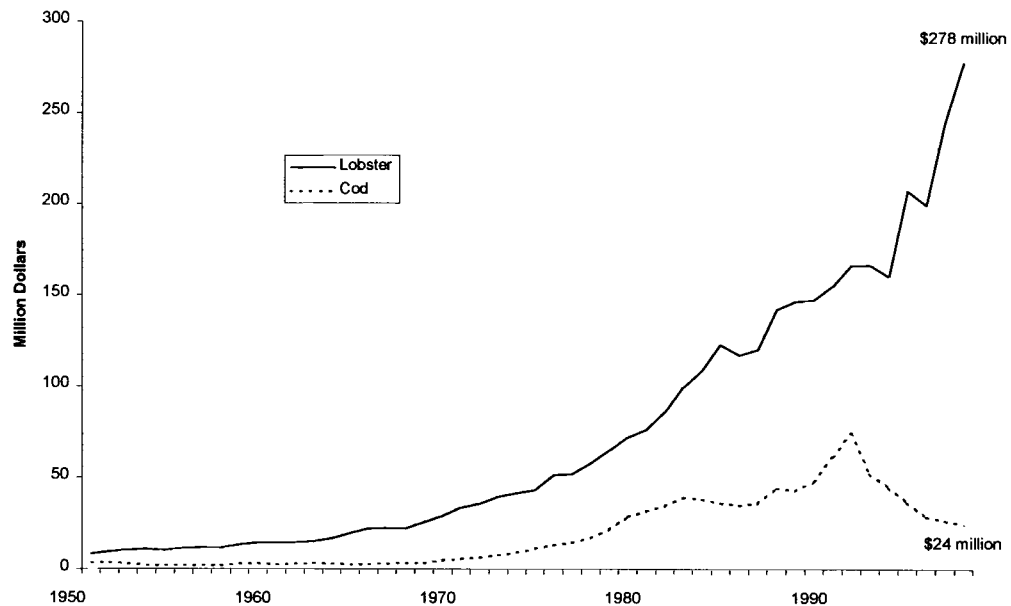


Figure 2: Value of Atlantic coast cod and lobster landings from 1950 to 1997 (source of data: National Marine Fisheries Service).

The Maine Mahogany Quahog Fishery

The Maine mahogany quahog fishery is without a doubt one of the most interesting and yet least known fisheries in the State. It has relatively few participants, its geographic scale is very limited, and in comparison to other fisheries of Maine, it is contemporary, having been initiated in the early 1970s due solely to the efforts of a single individual from Buck's Harbor attempting to augment his summer income (MAFMC, 1997).

Mahogany is really a colloquial term for the physical appearance of ocean quahogs of the species *Arctica islandica*, which inhabit the subtidal continental shelf waters from Newfoundland to Cape Hatteras. The heavy shelled, oval shaped bivalve mollusk has a dark membrane that covers the shell and, in some parts of the country, it is called a black clam. To the casual observer, these quahogs look superficially like the

common hard clam, *Mercenaria mercenaria*, however, the young, rapidly growing ocean quahogs have a golden brown color, hence the name mahogany used exclusively in the Maine fishery (Chenoweth and Dennison, 1993).

Biological Features

Although there are interesting biological characteristics of the ocean quahog, morphological characteristics related to age and growth and the organisms feeding behavior are most important here. The ocean quahog, *Arctica islandica*, is usually found in dense beds in sediments ranging from sandy to sandy mud. In eastern Maine, these beds are in relatively shallow water where bottom temperatures are cool throughout the year. In the more southern range of the species, ocean quahogs are found in deeper offshore waters.

Mahogany quahogs found in eastern Maine waters average in size between 1 ½ to 2 ½ inches and are therefore relatively small as compared with the same species found in southern New England and Mid Atlantic waters which average between 3 ½ to 5 inches in size. The species is unusually slow growing and represents one of the longest lived species of clam of commercial value with ages of between 60 and 100 years typical. The ocean quahogs found in Maine waters are relatively faster growing than those found in more southern waters. By way of comparison, whereas quahogs in the southern range take 9 to 17 years to reach marketable size of 2 inches, the Maine quahog can reach an equivalent size in as little as six to seven years. The Maine quahog also appears to be a more robust resource than the southern counterpart in that the

Maine stock produces regular strong years classes of settled spat and new recruits and areas that have been fished down appear to repopulate very quickly (MAFMC, 1997).

Ocean quahogs are bivalve mollusk filter feeders similar to other species of clams. Quahogs settle just below the surface sediment where relatively short siphons can extend above the surface to pump water containing food and oxygen through the organism's system. Much of the diet of mahogany quahogs consists of unicellular algae and it is this diet which poses a potential public health risk. Mahogany quahogs have been found to ingest the dinoflagellate *Alexandria tamarensis*, a marine algae responsible for a condition referred to as *red tide*. These single celled plants contain neurotoxins that can concentrate in the gut of the quahog. If ingested in concentrated form, this neurotoxin can cause serious illness in mammals including humans. This condition, known as paralytic shellfish poisoning (PSP) can even cause paralysis or death, consequently, the fishery is subject to very rigorous monitoring requirements and regulation under U.S. Food and Drug Administration guidelines.

Brief History of Landings

The differing growth rates between northern and southern quahogs is more than interesting from a biological perspective, it is also the basis for market differentiation. Furthermore, it has a bearing upon management due to the difference in scale and complexity of the distinctly different sectors of the fishery that have evolved.

The quahogs harvested in the southern range of the species are larger and destined for a high volume low value processed *chowder* market as compared with the Maine mahogany quahog which is sold into a low volume high value fresh *half shell*

market. While size influences market differentiation, the market also has a bearing upon how the resource is managed. Chowder quahogs are processed, generally with the viscera removed, and cooked before consumption. The Maine mahogany quahog, on the other hand, is sold into a half shell market where it is often consumed raw, and thus it presents a public health concern due the possibility of contamination by toxic marine algae.

The large so-called *chowder clams* found in the southern range of the species are the raw product of the commercial processed clam chowder market which has significant value in this country today. Prior to World War II, this fishery was relatively modest because the clam was difficult to shuck and the meat could develop a strong iodine flavor if not handled properly (Chenoweth and Dennison, 1993). However, a declining catch of the more popular surf clams and improvements in processing technology increased the demand for ocean quahogs. From 1970 to 1990 landings increased by nearly 95 percent. The fishery in the Mid Atlantic relies upon large 70 to 120 foot vessels rigged to tow large hydraulic dredges from which the catch is emptied into large metal cages holding 32 bushels. These cages are the industry standard that enables processors to handle large volumes of product (MAFMC, 1997). These vessels are typically owned by vertically integrated fishing operations and employ a number of crew. Vessels in the fishery operate throughout the range of the species, but primarily in the coastal and offshore waters of the Mid Atlantic region.

By contrast, the dramatically different Maine mahogany quahog fishery is concentrated in the eastern half of the State of Maine with landings of the quahogs exclusively in the 1 ¼ to 2 ½ inch size range. The market for these quahogs is

primarily *raw bars* serving clams on the half shell (Chenoweth and Dennison, 1993) and, reflecting the interests of consumers in Rhode Island where mahogany quahogs were first introduced, restaurants serving clam cakes. At first, mahogany quahogs served as a substitute for a dwindling supply of hard clams in the Rhode Island and Mid Atlantic *half-shell* market. Landings through the late 1970s remained relatively modest reflecting the *entrepreneurial* nature of the fishery. However, the success of the few participants in the early fishery attracted new entrants such that by 1984, landings equaled 130 metric tons of *meat* and by 1987 landings had increased nearly five-fold to 580 metric tons (Chenoweth and Dennison, 1993), declining thereafter to a low of 89 metric tons in 1993 due to market and resource limitations before rebounding to 400 metric tons in 1996 (Figure 3).

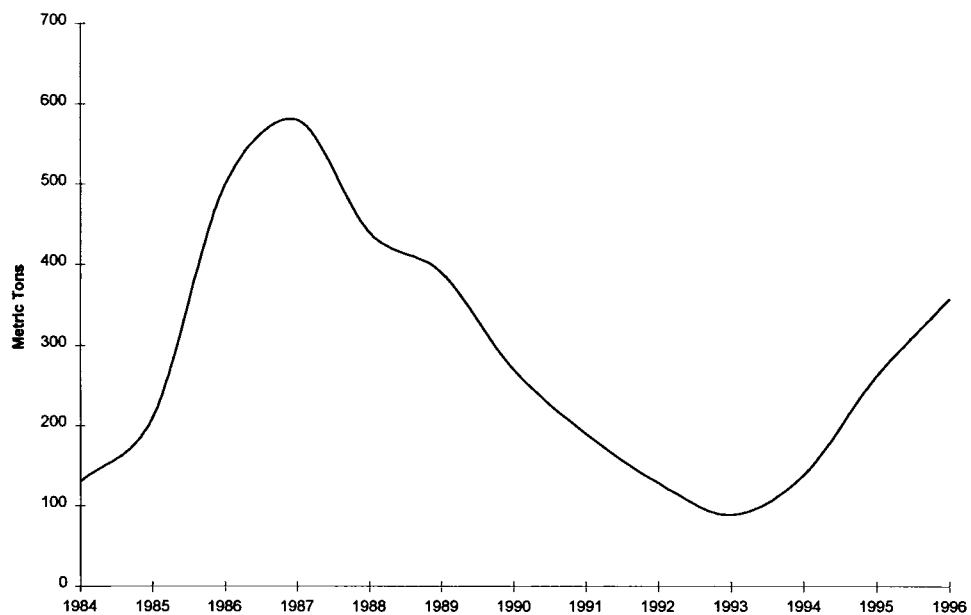


Figure 3: Maine Mahogany Quahog Landings 1984 – 1996: (source of data: Chenoweth and Dennison 1993; MAFMC 1997).

The typical size vessel in the fishery is a lobster-style hull in the 30 to 40 foot range. The quahogs are harvested by means of a small modified scallop dredge, dumped on deck where they are sorted, washed, bagged in half bushel lots, and placed on ice between decks (MAFMC, 1997). Daily landings are highly variable and dependent upon the requirements of local dealers to meet immediate market demands. Although a good vessel is capable of landing as much as 100 bushels per day, they may fish for as little as 20 bushels to meet dealer requirement for that day. In 1996 there were 72 fishermen licensed to participate in Maine's mahogany quahog fishery. Value has increased in this fishery along with landings from as little as \$364 in 1984 to \$2.3 million in 1987 whereupon it declined slightly and has averaged \$1.7 million annually through 1997. Price has also increased over the years, ranking this fishery within the top ten to fifteen species landed in Maine in terms of value per pound.

Chapter 6

CASE STUDIES: NEW ENGLAND FISHERY MANAGEMENT

The New England fishery is today a highly regulated business. It is a business regulated according to a scientific management regime codified by the U.S. Congress in the Magnuson Stevens Fishery Conservation and Management Act. It is also a business that, according to some, is being regulated out of existence. Others, however, believe that the fisheries have not been regulated enough and that the failure to do so has led to the demise of publicly owned resources. The New England fishery is one that many consider to be in a state of crisis, its management synonymous with incompetence, "a metaphor for management failure." (Shelley et al., 1996). If this is so, then we are not just witnessing a failure of fish stocks, but of conservation efforts as well. Yet, despite the claims of failed management and failed conservation, fish stocks in the region are exhibiting measurable and substantial success towards rebuilding (NEFMC, 2001b; CCT, 2001; Boston Globe, 2001). So then, what is failure – indeed, what is success? Against what standard is success or failure of fishery management to be measured? Is it enough to count numbers of fish produced or is there another more appropriate metric to be used? Singleton (1998: 26) points out that defining success only in terms of outcomes fails to acknowledge that many factors affect sustainability including those related exclusively to the environment and that sustainability may or may not be achieved for reasons "unrelated to institutional design" of a management plan.

This chapter presents case studies and comparative examples of the management institutions established for the Maine mahogany quahog fishery, the New England

lobster fishery and the Northeast groundfish fishery. These three fisheries are vastly different in scale and complexity and so too are their management institutions. Perhaps the most significant difference is that the lobster fishery had been subject to regulation well prior to the advent of federal management under the Magnuson Stevens Act with management measures largely developed by the industry over the course of more than a century. Conversely, the management of the groundfish fishery is a relatively recent phenomenon ushered in with extended jurisdiction in 1977 while the management of the mahogany quahog fishery in Maine did not come about until well after the advent of federal control. Consequently, the management of the groundfish and mahogany fisheries has occurred primarily within the federal venue and with little or no direct involvement of industry in management decision-making.

Lobster Management

Regulation came relatively early after the commercial development of the Maine lobster fishery in the 1840s with enactment in 1872 of a law prohibiting the taking of egg bearing or *berried* lobster. Acheson (1997) has done an extensive study of the development of controls upon the lobster industry finding three periods marked by changes in attitude and purpose. The first period is the early development of regulations through the 1920s marked primarily by conflict between sectors of the industry. Although conservation measures were enacted during this period, the impetus for action was often market conservation as opposed to biological conservation. During this period, management measures emanated primarily from industry, and not from the state management agency. The second period reported by Acheson commenced in

response to a serious decline in the resource that threatened the future viability of the industry. This period was marked by the enactment in 1933 of the minimum/maximum size restrictions (the so-called *double gauge*) that form the basis of lobster conservation measures today. During this period the state conservation agency assumed a leadership role in the conservation and management of the resource. The final period documented by Acheson commenced in the 1980s when the State of Maine and other New England states ceded management control of the lobster fishery to the federal government. Although this latter period up through the beginning of the 21st Century is of primary interest in this thesis, an examination of the early evolution of institutions demonstrates differing conditions of management to support elements of my hypotheses.

Early History of Lobster Management

The early development of controls in the Maine lobster fishery came about primarily as a result of distribution fights between fishermen and dealers involved in the live lobster trade and their counterparts involved in the lobster canning industry. The battleground was the legislature -- the conflict was over supply. Competition between these rival sectors of the industry largely resulted in statutory controls upon lobster size and fishing season. Ultimately the conflict proved costly for the canneries as power shifted from them to the live lobstermen and dealers over the course of twenty-five years. In that time, both the canning and live-market sectors of the industry worked to establish laws assuring preferential access to the resource. However, the laws that were established, perhaps unwittingly, were designed to protect juvenile lobsters and egg-bearing female lobster and today these measures form the basis of conservation efforts focused upon protection of the breeding stock (Acheson , 1997: 8). During this period

of time the industry, not the government, was the driving force behind the development of conservation measures. The industry effectively engaged in the political arena of the legislature and, whereas the canning industry initially exhibited significant political influence, the live-market fishermen eventually ascended in numbers and political influence to a position of dominance.

The last decade of the 19th Century and the first twenty years of the past century was marked by a period that Acheson refers to as stagnation. Despite the success achieved by the live-market sector of the industry in its ascendancy over the canners, a decline in catch during this period presaged troubling developments within the industry that lasted for half a century. Lack of unanimity between lobstermen on the need to reduce the minimum size and the concern of state biologists about protecting the larger sized brood stock paved the way for legislative action that pleased no one. In 1907 the minimum size was increased from 10 ½ inches total length (approximately 4 ⅔ inch total backshell/or carapace length as measured today) to 4 ¾ inches. This was a size greater than the majority of the lobster caught yet it was a size that continued to focus fishing effort upon the adult *brood stock*. Lobstermen referred to the new minimum size as the “poverty gauge” and biologist Francis Herrick claimed it was unscientific, defective and bound to fail (Acheson, 1997:9). The industry ultimately prevailed upon the legislature to reduce the poverty gauge to a new minimum size of 3 ½ inches in 1919. However, this was still insufficient to placate an industry which had developed a total disregard for conservation. Violation of lobster laws including the scrubbing of berried lobster, an extensive trade in short lobster, and even the smashing of small

lobster to use as bait became widespread and contributed to sharp declines in catches that continued to the second World War.

Catch declines of over 50 percent coupled with a price collapse during the depression created desperate conditions within the industry forcing many lobstermen out of the industry while many of those that remained fished only part time. Acheson (1997: 10) makes the point that there was not agreement (then or now) on the cause of the disaster the befell the industry. Lobstermen were convinced it was a function of price driven down by imports of low-priced Canadian lobster. The enforcement community saw the widespread violation of conservation laws as responsible. Herrick and biologist Field maintained that the size regulations did not adequately protect the brood stock. Several failed marketing and protectionists efforts ultimately gave way to the political entrepreneurship of the State's fisheries commissioner who prevailed upon the industry for support, and the legislature for passage in 1933, of the so-called *double gauge*. This established for the first time the use of a *slot limit* for lobster harvested in the size range of a $3 \frac{1}{16}$ inch minimum and a $4 \frac{3}{4}$ inch maximum. The industry was essential but played only a supportive role in the development of the double gauge which is the lobster management standard today. The industry was unorganized and split on the issue. The law was negotiated by the commissioner who had allied himself with a powerful faction of fishermen in the western part of the state. Thus he was able to assume a leadership role negotiating the establishment of what was, at the time, a controversial approach to lobster management (Acheson, 1997: 14).

The thirty year period between the end of World War II and the enactment of the Magnuson Stevens Act was a period of resurgence of catch and, importantly, in the

reestablishment of a conservation ethic within the lobster industry. Wide-scale disregard of conservation measures came to an end as the industry became convinced of the damage that violators caused the resource (Acheson, 1997: 14). Local sanctions kept many would-be violators in check and, during this period, there was little distribution-based conflict within the industry to prompt legislative action. In fact, the most significant pieces of legislation developed during the period, the *V-notch* law in 1947 and the *escape vent* law in 1979, were motivated by a desire to conserve the resource; the former to protect “proven” breeding stock, the latter to protect sub-legal juvenile lobster. This is a period during which the industry became better organized and reasserted its prerogative to a leadership role in the management of the lobster resource.

This early history of lobster management demonstrates the influence of powerful factions within the industry in supporting rules which benefited them. Fortunately these rules had conservation benefits as well. Moreover, there was little or no serious opposition from state biologists with a perspective on management that departed significantly from the majority in the industry. In fact, dominant factions of the industry aligned with the commissioner and biologists to garner legislative support for the adoption of several measures including the maximum size limit and the escape vent. Although there were costs associated with arriving at agreement upon control measures, fisheries management during the first 130 years of the Maine lobster industry worked reasonable well because most of the measures emanated from the industry and information asymmetries between lobstermen and the scientific community were minimal. In 1985, however, action at the state level set in motion events that were to have profound and costly effect upon lobster management and indeed upon the regional

fishery political scene for several years. These events were a matter of a coincidence of interests between government fishery managers and leaders in the lobster industry and related to the legal size of lobster, the exclusive practice in the State of Maine of protecting egg producing lobsters, and the international trade in lobster.

State – Federal Partnership

Since 1972, the states along the Eastern U.S. seaboard have cooperated to coordinate lobster management research and the regulation of individual state lobster fisheries. This occurred under the auspices of the National Marine Fisheries Service (NMFS) State-Federal Partnership Management Program (Lobster Sub Board, 1978) and the Interstate Fishery Management Program of the Atlantic States Marine Fisheries Commission (NMFS 1998).

In 1977, shortly after implementation of the Magnuson Stevens Act management program, both the Mid Atlantic and New England Fishery Management Councils agreed, pursuant to a recommendation of a policy board established under the State-Federal Management Program, to prepare a fishery management plan for American lobster. In 1983, the New England Fishery Management Council's American Lobster Fishery Management Plan (FMP) was implemented in federal waters and, for the first time in the history of this country, the harvesting activities of lobster vessels became subject to federal management provisions.

During the time period between the initiation of the Federal-State coordinated lobster management Program in 1972 and the implementation of the New England Council's Lobster FMP in 1983, the lobster industry had little or no involvement in management activities beyond the state level. The activities of the Federal-State

Program were focused upon coordination and the Program *per se* had no authority to implement management measures or research initiatives directly. Its purpose was to provide a forum for cooperation and information transfer and any management or research measures it deemed appropriate were put forward as recommendations for state level action to be accomplished through regulatory or statutory change at the individual state level. This process accommodated the interstate variation in lobster fishing activities and management practices while acknowledging a broader regional relationship.

The Federal-State Program was a forum that was exclusively the domain of governmental agencies with no industry involvement. The lobster industry in Maine had ample opportunity to influence the direction of management initiatives in state level venues and clearly took advantage of that opportunity (see Acheson and Knight, 1998). Consequently, the industry had no reason to be involved in the State-Federal Program. The industry had even less reason to be involved in the activities of the Atlantic States Marine Fisheries Commission which was, by and large, unknown to the industry. Although the Commission did deliberate on matters related to the lobster resource and had a lobster management plan, as a body involved with the coordination of transboundary intra-coastal water resources, its focus was perceived to be upon those species considered of recreational use only such as striped bass.

The Magnuson Stevens Act had declared as federal waters, those beyond the territorial limit of a state and referred to the new management area as the Fishery Conservation Zone; now referred to as the Exclusive Economic Zone (EEZ). In the late 1970's when the Act was first enacted, the offshore lobster fishery was a relatively new

development that few Maine fishermen participated in. Although many, if not all Maine lobstermen fished in the new federal waters, it was only seasonally during times of inshore/offshore lobster migration and their fishing activities extended little more than 12 to 15 miles offshore. To most Maine lobstermen the federal waters were considered remote, both in terms of geography and technology, and few if any lobstermen even sought the newly required permit to fish in federal waters. In fact, federal and state authorities did not enforce federal permit requirements upon Maine lobstermen.

Despite the fact that the Magnuson Stevens Act had initiated federal regulatory authority over fisheries in waters frequented by Maine lobstermen, the lobster industry remained relatively disinterested in extra-state fisheries forums. Although the lobster *market* was clearly of regional interest to lobstermen, management and fishing practices were strictly a state and local concern. In fact the Maine lobster industry had little or no role or even involvement in the development of the New England Council's Lobster FMP. To the Maine lobster industry, the Council's FMP merely codified in federal regulation the salient lobster conservation measures already in force at the state level including a minimum carapace length of $3 \frac{3}{16}$ inches, prohibition on possession of egg-bearing lobsters, and provisions for escape vents to be fitted in lobster traps. As late as 1986, when the first amendment to the FMP was approved, the Maine lobster industry still had little involvement in the process, nor reason to become involved. Amendment 1 related to issues of no direct relevance to Maine (NMFS, 1998: 4). However, the industry's interest in extra-state management activities quickly changed thereafter.

Federalization

For a number of years, and certainly since the report of the Federal-State Program's Lobster Board in 1978 (LSB 1978), lobster biologists had called for an increase in the minimum size of lobster to enhance the reproductive potential of the resource. In the face of escalating pressure on the stock, the Lobster Board called for an increase in the minimum size to 3 ½ inches as the only practical means to address perceived excessive fishing mortality rates. State and federal biologists argued that too much of the harvest was upon female lobster that had not had sufficient opportunity to reproduce and that an increase in the minimum size would enable a greater portion of the population to survive the fishery long enough to procreate. This strategy was embraced by Maine's Department of Marine Resources which commenced efforts to bring about a change in state law to that effect.

Coincident at the time, the Maine lobster industry had become increasingly concerned about apparent efforts at the regional level to overturn conservation measures which had long standing popular support among Maine lobstermen (Acheson and Knight, 1998: 18). The State-Federal Lobster Board had reported that it considered the maximum size restriction, a provision exclusive to Maine, to be ineffective as a means of maintaining brood stock abundance. The Board also felt that the practice of cutting a notch in the tail a lobster's flipper, the so-called V-notch law exclusive to the State of Maine, created a source of infection and increased mortality. Several states had removed prohibitions on the landing of these notched lobsters (LSB, 1978: 77-78). The Maine lobster industry's concern about these developments was heightened by concerns that its competitive position in the market was slipping as a result of a recent and rapid

increases in imported lobster from Canada; lobster which could legally be brought into this country at a size less than Maine's legal minimum. The potential demise of laws considered important to the Maine lobster industry coupled with the industry's concern about competition was to set the stage for fifteen years of conflict, high transaction costs and failed management institutions.

In 1985, with the support of leaders in the lobster industry, the Maine State Legislature increased to $3 \frac{5}{16}$ inches the minimum size of lobster via a schedule of four $\frac{1}{32}$ -inch increments to occur over a five year period (Laws of Maine: 12 M.R.S.A. § 6431). As a mechanism to trigger the commencement of these increases, the legislation included a certification provision, which called for the state's Attorney General to certify that federal law had been modified in a similar fashion. Although not stated explicitly in the statutory language, the Maine industry believed that changes would be ushered in at the federal level to secure the V-notch and maximum size measures throughout the biological range of the resource and that efforts to address the importation of undersize Canadian lobster would also be taken.

In 1987, Amendment 2 to the New England Fishery Management Council's Lobster FMP was implemented. Commencing in 1988, the minimum size requirements were to increase via a schedule similar to that enacted in Maine. This amendment moved through the Council process rather expeditiously aided to a significant extent by industry leaders from Maine who had become engaged in the Council proceedings largely in an effort to secure provisions to protect if not expand the range of the V-notch and maximum size measures. The provisions adopted by the Council in this regard provided that no sanction would be imposed if notched and oversize lobsters were

released when obtained in federal waters, a much less restrictive measure than that advocated by the Maine industry, but a compromise which enabled adoption of the amendment. To address the Canadian import issue, Maine Congressman John R. McKernan, Jr., introduced a bill in the U.S. House of Representatives in 1985. This legislation was designed to amend the Magnuson Stevens Act so as to make it illegal to import live lobster of a size less than that established in U.S. federal regulation. This measure was ultimately enacted in 1989 under the sponsorship of Senator George Mitchell (MSFCMA, 1976: §307 (J)).

Coincident to the commencement of lobster minimum size increases in 1988, the regional and national economy began to decline and head towards recession. By the time of the first scheduled $1/32$ -inch increase, the lobster industry, along with many other sectors of the economy, had begun to feel the negative effects of the worsening economic conditions. By 1989, following the second $1/32$ -inch increase, industry leaders from both Maine and Massachusetts called for the Council to consider delaying further increases due to concern about the market and lobster availability (NEFMC, 1987, May 1989: 15). The concerns of U.S. lobstermen were heightened when Canadian government efforts to bring about an increase in the minimum size of lobster in that country failed in June of 1989. At about this same time, a paper prepared by a University of Maine researcher challenging the validity of minimum size increases as a management tool was circulated among and embraced by industry as further reason to delay (Steneck, 1989). At its June 1989 meeting, the Council was called upon by industry leaders from the New England states to delay the next scheduled increase for three years so as to provide time to evaluate market and biological conditions (NEFMC,

1987, June 1989: 7). By August of 1989, the first formal motion to delay was offered at a Council meeting.

This effort to delay further increases was defeated and it would be another year and a half before the Council would act favorably on the industry's request. To an industry which had often demonstrated its effectiveness at influencing management decisions at the state level, the federal regional management structure proved a much more ponderous and complex institution in which to effect change. Because the economic downturn effected all sectors of the industry throughout the region and because the industry held the minimum size increase responsible, the prospect of further so-called *gauge increases* became an issue around which the region's industry rallied. The formation of coalitions between various sectors of the New England-wide lobster industry proved essential, not just due to the logistical needs of the effort to delay the gauge, but because the industry had unwittingly begun to change the very basis of lobster management. Lobster management was to become truly a regional effort, one that required the direct participation of industry on a regional basis. It was at this time that the scale of the regional lobster industry became truly apparent to managers. It would be some time, however, before managers fully appreciated the diversity and regional differences to scale that existed within the industry.

The industry's approach to the gauge issue was three-pronged. At the regional level, industry leaders commenced lobbying efforts in their respective states for legislation to halt or delay gauge increases. They also became actively involved in the Council process as members of the Council's newly created industry advisory committee, as participants at the Council's Lobster Committee meetings and at plenary

meetings of the Council. At the national level, industry leaders became very familiar visitors in the Washington offices of their regional Congressional delegations. They also spent a considerable amount of time fostering relationships with government officials in leadership positions at the National Marine Fisheries Service and, its parent agency, the National Oceanic and Atmospheric Administration. Furthermore, industry leaders began to familiarize themselves with other fisheries management organizations, such as the Atlantic States Marine Fisheries Commission, and they developed relationships with various conservation organizations.

While industry leaders continued to prevail upon the Council to delay further increase in the gauge, they were also engaged at the international level working with their Canadian counterparts. United States legislation had been adopted in 1989 that effectively prohibited the importation of undersize live lobster and the Canadian government moved swiftly to petition for the establishment of a dispute settlement panel under provisions of the U.S./Canadian Free Trade Agreement. By June of 1990, the arbitration panel had found in favor of the U.S. and ultimately, the gauge delay became cast as a US/Canada free trade issue. During 1990, a considerable effort was devoted to joint meetings between U.S. and Canadian industry representatives. In August, at the urging of industry, a motion was offered during the Council meeting to request the implementation of an emergency amendment to delay gauge increases due to the implications for "international trade and benefits derived through a bettering of international cooperation" (NEFMC, 1987, August 1990: 8).

While a delay in further gauge increases was the original impetus for industry involvement in regional management forums, the focus began to change and ultimately

a new direction in lobster management began to emerge. The transition was marked by four events at the New England Fishery Management Council. The first event was a statement made by the Council's Lobster Committee Chairman during the Council's January 1990 meeting that signaled for the first time a shift in sentiment towards support for a delay and for the possibility of managing the resource through a means other than minimum size increases (NEFMC, 1987, January 10, 1990: 11). Second, the industry's rationale for a gauge delay was recast as a necessary and responsible pause to provide time to develop a new and more comprehensive approach to lobster management. This rationale ultimately swayed the Council which, during its January 1991 meeting, voted to delay further gauge increases and to develop a comprehensive amendment utilizing alternative management (NEFMC, 1987, January 1991: 8).

The third significant development occurred during the April 1991 Council meeting when the Lobster Committee Chairman indicated that the industry would be requested to develop a consensus position concerning measures to include in a comprehensive amendment (NEFMC, 1987, April 1991: 4). This was significant because the Committee leadership had agreed that the most appropriate approach towards the development of a comprehensive amendment was to delegate responsibility to the industry directly. At the October 1991 Council meeting, it was agreed that an industry group would be formalized for the purposes of developing a comprehensive lobster amendment (NEFMC, 1987, October 1991: 10).

The last, and particularly significant development ushering in change in lobster management occurred in June 1992 when the State Directors of the three largest lobster producing states (Maine, Massachusetts, and Rhode Island) mapped out a strategy for

regional lobster management that provided for industry's direct involvement in the development of management measures, federal withdrawal from the lobster management arena, and a shift in lobster management jurisdiction back towards state primacy.

The sought after temporary gauge delay occurred on January 3, 1992, when the National Oceanic and Atmospheric Administration announced in the Federal Register the final rule implementing Amendment 4 to the Fishery Management Plan for American Lobster. This amendment in essence froze the legal minimum size of lobster at 3 ¼ inches, delaying for two years, until December 27, 1993, further scheduled increases in the gauge. In the interim, the New England Fishery Management Council was to develop a comprehensive amendment (Amendment 5) providing an alternative approach to management of the resource throughout the range of the species to reduce the risk of overfishing. The formal impetus for this alternative approach, one involving the industry directly in its development, was a May 16, 1991 Council motion that:

“the Council approve the development of an amendment to the Lobster Management Plan which would comprehensively address management throughout the range of the resource. To initiate the amendment development process, the Council shall request that the U.S. lobster industry provide the Council with a consensus position as to what conservation and management measures it wants to see incorporated into this amendment...” (NEFMC, 1987, May 1991: 8).

Using the Council's Lobster Industry Advisory Committee as its base and other industry representatives who expressed interest in participating, an initial working group was established at a meeting on August 15, 1991 (Marshall, 1991a). This group was ultimately to grow and formalize as the Lobster Industry Working Group. Meetings

of the LIWG, facilitated by the University of New Hampshire's Cooperative Extension service, were conducted in various New England ports through the balance of 1991 and throughout 1992. In December of 1992 the National Marine Fisheries Service agreed to provide financial support for the development of the industry's proposal for Amendment 5. A contract was let with Drs. Acheson, Steneck and Wilson of the University of Maine for that purpose (CFN, 1993a: 17A) and on May 17, 1993 the Council received a draft of the LIWG's Amendment 5 (Russell, 1993a). In addition to maintaining existing lobster management measures, the industry proposed a four-zone regional approach to management including a framework for developing an overfishing definition and the creation of an Effort Management Team to develop long-term management strategies within each zone. The industry approach also proposed mandatory reporting, controlled access to the fishery with a two-year moratorium on new entry and a limit on the harvest of lobsters by vessels rigged for dragging (NEFMC, 1993a).

The 10 Percent Solution

The protocol developed by the Council for the finalization of Amendment 5 called for joint participation by the Council and the Atlantic States Marine Fisheries Commission, their respective lobster committees, and their technical advisory bodies (Marshall, 1991b). On May 18, 1993 the Council's Plan Development Team (PDT) conducted a review of the industry's draft Amendment 5. This review uncovered a number of substantive policy issues, the most significant of which related to the proposal's means of translating the calculated level of fishing mortality (F) to satisfy a 10 percent maximum Egg Per Recruit (EPR) threshold criteria required under

guidelines developed by the National Marine Fisheries Service. In the PDT's view, the industry's proposal was deficient in providing increases in lobster spawning potential equivalent to that which would have been achieved by the gauge increases that would otherwise had been implemented. This related both to the means by which this equivalent would be achieved and its timing (Russell, 1993a; 1993b). The overfishing definition and the status of the resource with respect to that definition proved to be an extremely vexing issue, causing delay in finalization of Amendment 5 and ultimately playing a part in the federal /state conflict over lobster management jurisdiction. The Lobster Industry Working Group suggested in its draft amendment that effort reductions (to be accomplished through the use of the proposed Effort Management Teams) would be appropriate to reduce overfishing. However, neither the industry nor the joint NEFMC/ASMFC lobster committees had achieved progress in developing specific necessary measures to this end (Brancaleone, 1993).

Although risk assessment was not initially required under the Magnuson Stevens Act, in 1989 the NMFS promulgated guidelines requiring such assessments in the form of overfishing definitions (50 CFR § 602.1-17). Prior to these 602 guidelines, therefore, a risk definition was not included in the Lobster Fishery Management Plan. However, as Amendment 4 (providing a temporary delay in gauge increases for two years) was developed following this promulgation, it was required to include a definition of overfishing. The definition included in Amendment 4 was considered by the NMFS to be "a provisional definition pending more complete analyses of lobster population dynamics" (Roe, 1991). It had been developed by the NMFS for purposes of a proposed Secretarial amendment and was made available to the Council during the

development of Amendment 4 (Peterson, 1992). The scientific basis for the definition was a new growth and egg production model developed by NMFS scientists Fogarty and Idoine (1988) building on work done by Canadian federal scientists that incorporates molt increments, molt frequency and fecundity information. These are used to model egg production per recruit, considered to be analogous to spawning stock biomass per recruit. The definition states that the American lobster resource is considered to be overfished when, based on information concerning the status of the resource throughout its range, it is harvested at a fishing mortality rate (F) and minimum size combination that results in a calculated egg production per recruit of less than 10 percent of a non fished population. The selection of 10 percent (as opposed to 5 or 15 for example) was based upon life history studies and was the NMFS scientists' best estimate of the lower level at which egg production might be inadequate to support the population.

Scientific confidence in the definition was not universal because a stock recruitment relationship had not been demonstrated and the model relied upon data from the offshore fishery only, thus it had little application for inshore populations (Howell, 1992). The industry, reacting to dire predictions of collapse in the face of years of steady increases, were also skeptical of the definition developed by the federal scientists (Allen, 1991). The Council requested on several occasions that NMFS review the definition prior to development of the comprehensive amendment called for in Amendment 4. In April 1991 the Service responded that "(n)otwithstanding the lack of precise information, the provisional reference point of 10 % attempts to address the underlying overfishing of the parental stock, and the potential long-term ramifications

for fishery yield” (Pearce, 1991). In 1992 the Service again registered support for the definition, stating that it was “satisfied that it is the best available given our current scientific knowledge. In addition, it meets the criteria for rate-based definitions called for under (the 602 Guidelines)” (Peterson, 1992). The Industry Working Group forged ahead to develop Amendment 5. Although it proposed to retain the 10 percent maximum spawning potential definition initially, the industry draft amendment also proposed that eventually the provisional definition would be used in concert with several other criteria for determining the status of the stock.

Given the growing complexity of the situation caused by the difficulty addressing overfishing goals and that the regulatory processes for state and federal waters are different, the Atlantic States Marine Fisheries Commission decided to defer action on a complimentary management plan until the Council’s amendment had been completed. The Council’s committee, however, was hoisted somewhat upon the petard of the timeframe established in Amendment 4 mandating an alternative strategy to forestall further gauge increases. Developing specific measures to address overfishing proved to be too difficult a task to accomplish prior to the December 27, 1993 Amendment 4 deadline, therefore, the committee opted to postpone that task for a year and to forge ahead with other necessary components of an amendment.

Seeds of Change: The Regional Approach

The approach that the Council and ultimately the federal government was to take with respect to lobster management was laid out in a June 23, 1992 memo from the Maine state director to state directors Borden of Rhode Island and Coates of Massachusetts. I was at the time Maine’s state director and had been the chairman of

the Council's Lobster Oversight Committee. This memo presented my observation about the management situation and recommended a strategy for dealing with the number of difficult issues thwarting development of an alternative management approach, including the extensive federalization of the lobster fishery. This strategy contained four elements:

- “1. That the Lobster Industry Working Group proposal submitted on June 17 be used as the fundamental elements of a revised management approach. These provisions would be applicable throughout all areas of management.
2. That the revised management approach also provide for separate management ‘units’ which describe inshore/offshore and regional variations in lobster fisheries. Within these management units, different management measures may be utilized beyond those considered to be fundamental elements common to all management units.
3. That we will explore the possibility, under Magnuson but not necessarily through a plan amendment, to delegate management authority for lobster to some other non-NEFMC entity (i.e. geopolitical sections of ASMFC).
4. That we will move forthwith to identify the most expeditious means of extending the deadlines established under the last amendment.

The principal purpose of the proposal is to utilize a ‘Striped Bass Act’ approach to lobster management. An approach which utilizes common elements, and yet allows for regional variations and state level enforcement in the inshore fishery. The contemplated approach would also empower the non-NEFMC entity to develop management measures for the offshore fishery and provide a federal enforcement mechanism” (Brennan, 1992).

This strategy set the stage for the significant change that was to take place in lobster management. A change that accommodated the scale and complexity of the regional lobster fishery and enabled complementary involvement of industry in the management decision-making process.

The lobster committee agreed to use the Lobster Industry Working Group's proposal to serve as the base for Amendment 5, thereby endorsing the concept of regional lobster management. In November 1993, the Council conducted a series of hearings on an amendment that would maintain the minimum size of lobster at 3 ¼ inches, limit entry into the fishery, establish four lobster management zones (three zones along the eastern seaboard plus one offshore zone), and create a mechanism to enable differing management within each zone. Fundamentally, Amendment 5 proposed to shift the basis of lobster management away from reliance upon the gauge to reliance upon effort reduction. Although many in the industry were reluctant to see this change, it was acknowledged that effort was too high, that there were too many traps on the bottom and too many people trying to catch lobster (CFN, 1993b: 1B).

At its December 8-9, 1993 meeting, the New England Fishery Management Council voted 13-2 in favor of Amendment 5 to the American Lobster Fishery Management Plan. Although the Council had met the required time frame to forestall further gauge increases, the National Marine Fisheries Service needed time to review the amendment and announced on December 28, 1993 a 146-day delay in further increases while it did so. Although the Service had previously signaled its concerns that the amendment was deficient, at the January 1994 Council meeting the Services' Regional Director made it clear that, if the deficiencies could not be adequately addressed, responsibility for the lobster fishery could default to the Secretary of Commerce. But it was also at this time that the federal government indicated its reluctance to get mired in the "politics of the gauge" because lobster management is "largely an issue of the states" (CFN, 1994b: 12A). One option available to the federal

government was to withdraw the federal lobster FMP and thus remove the lobster fishery from federal control, a proposition the Regional Director had earlier made clear to the Council (NEFMC, January 1993: 2-14).

The logistical possibilities of this option became more real in December of 1993 with passage of the Atlantic Coastal Fisheries Cooperative Management Act (ACFCMA, 1993: 16 U.S.C. 5101-5109) which was modeled on the Atlantic Striped Bass Conservation Act (16 U.S.C. 1851) mentioned in the state director's memo above. The "interjurisdictional bill" as ACFCMA was commonly referred, authorizes financial assistance to the coastal states and ASMFC to adopt and implement fishery management plans. The Act also provides a federal means of ensuring that coastal states comply with fisheries management plans developed by ASMFC. Most importantly, however, ACFCMA provides a means of federally enforcing state (ASMFC) developed management measures in federal waters. The Atlantic Coastal Fisheries Cooperative Management Act enables the federal government to leverage control over coastal state resources without having direct responsibility for their management. The passage of ACFCMA, therefore, provided the federal government with a means of distancing itself from lobster management without having to abandon a resource it argued was overfished.

On May 11, 1994 the National Marine Fisheries service informed the Council that it had partially disapproved Amendment 5 (Peterson, 1994). Although the gauge freeze, regional management approach, moratorium on entry, permitting requirements, and framework provisions were preserved, the Service was opposed to elements of Amendment 5 that would have divided the fleet into vessel permit categories and

imposed a landings quota upon the trawl sector. This would, in the Service's view, violate National Standard 4 of the Magnuson-Stevens Act that management measures not discriminate against residents of different states. Despite this, the Council had already begun work on framework refinements to Amendment 5 by formally establishing the Effort Management Teams that would develop specific management measures for the four lobster management zones originally proposed and an additional zone in the Outer Cape Cod area added after public hearings. Coincident to this, the Atlantic States Marine Fisheries Commission began preparation of Amendment 2 to its obsolete lobster plan to bring it into conformity with existing federal standards. These standards were the 3 ¼ minimum carapace size, a requirement for escape vents, and a prohibition on possession of berried and scrubbed lobster, lobster meat and lobster parts (ASMFC, 1995).

The Battle For Primacy

With passage of ACFCMA and the Effort Management Teams working to develop area specific management strategies, the stage was set for federal withdrawal of the lobster FMP. This, however, would not happen quickly, smoothly, or without conflict. Under Amendment 5, the Effort Management Teams worked to develop proposals to address overfishing and establish criteria to be used to assess reductions in fishing induced mortality. These included existing measures in some areas and trap reductions in others. What the industry hoped to achieve with respect to existing measures was a quantified acknowledgement by the fisheries service of the conservation value associated with measures such as V-notch protection and the 5 inch maximum size. The service steadfastly refused to oblige, however, and this created

significant conflict between factions of the regional industry and between the Maine industry and federal scientists.

The EMT's continued to work through the balance of 1994 with an ambitious deadline of January 20, 1995 to submit proposals for the five areas including the Gulf of Maine (Area 1), Southern New England Inshore (Area 2), Outer Cape Cod Area, Offshore (Area 3), and the Mid Atlantic (Area 4). Each EMT was comprised of a core group of technical members as well as industry members appointed on an area basis. The EMT process proved to be extraordinary in that several disparate factions of a regional fishery were able to reach consensus on a management strategy within an 18 month period. Their success is further demonstration of the benefits associated with reducing scale complexities through area management.

Once the area-specific recommendations were received, the schedule called for the Council to submit a comprehensive management package to the National Marine Fisheries Service on July 20th. This package was to be submitted in the form of a framework adjustment to Amendment 5 rather than as a more cumbersome amendment (CFN, 1994a: 12A).

Just days after the EMT's met their January 20th submission deadline, the National Marine Fisheries Service notified the Council, and put the states on notice, that it would not approve a revision to the lobster plan unless comparable regulations were in force within state waters. The principal issue of concern to the federal agency was that management measures span the boundary between state and federal waters and effectively reduce fishing mortality. According to the Regional Administrator of NMFS, the management measures would have to relate to a conservation standard that

“applies throughout the range of the stock” and is based upon the overfishing definition (CFN, 1995: 5B). The federal propensity to standardize the regulatory approach was thwarting efforts to devise management measures that accommodated variations in scale and complexity. What had been considered by the service as a provisional overfishing definition, became the *de facto* standard and the service was adamant that management measures in Amendment 6 would have to meet the 10 percent egg production definition established in Amendment 5.

On this point, NMFS was adamant, however, the states and Council members were skeptical and the industry was outright opposed because adherence to this standard would translate into a 50 percent reduction in effort over 10 years in the Southern New England area and a 20 percent reduction over five years in the Gulf of Maine. The effort to modify the EMT proposals to conform with the overfishing definition standard proved to be extremely difficult for the Council, particularly so because each area proposed different qualifying criteria and effort reduction measures that were deemed most appropriate to local areas. Considering that each modification to the EMT proposals lessened the support of area lobstermen, it was not surprising that the Council failed to meet its deadline for submitting the comprehensive management package and withdrawal of the federal management plan became imminent.

On February 23, 1996, via letter to the Council Chairman from the head of the National Marine Fisheries Service, the Council was informed that the agency intended to “withdraw Secretarial approval of the Fishery Management Plan for American lobster and remove its implementing regulations...” (Schmitt, 1996). Ostensibly, the basis for this action was President Clinton’s plans for further regulatory reform as part

of his efforts to reinvent government and the consequent “elimination, consolidation, and/or revision of those regulations that are outdated or otherwise in need of reform.” However, this reform effort merely provided legitimate cover for action the agency had already decided upon “because more appropriate mechanisms for management of this resource exist ... (specifically)... regulations to protect American lobsters in the EEZ ... (to be)... initiated through action by the Atlantic States Marine Fisheries Commission ... under the authority of the Atlantic Coastal Fisheries Cooperative Management Act.” Once the ASMFC had a comprehensive management plan in place, the Fisheries Service would delegate primary management responsibility to the Commission.

The ASMFC Lobster Board adopted a timetable for developing a comprehensive interstate plan with a target date of early 1997 (CFN, 1996: 2B) and commenced development of Amendment 3 to its lobster management plan. The Commission recognized the level of work that went into the development of the EMT proposals and was intent upon incorporating as much of their work as possible (ASMFC, 1996). The ASMFC proved to be good on its word and took to public hearing in the summer of 1997 an amendment that contained many of the key elements of the original EMT proposals (ASMFC, 1997). The foundation of Amendment 3 is adaptive management, an approach similar in concept to the area management upon which the Council’s Amendment 5 was based. Also like Amendment 5, the Commission’s Amendment 3 implements some fundamental regulations throughout the range of the resource and leaves to seven EMT-like Lobster Conservation Management Teams (LCMT) the development of effort reduction measures.

However, by the Fall of 1997 the National Marine Fisheries Service appeared far less committed to distancing itself from lobster management and delegating management responsibly to the ASMFC. During meetings of the Commission and of the Council in September and October, representatives of the Service made it clear that the Commission's plan was no better than the Council's in addressing overfishing and that the Service had no intention of withdrawing the federal plan until something was developed to do so. This angered members of both management entities who charged that the federal government was holding "the states hostage when 90 percent of the resource is under state jurisdiction" (CFN, 1997a: 2B). Nevertheless, in late October the Service announced in the Federal Register its intent to examine alternatives for managing lobsters in the Exclusive Economic Zone as well as state waters (NMFS, 1997). This began a game of brinkmanship, the overriding priorities for NMFS being to end "overfishing and restoring egg production" according to the federal Regional Administrator (CFN, 1997b: 5B). Adoption of the initial federal fishery management plan for lobster in 1983 had the effect, perhaps unintended at the time, of federalizing the lobster fishery and subordinating state control. However, the language in Section 306 (b) of the Magnuson-Stevens Act suggests that a state's jurisdiction over a fishery is not diminished if the fishery is one that is practiced predominately within state waters and it was clear to the state directors, on that basis, that the American lobster fishery was clearly a state waters fishery. A state/federal confrontation over jurisdiction supremacy thus ensued.

The Service was demanding that trap limits be incorporated into Amendment 3. However, the Commission argued that to do so in areas without existing limits before

the Conservation Management Teams had a chance to meet, would violate the intent and purpose of adaptive management (CFN, 1998a: 8B). Ignoring the NMFS threat, the ASMFC passed Amendment 3 on December 12, 1998. However, the Magnuson-Stevens Act as amended in October 1996 by the Sustainable Fisheries Act (Pub. L. 104-297) provided NMFS with a trump card in that the new amendment requires the Secretary of Commerce to step in to end overfishing and rebuild overfished stocks where a Council fails to do so. As the management of lobster was still technically within the domain of the federal government and the New England Fishery Management Council, the federal agency had a legal prerogative to force an effort reduction via trap limits despite the fact that the fishery occurred predominately within state waters and that any action by the federal government would be tantamount to federal encroachment into state territorial waters.

In March 1998 the National Marine Fisheries Service issued its draft management approach in preparation for public hearings (CFN, 1998b: 1A). The approach contained provisions for both the trap and non-trap fisheries, its primary management strategy for the trap fishery proposed to establish three fishing zones within which an initial trap cap would be set and then reduced annually into the year 2003. The zones proposed were (A) from 0-30 miles, (B) from 3-30 miles, and (C) beyond 40 miles from shore. Between 30 and 40 miles a 10-mile buffer zone was proposed within which no traps could be set. Within Zones A and B the initial trap cap would be set at 800, and reduced 10 percent annually to a total of 480 traps per permit holder. In Zone C the initial cap would be 2,000 traps, reduced to 1,200 by the year 2003. This proposal was roundly criticized by lobstermen at all thirteen hearings the

Fisheries Service held along the eastern seaboard. Interestingly, although not surprisingly given the concern lobstermen had about the draconian nature of the proposed trap reductions, “the most common thread outside of Maine (in the lobstermen’s comments) was support for an increase in the minimum size” (CFN, 1998c: 20B). An increase in the gauge was seen by many as the lesser of two evils, although support was expressed for the ASMFC Amendment 3 adaptive management approach.

State Control Regained

Between these public hearings and January 13, 1999, the Service relented and acknowledged that the majority of the lobster fishery takes place in state waters and that regulatory action in the EEZ, “even a total moratorium on harvesting lobsters, would not end overfishing of the resource without implementation of effective management measures by state jurisdictions.” In its Federal Register solicitation of comments on its proposal to abandon its management approach and finally transfer management authority to the ASMFC, the National Marine Fisheries Service acknowledged that “it is not possible to meet the requirements of the Magnuson-Stevens Act without full cooperation of states with lobster fisheries, and thus a cooperative management partnership under ACFCMA is preferable” (NMFS, 1999a). The Deputy Assistant Administrator of NMFS confirmed that the agency proposed “full adoption of the ASMFC plan structure” (CFN, 1999: 1A).

On December 6 of that year the Service announced the final rule, to become effective in January 2000, transferring management authority from the Magnuson Stevens Act to the ASMFC via the Atlantic Coastal Fisheries Cooperative Management

Act (NMFS, 1999b). Seventeen years after the states unwittingly ceded preeminent management authority for the lobster fishery to the federal government, that authority had once again been regained.

Since assuming management jurisdiction, the Atlantic States Marine Fisheries Commission has focused upon efforts to meet the 10 percent egg production goal. Utilizing the adaptive management approach and the concept of conservation equivalency to “provide states with the flexibility to adopt alternative management approaches” in the management of the lobster resource (ASMFC, 2001a). The Commission in February 2001, approved Addendum II of its lobster fishery management plan. This measure establishes a schedule for egg production rebuilding, minimum size increases, and trap reductions based upon recommendations of the Lobster Conservation Management Teams (ASMFC, 2001b). In the Fall of 2001, the Commission sent out for public hearing Addendum III developed by the LCMTs that, among other things, mandates V-notching in certain offshore areas and provide for the use of a maximum gauge size (ASMFC, 2001c). These two provisions had been exclusive to the State of Maine. They are also the provisions that led initially to federalization of lobster management and, in part, they are provisions that caused significant conflict and transaction costs between factions of the regional fishery and between the Maine industry and federal scientists.

In the twenty-five year history of federal involvement in the lobster fishery, The management institution has shifted dramatically. The minimum size has increased as advocated for by many in the scientific community, gear and entry limitations have been imposed to rationalize socioeconomic and biological conditions in the fishery, the

management community has conceded the conservation benefits of the V-notch and maximum size measures advocated for by the Maine lobster industry, a statutory prohibition on the importation of undersize Canadian lobster has been enacted, an adaptive and collaborative approach to management has been instituted that recognizes differences between regional sectors of the fishery, and lobstermen throughout the range of the resource have a formal role in the management decision-making process.

Although still overfished relative to biological targets, the control measures presently being adopted are apparently relieving this condition. According to the most recent stock assessment, lobster stocks in the Gulf of Maine, Georges Bank, and Southern New England are all considered to be below the 10 percent egg per recruit reference point. However, in recent years recruitment, total egg production, and stock abundance have increased in all areas leading assessment scientists to conclude that recruitment overfishing has stopped (ASMFC, 2001d). Participants in the fisheries management bargaining process have agreed upon rules to address the collective action dilemma and these rules appear effective in conserving the stocks. It is thus reasonable to conclude that based upon these outcomes, lobster management has been successful.

Summary

The history of lobster management for the purposes of this thesis can be framed into somewhat different time periods than those identified by Acheson (1997). The first period is one of state-level control between 1870 and 1970 during which time most of the important lobster conservation measures were established. During this period the industry had significant influence within the legislative/state agency venue and most measures that were adopted resulted from distribution fights between sectors and

factions of the industry. This is also a period during which there was little or no serious opposition from state biologists with a perspective on management that departed significantly from the majority in the industry. In fact, dominant factions of the industry aligned with the commissioner and/or biologists to garner legislative support for the adoption of several measures still in use today. Fisheries management during the first 130 years of the Maine lobster industry worked reasonable well because most of the measures emanated from the industry and information asymmetries between lobstermen and the scientific community were minimal.

The second period can be characterized as one of federal control, beginning when the states relinquished primacy to the federal government in the mid 1980s. This occurred as a coincidence of interests between state agency scientists seeking to advance biological goals (a 3 ½ inch minimum size) and industry policy entrepreneurs seeking to secure preferred management measures (V-notching and maximum size). It is a period characterized by significant distribution fights between the industry on a regional basis and the federal government. And, it is a period of high transaction costs both in terms of power asymmetry with respect to the manner in which the Magnuson Stevens Act was implemented and with respect to asymmetrical information pertaining to the reproductive potential of the resource and the conservation value associated with the V-notch and maximum size measure. During this period the complexities of regional scale compounded by asymmetries of power and information made it difficult for parties to the fishery management bargaining process to overcome the relatively high transaction costs and put in place effective rules that had political support. However, while the industry had less direct influence within the federal venue during

this time period than it previously had at the state level, this period also saw the development of an area management approach that lessened the complexities of scale and enabled the industry to develop regional capabilities that positioned it to transition into the third period of lobster management.

The third period of lobster management is one characterized by a devolution of management authority from the federal level back to the state level under the aegis of the Atlantic State Marine Fisheries Commission. It is also a period of significant advances in co-management and industry/government collaboration at the regional level through the Lobster Conservation Management Teams. Asymmetries of power have been reduced so that management measures can once again emanate from the industry, issues of scale have been addressed through area management, and many information asymmetries have been reduced due to acceptance of the conservation benefits associated with management measures advocated by industry.

Groundfish Management

The contemporary management history of groundfish is far less complex, from a jurisdictional perspective, than is lobster because it is almost exclusively a federal waters fishery. However, from a biological perspective it is far more complex because of its multi-species nature. Prior to the enactment of the Magnuson Stevens Act in 1976, U.S. fishermen were subject only nominally to federal involvement under the ineffective management of the International Commission for Northwest Atlantic Fisheries. The regulation of fisheries, therefore, was ostensibly the exclusive responsibility of the states. The management of those fisheries occurring seaward of the territorial jurisdiction of the coastal states, such as groundfish, depended essentially

upon the degree to which an individual state cooperated with interstate management measures and, through state-level landing laws and licensing provisions etc., pursued enforcement action.

A Difficult Compromise: The Failure of Quota-based Management

Since the commencement of management under the Magnuson Stevens Act, analytical limitation coupled with the procedural complexity of the Act has often forced the Regional Councils to respond in a reactive nature rather than strategically. This, unfortunately, is the reality of many regulatory programs (Breyer, 1982). Because of the uncertainty caused by informational limitations, managers have often found it necessary to revise plans to accommodate economic exigency. Managers have been accused of overlooking the long range planning necessary to satisfy stock rebuilding goal for the sake of maximizing the fishermen's yearly catch and income and to maintain the Council's political stability. The early development of the Atlantic Groundfish Fishery Management Plan (FMP) is a case in point. The difficult compromise between promotion of the industry and conservation of the resource led to piecemeal development of guidelines incorporating trip limits, quotas and vessel allocation. In some respects, piecemeal development continues today.

Due to the depressed condition of many New England groundfish stocks, the groundfish fishery management plan (exclusively for cod, haddock and yellowtail flounder at the time) was one of the first developed and approved by a regional fishery management council (Warner et al., 1980: 51). The plan was not technically developed by the New England Fishery Management Council but primarily by the National Marine Fisheries Service and was an extension of the quota-based management program

were reached, the Council would establish new ones that, in turn, became the new harvest target (Hennessey, 1983: 81). Eventually there were more than 100 different quotas regulating the harvest of Atlantic groundfish.

Unfortunately, serious subsidiary problems began to manifest including erosion of reliable commercial statistics upon which active regulation depends. According to the New England Regional Council, fishermen reported where and how much fish was caught “in such a way as to avoid a violation of the regulations rather than to convey accurate information. Because of limited enforcement resources and unwillingness by fishermen to testify against others, data evasion could not be prevented. The erosion of the database has skewed data important for stock analysis...” (NEFMC, 1981).

Fishermen often considered the management plans too technical and as a consequence of widespread misreporting, they did not agree with the scientific and technical data upon which management plans were based. “As a result, the plans and accompanying regulations were not well received and supported” (USGAO, 1979: 23). Hostility, mistrust, and poor communication among scientists, fishermen, and managers intensified the management failures. Hennessey and Healey (2000: 208) report that “(i)t was not just normal scientific uncertainty that weakened the influence of scientific advice in the management of the New England fishery, but scientific uncertainty coupled with low credibility of scientists among managers and fishers.”

Any support that may have existed was further eroded by the fishermen’s perception of inconsistent enforcement. It was stated in a report by the General Accounting Office, that fishermen “allege that NMFS efforts for the most part have centered on Gloucester where the agency’s regional headquarters is located while other

established by the International Commission for Northwest Atlantic Fisheries (ICNAF). Eleven weeks after implementation of regulations in 1977, New England fishermen exceeded the entire cod quota established in the new FMP for that year. The fishery was subsequently closed, however, the public reaction against the closure was so intense that the Secretary of Commerce instituted emergency economic provisions which raised the quota, opened the fishery and thus relieved the political pressure.

As the stocks improved with the removal of foreign fishing effort, the number of domestic vessels increased dramatically between 1977 and 1980 causing the annual quota to be caught more and more quickly each time it was set (NEFMC, 1993b). Management measures were changed almost weekly with the quotas increased five times in the three years following adoption of the initial FMP. This direct regulation of the harvester had supplanted the fisherman so that the Council had begun making decisions normally made by the fisherman (Hennessey, 1983: 77). Moreover, these yearly quotas played havoc with the market by creating gluts, price declines and idle fleets.

In an attempt to alleviate these market problems, the Council instituted quarterly quotas designed to spread the catch more evenly throughout the year. However, the capacity and capability of the vessels varied to such a degree that all were not able to take an equal share of the resource before the quota was reached. This prompted the Council to further amend its plan to allocate quotas based upon vessel class. Unfortunately, the imposition of quotas encouraged fishermen to engage in intense fishing when the season opened. Quotas were then viewed as targets with the end result being that the quota would be reached more quickly than intended. As the initial quotas

ports, such as New Bedford, which harbors large fishing fleets, receive lesser attention. They also indicate that smaller ports throughout the entire region receive little or no coverage. ... A Department of Transportation internal audit report cited the Coast Guard for similar inconsistencies in its enforcement program, specifically in the 3 to 12 mile offshore area.”

Because fisheries management schemes can only attempt to manage fishermen and not fish, maximum effectiveness in any management plan depends upon a high degree of cooperation from the industry. The continued changes in regulation, the ability to secure regulatory loopholes, the perception of inconsistent enforcement, and the time it took for the federal government to resolve violations led fishermen to generally become uncooperative with management regimes (Pollnac and Miller, 1978; Sutinen and Hennessey, 1986; Sutinen, Reiser and Gauvin, 1990). Serious violations of management regulations such as the use of small-mesh liners in cod-ends and fishing in closed area have been admitted by fishermen (Hall-Arber and Finlayson, 1997: 122). Reports of fishing violations during the early years of groundfish management were common in local papers and trade journals – “dragger fined for fishing in closed spawning site,” “boat’s catch exceeds limit by 10,000 lbs.,” “Old Colony fined \$100,000 for landing limit violations” (Pierce, 1982: see attached newspaper clips). It had become so common place to evade regulations that fishermen who did adhere to regulations were scoffed at by their competitors (Pierce, 1982: 17) and “suffered economic hardship, lost prestige in the eyes of other fishers, and lost their credibility as effective captains” (Hennessey and Healey, 2000: 196). The widespread level of violation and the federal government’s failure to adequately enforce the management

regulations was of such concern to the New England Fishery Management Council that it sent a telegram to the Secretary of Commerce urging immediate action to prevent further erosion of the Council's credibility and prevent further social, economic and biological problems within the New England fishing industry (Pierce, 1982: 16).

Clearly fishermen were opposed to regulation of the groundfish fishery, an attitude Acheson (1984: 322) documented during a 1978 survey of New England fishermen. However, violation was not the only means of avoiding or circumventing the effects of regulation. Acheson also found that fishermen innovated significantly by purchasing larger vessels, by investing in electronic gear to improve their fishing efficiency, and by increasing the amount and kind of fishing gear to improve the effectiveness of their fishing operation. The net effect of the industry's response to management constraints upon their activities (innovation and violation) has been twofold in that the putative benefits of the control rules have been negated and the transaction costs involved in managing this fishery have escalated and remain high today. High transaction cost coupled with the information disconnect between fishermen and scientists that Hennessey and Healey (2000) point to has intensified the fisheries management failure and has contributed to continued declines in the groundfish resource.

The fact that difficulties were encountered during the implementation of the Atlantic Groundfish FMP is not surprising considering that the Council system was a new entity, that NMFS was just beginning to grasp its role under the new system and that for the first time in the history of the New England fishery, domestic fishermen were brought under a federal management regime. The net effect of quota-based

management in the New England region was that conservation goals were not achieved nor were the promotional aspects of the Magnuson Act fostered. This early experience with quota-based management has *poisoned the well* such that managers today assiduously avoid them. Confronted today with serious resource concerns and pressed by the courts to respond with appropriate management tools, the New England Fishery Management Council continues to have difficulty with quota-based management or derivatives that would require the imposition of total allowable catches as part of a suite of management measures.

Passive Management

By the early 1980s, the Council had become convinced of the fallacy of the single species management approach that it adopted from the federal and international managers. It abandoned this form of management in order to concentrate on the long term concerns of the multi-species fishery. Stock conditions had stabilized by 1979 to the point where the Council felt intervention and control could be minimized. As an alternative, the Council instituted a passive form of management upon the fishery incorporating indirect controls such as minimum fish sizes, a minimum codend mesh size, and selective closures of spawning areas. The fishery operated with minimal restrictions enabling the Council time to gain a better understanding of the fishery's dynamics and to prepare a long-term management program (NEFMC, 1981). However, stocks continued to decline. In part this was exacerbated by the boundary established by the International Court of Justice in October of 1984 between U.S. and Canadian waters in the Gulf of Maine/Georges Bank area, referred to as the Hague line (ICJ, 1984). This delimitation put the most productive haddock grounds, traditionally fished

by U.S. vessels, on the Canadian sides of the line thus forcing U.S. fishermen to fish on other parts of Georges Bank closer to shore. By the time the New England Council submitted its new Northeast Multispecies FMP in late 1984, the scientific community had begun to express concerns about the status of the stocks.

The 1982 Interim Groundfish Plan defined optimum yield in a very curious fashion. It declared that optimum would be the amount of fish harvested by U.S. fishermen in accordance with the indirect control measures incorporated in the plan (NEFMC, 1981). In essence the Council declared that the optimum harvest would be whatever U.S. fishermen would be capable of taking. This was a prescription for calamity because fishing effort, aided in large part by federal subsidies, doubled with most of the increase coming from new large vessels that were much more efficient as a result of advances in electronic sounding and navigational instruments. In the time period between enactment of the Magnuson Stevens Act and adoption of the Interim Plan, groundfish landings from Georges Bank increased by 83 percent, Southern New England landings increased by 94 percent and Gulf of Maine landing more than doubled (U.S. Congress, 1992).

The new fishery management plan developed during the interim years built upon the passive form of management operative during the intervening years and it was the first plan ever to use biological targets designed to prevent overfishing (NEFMC, 1993b). Its objective was to prevent stocks from reaching minimum abundance levels through the imposition of more restrictive, but nevertheless indirect control measures. These included a 5¹/₂ minimum mesh size for cod-ends used in certain fisheries, closures of spawning areas during certain times of the year, and minimum size limits for

cod, haddock and yellowtail flounder and newly added species including witch flounder, American plaice, winter flounder and pollock (NF, 1985: 12-13; NEFMC, 1985). The plan also established an exempted fisheries program for small mesh fishing in the Gulf of Maine and it created provisions for a Technical Monitoring Group (TMG) to periodically review the plan's effectiveness. Importantly, the plan also required that any vessel participating in the groundfish fishery must obtain an annual permit to do so.

The biological targets incorporated in the plan were expressed as the maximum spawning potential of the resource. The spawning potential ratio is the number of eggs that could be produced by a fish over its lifetime as part of fished stock divided by the number of eggs that could be produced by the same fish from a stock that is not fished. Essentially, this incorporates the principle that enough fish must survive to spawn in order to replenish the stock at sustainable levels. The Spawning Potential Ratio (SPR) can also be expressed using the biomass or weight of fish that contribute to spawning as a substitute for the eggs produced in a fished and unfished stock. It is generally agreed that for most of the species in the multispecies complex, the stocks can maintain themselves if the spawning stock biomass is maintained at 20 percent and this is the target incorporated in the Multispecies FMP. In concept, if the spawning stock biomass falls below 20 percent, fishing mortality should be reduced.

The Northeast Multispecies Fishery Management Plan as implemented was a much less interventionist approach than the original New England groundfish FMP and less onerous to industry, having been modified several times during the drafting stage to accommodate industry's concerns (CFN, 1985: 20). The National Marine Fisheries Service, citing overfishing and that the new plan was deficient, originally rejected the

new Multi-species plan (NMFS, 1986), however, ultimately backed down in the face of political pressure from the New England Congressional delegation.

Iterative Management

Since its adoption in 1986, the Northeast Multispecies Fishery Management Plan has been amended and modified numerous times in a piecemeal and iterative effort to address evolving management needs in an extremely complex, large scale, intensely competitive, and overfished fishery. Today, the multispecies plan as amended is far more interventionist than was the original Atlantic Groundfish FMP and yet it lacks a mechanism to address the collective action dilemma existing in the fishery.

In 1987 the first amendment to the plan, intended to ameliorate NMFS's initial objections, was adopted to tighten controls on the exempted fishery for silver hake and the existing mesh size regulations, and to expand the southern large mesh area where it effected yellowtail flounder. In 1989, Amendment 2 to the plan was adopted, eliminating the scheduled codend mesh size increase because of compliance difficulties. This amendment also introduced bycatch trip limits, established a new seasonal large mesh area on Nantucket shoals, increased some of the minimum fish sizes, and applied the minimum mesh size to the entire net. Also in 1989, Amendment 3 was implemented to establish a mechanism to enable the Council to react quickly to protect concentrations of juvenile fish. The Flexible Area Action System, however, proved to be ineffective largely due to ancillary regulatory burdens, underscoring the difficulty of managing natural resources on a real-time basis within the procedural and administrative confines of the Magnuson Stevens Fisheries Conservation and Management Act. In 1991, the FMP was again amended (Amendment 4) expanding the

list of regulated species (to include silver hake, ocean pout and red hake), to adjust mesh size provisions further, and to establish gear modifications to reduce groundfish bycatch in the northern shrimp fishery (NEFMC, 1993b).

In response to a 1989 NMFS revision to the fishery management plan guidelines developed under Section 301(b) of the Magnuson Stevens Act, the Council adopted as the overfishing definition the 20 percent maximum spawning potential (MSP) target for groundfish included as part of the original Multispecies FMP. The so called 602 Guidelines required that management plans contain objective and measurable definitions of overfishing and recovery plans for stocks determined to be overfished based upon those definitions (Shelley et al., 1996: 227). Amendment 4 acknowledged that overfishing was occurring and that no provisions were contained in the amendment to eliminate that situation. The amendment proposed to address this need in a subsequent amendment. In response, the Conservation Law Foundation and the Massachusetts Audubon Society sued the Secretary of Commerce and other NMFS administrators for what they considered a violation of the MSFCMA's national standards (CLF, 1991). This action was significant and has had a profound influence upon the fishery management arena, ushering in a litigation movement that continues unabated. As a result of litigation pursued now by all players within the fishery management arena, the management of fisheries has, in some cases, been ceded to the judicial branch of government.

In June, 1988, the Technical Monitoring Group produced an assessment of the effectiveness of the Northeast Multispecies plan, finding that only limited progress was being made towards the achievement of objectives and that the overall system was

inadequate for dealing with resource rebuilding needs. The TMG found that this failure was largely due to the fact that the plan's regulations were difficult to enforce and easy to subvert (NEFMC, 1993b). Stock assessment reports issued subsequent to the initial TMG report indicated a worsening stock condition, leading the TMG to recommend that a 50 percent reduction in fishing mortality would be necessary to achieve the maximum spawning potential (MSP) goals prescribed by the plans overfishing definition (NEFMC, 1996). The industry did not need to have this spelled out in detail. It was evident to all involved in the fishery management process that a 50 percent reduction in fishing mortality would translate into a significant reduction in effort and, thus, the passive management approach embodied in the Northeast Multispecies FMP would have to yield to a far more interventionist approach.

In the spring of 1991, when the Council began development of a comprehensive amendment (Amendment 5), the atmosphere had become poisoned with hostility. The industry held contempt for the CLF and the other public interest and environmental organizations that had *discovered* fisheries and had become regular participants in Council committee and plenary sessions. Feeling pressed between the courts as a result of the CLF lawsuit and the industry because of the draconian measures necessary to address overfishing, a siege mentality took hold of the Council. The acrimony intensified when in August of that year, without consulting the Council, the National Marine Fisheries Service entered into a consent decree with CLF establishing a judicially supervised schedule for the Council to develop a plan to end overfishing, and if it failed to do so by September 1992, one was to be developed by the Secretary of Commerce.

Developing management proscriptions to achieve biological objectives is very complex in the socioeconomic milieu that is a fishery. The Council clearly recognized this reality when in 1985 it stated that “the multi-species fishery is the natural adaptation of an industry faced with resource and market uncertainty. ... (that any management action is problematic if it) substantially interferes with the operational flexibility of the fishery ... (that) management actions will be most effective when they are in concert with the natural behavior of the industry. ... (and that) the long-term viability of the stocks can only be realized through measures that are compatible with the way fishing is conducted in New England” (NEFMC, 1985: 1.2). Amendment 5 was to indeed change the way fishing was conducted in New England and, consequently, it was an amendment that took three years to develop; time which the plaintiffs in the CLF suit and consent decree ultimately agreed to provide.

Amendment 5: Too Little Too Late

Amendment 5 was implemented on March 1, 1994 (NMFS, 1994a) proposing to reduce fishing mortality by 50 percent over five years utilizing a combination of measures including a reduction in the number of days that a vessel could fish (effort reduction program) and by imposing a moratorium on new permits (limited access program). In addition, Amendment 5 required permits for all vessel operators and dealers, established mandatory reporting of landings and effort data (in some instances requiring that vessels utilize electronic vessel tracking devices), established a possession limit of 5,000 pounds of haddock, expanded existing closed areas, made a number of other adjustments to control fishing induced mortality, and established measures to reduce the bycatch of harbor porpoise in the Gulf of Maine sink gillnet

fishery. This amendment also included provisions for a framework adjustment system that would allow the Council to add or delete regulations more expeditiously in order to meet plan objectives. This mechanism was intended to provide a real-time means of addressing the dynamics of the fishery, however, its adaptiveness has been hobbled by the imposition of administrative and procedural constraints (Butler et al., 2001) largely as a result of litigation.

The Amendment 5 permit moratorium established for the first time in its history, a prohibition on entry into the groundfishery. The amendment's effort reduction program was also a significant departure from prior management approaches. It stipulated that vessels either be removed from the fishery for blocks of time or that an individual allocation of days-at-sea (to be reduced in annual increments) be utilized at the owners discretion. Based upon annual harvest targets to evaluate the progress of the plan, the effort reduction program left those who had opted for the individual allocation with no more than a total of 88 days-at-sea (DAS) during which to fish for groundfish. Although it was not acknowledged or perhaps recognized at the time, the net effect of Amendment 5 was to transfer value in the fishing enterprise from the vessel, to the permit and ultimately to the allocation of DAS. In a fashion reminiscent of the quota-based management system of the previous decade, the days-at-sea allocation system supplanted the fisherman such that the management regime was making decisions normally made by the fisherman. Nevertheless, the plan did not truly address the overcapitalized nature of the fleet and provide a means of removing vessels. In fact, the qualification process enabled access to permits for anyone (vessel) who could document the landing of at least a pound of groundfish. It was argued at the time that this was the

only may to ensure equity in the assignment of *rights* to the fishery. It was also argued that fishermen who received a federal groundfish permit would not be required to actively remain in the groundfish fishery to maintain the permit's validity. This has become known as the *no use it no lose it* principle which theoretically would encourage fishermen to shift effort off the groundfish resource without ultimately being penalized for their *conservation investment*.

Amendment 6 was approved by the Council and implemented in May of 1994 to permanently establish measures that had been adopted by the Secretary under emergency to restrict the harvest of Georges Bank haddock to 500-pounds per trip (NMFS, 1994b). However, despite this amendment and the sweeping changes brought about under Amendment 5, the August 1994 stock assessment report paralleled earlier reports presented to the Council during the development of Amendment 5 that stocks of haddock, yellowtail flounder and cod were in serious decline and that the Amendment 5 measures were inadequate to prevent a collapse of the stocks (NMFS, 1994c). At its September 1994 meeting, the Council voted to commence development of a new amendment (Amendment 7) to address the condition presented in the stock assessment report. By the time of its October meeting, recognizing that the condition of the stock was too dire to wait until completion of Amendment 7, the Council requested that the Secretary implement emergency rules to "slow the decline of those critically low stocks while it developed a comprehensive rebuilding plan" (NEFMC, 1996: 10). Emergency rules were implemented in December of that year closing portions of the fishing grounds defined as Area I, Area II and the Nantucket Lightship Area to all fishing

including scallop dredging. These emergency rules were subsequently made permanent by the Council through the use of its new framework adjustment system.

Amendment 7 was approved and the final document submitted by the Council on February 7, 1996. It was designed to rebuild spawning stocks of cod, yellowtail flounder and haddock through an acceleration of the days-at-sea effort reduction program, an elimination of some exemptions to the effort control program, broadened area closures, brought scallop vessels under the multispecies permit system, and provided incentives for fishermen to fish exclusively with mesh larger than that required. In addition, Amendment 7 established a Multispecies Monitoring Committee (MMC) to set target Total Allowable Catches (TACs) to help in monitoring the status of the fishery with respect to the fishing mortality objectives (MMC, 2000). Since that time, the Northeast Multispecies Fishery Management Plan has been amended 5 times, including Amendment 9 that revised overfishing definitions and specifications of optimum yield for the 12 regulated groundfish species to bring the plan into conformity with the Sustainable Fisheries Act. In addition, the plan has been modified a total of 35 times through framework adjustments.

During the time of this writing, the Council has been in the process of developing Framework 36 and a new amendment (Amendment 13) because large reductions in fishing mortality rates are still needed to achieve rebuilding goals for the five major stocks (MMC 2000). According to the July 2001 stock assessment report for Gulf of Maine cod, “(f)ishing mortality has remained high despite recent trip limit and area closure management action to reduce fishing mortality ... (to meet the target, fishing mortality) must be markedly reduced” (NMFS, 2001: 9). The Multispecies

Monitoring Committee reported in November 2001 that the magnitude of the reduction necessary to achieve mortality targets for Gulf of Maine cod would be severe and that further reductions in mortality are needed for several other species in the complex (MMC, 2001).

Earlier reports had indicated that stock status had been improving and, in fact, the Council had issued a press release stating that “(f)or the first time in a number of years federal fisheries management programs in New England are experiencing measurable and substantial success in rebuilding sustainable fisheries” (NEFMC, 2001b). What was being presented in the assessment report was new information that could portend a further reduction in effort, perhaps by as much as and additional 50 percent, and this was extremely disheartening to all involved in the management process.

During the December 2001 Council meeting, further development of Framework 36 was suspended so that the Council could devote its time to Amendment 13. The basis for this decision to dispense with Framework 36 was that the measures necessary to reduce the condition of overfishing would be too severe to develop (administratively) through the expedited decision-making process of a framework action. Although not agreed upon by all stakeholders, the Council anticipated the need to further reduce days at sea by as much as 63 percent to meet targets set according to overfishing definitions. This would come at a huge socioeconomic cost and necessitated the use of a full amendment.

The most recent and most serious development in the groundfish management saga occurred on December 28, 2001 with a federal judicial ruling in a suit brought by

the Conservation Law Foundation and other conservation organizations against the Secretary of Commerce and the National Marine Fisheries Service (CLF, 2001). The Court found for the plaintiffs that the federal government had violated the Sustainable Fisheries Act when it approved a framework adjustment (Framework 33) that lacked more rigorous Amendment 9 overfishing targets and because it did not adequately address SFA requirement to prevent bycatch. As a remedy, the conservation organizations have requested that the Courts impose strict time frames for coming into compliance with the SFA, require that fishermen be monitored remotely via satellite and directly via onboard observers, impose a quota system that would close the fishery, reduce the management role of the New England Fishery Management Council and remove it from the rule-making process, and maintain the court's jurisdiction over the groundfish fishery until stocks have been rebuilt (CLF, 2002). The New England Fishery Management Council and fishermen are not directly a party to the suit and, therefore, neither are entitled to participate in negotiations about the remedy to be selected by the Court. Several fishermen organizations have sought intervenor status, however, the Council does not have legal representation beyond that provided by the National Marine Fisheries Service. Consequently, it can not seek intervenor status and it will, therefore, be excluded from the new court imposed decision-making process.

Summary

The history of groundfish management for the purposes of this thesis can be framed in four time periods with the first period being all the many years prior to enactment of the Magnuson Stevens Act in 1976. This period stands in stark contrast to subsequent periods because it marks a time during which the groundfish industry was

subject to virtually no management control, particularly that of the federal government. All periods after that can be characterized by varying degrees of government-centered top-down control upon a fiercely independent industry that was ill-prepared for the advent of government intervention.

The second management period is the commencement of federal management and includes the years of the quota-based approach modeled upon the flawed system utilized at the international level and the passive years of the Interim Plan up through the initial adoption of the Multispecies Fishery Management Plan in 1986. During this period, the federal government was ill-prepared for its new role as regulator and the industry exercised significant influence upon the new management system through innovation, evasion and politics. Acheson (1984) points out that during the period immediately following enactment of the Magnuson Stevens Act, the industry was sent “a mixed set of signals” such that the regulations adopted had the effect of producing a fleet with an enhanced capacity to exploit fish stocks. This period can be characterized as one during which the stage was set for serious institutional and resource demise.

The third period commenced in 1987 with the first amendment to the new management plan and extends to December 2001 when the federal court took control of the fishery. This period can be characterize as one of conflict and costly distribution fights between industry and government during which the federal government began to assert significant control, with both parties to the fishery management bargaining process increasing the transaction costs for the other as demonstrated by the extensive interative modification to the management strategy. During this period, the groundfish

stocks of the Northeast Atlantic coast suffered serious decline and the face of the New England fishing industry was changed forever.

The forth period has just commenced with the Court decision in the recent Conservation Law Foundation suit against the federal government. Regardless of the specific suite of measures the Court selects as a remedy in this case, it is clear that further reductions in fishing effort will be required. This will come at an extreme cost to the industry and to the fishing dependent communities given that participation in the groundfish fishery, since implementation of Amendment 5 in 1994, has declined by as much as 50 percent in many New England ports (NEFMC, 2001a).

Despite years of effort and numerous revisions to the groundfish management plan to accommodate exigencies in the fishery over the course of twenty-five years, groundfish management in New England has truly become a metaphor for management failure. Hennessey and Healey (2000) make the case that economic and political interests have driven the New England groundfish fishery to overcapitalization and overexploitation and that this has occurred despite decades of change in Council membership and in senior state and federal government officials. This suggests “that the problem is systemic and not related to any particular individual or philosophy regarding the fisheries” (2000: 208). Indeed, they have found examples of overfishing to be widespread and occurring around the globe. Clearly the New England groundfish fishery is complex in scale and subject to significant asymmetries of information and power generating high transaction cost that can not be easily overcome. The interaction of parties involved in the groundfish fishery management negotiation has caused a downward spiral of institutional and resource failure.

Mahogany Quahog Management

The mahogany quahog fishery is an interesting case study because it is so comparatively new, geographically circumscribed, and managed in such a unique fashion as compared to other fisheries in the New England region. State regulation came early in the development of the mahogany quahog fishery reflecting the public health concerns of the Maine Department of Marine Resource. A state issued license is required to fish for, possess, transport or sell quahogs within the state's jurisdiction (12 M.R.S.A. § 6731), and the DMR monitors levels of toxin in the tissues of quahogs from the areas where fishing activity is concentrated (12 M.R.S.A. § 714-A). Only areas that have been specifically tested and found to have toxin levels below 80 micrograms per 100 grams of quahog meat are open to fishing. This monitoring program has been conducted by the state which charters commercial vessels to collect samples on a frequent basis depending upon the season. It is also a monitoring program that has been supported by the industry through user fees in the form of a landings tax on each bushel of quahogs landed (36 M.R.S.A. § 714). This tax has since been repealed with funding for the monitoring program now supplied via direct legislative appropriation to the department.

Fishermen have had a significant involvement over the years in helping the DMR determine where monitoring activity should be conducted. This has occurred with relative ease and minimal conflict because there have been few participants in the fishery and direct communication between industry and government occurs on a real-time basis.

Beyond the requirements for licensing, a drag size limitation which nominally serves resource conservation purposes, and a rigorous public health monitoring program, the mahogany quahog fishery was subject to very little management. In 1990, however, the conditions of management changed dramatically when a mahogany quahog vessel fishing in federal waters off Jonesport, Maine was boarded by the U.S. Coast Guard. Much to the surprise of the fisherman, a summons was issued for violation of regulations of Amendment 8 to the Mid Atlantic Fishery Management Council's management plan for Surf Clams and Ocean quahogs.

Imposition of Federal Control

The Mid Atlantic Fishery Management Council has had management jurisdiction for surf clams and ocean quahogs since the inception of the council system. The original management plan for these fisheries, approved in November 1977 and extended through December of 1979 via Amendment 1, established quarterly quotas for surf clams and yearly quotas for quahogs. It also instituted a moratorium in the surf clam fishery while a limited entry program was under development (MAFMC, 1997). By 1988, eight amendments to the surf clam and ocean quahog fishery management plan (FMP) had been approved, each time to address issues attendant to the management of surf clams including quota adjustments, minimum size and fishing areas. Amendment 8 approved in 1988 was principally intended to further address surf clam issues by replacing the quota management approach with an Individual Transferable Quota (ITQ) system. Although the yearly ocean quahog quota established in the original plan in 1977 had never been reached and despite the fact that there existed no evidence of resource depletion, the Mid Atlantic council decided to bring this

fishery under an ITQ system as well. This decision was readily embraced by the industry which was, by and large, industrial scale with many of the harvesting assets owned directly or indirectly by the processing sector. The new ITQ system employed a formulae that gave participants in the fishery an initial allocation based on the vessel's average catch divided by 32 bushels, the number of bushels in a standard harvesting unit (referred to as a *cage*).

During development of Amendment 8, the State of Maine through the New England Fishery Management Council, brought to the attention of the Mid Atlantic Council the presence of the Downeast mahogany quahog fishery and requested that it be excluded from ITQ provisions of the amendment. This was initially agreed to by the Mid Atlantic Fishery Management Council as being appropriate for a number of reasons related to the vastly different scales and complexity of operation between the two fisheries. Furthermore, the resource in the northern Gulf of Maine had not been included in the original management unit, the State of Maine closely managed the fishery for public health purposes, the fishery was operating within state territorial waters, and the market and fishing practices of the Maine fishery differed considerably from that of the southern fishery and thus could not appropriately be managed using the techniques proposed in Amendment 8. This later point was particularly relevant given that the basic management unit of Amendment 8, the 32 bushel cage upon which quota allocation was based, is too large to fit on most of the boats in the Maine fishery and would pose a considerable safety hazard to both vessel and crew if it were to be used.

Despite the realities of the fishery and assurance to the contrary, in 1990 the Mid Atlantic council altered its position, claiming that, as National Standard 3 of the

Magnuson Act (MSFCMA, 1976) stipulates that a species shall be managed throughout its range, the participants in the Maine mahogany fishery were bound by the rules established under the management plan amendment and would be brought under the ITQ system. The State of Maine opposed this interpretation which set up a conflict between the state and the federal government, between the New England Fishery Management Council and the Mid Atlantic Fishery Management Council, and between the Downeast mahogany quahog fishermen and their counterpart in the southern chowder clam fishery.

The National Marine Fisheries Service granted experimental status in 1990 to the Maine fishery while an effort to resolve the problem commenced and the Mid Atlantic Council voted to allow the Service to develop a Secretarial Amendment (considered Amendment 9). This amendment proposed to establish a special management area North of a line drawn at 43° 50' North latitude within which the mahogany quahog fishery would be contained and managed pursuant to the extant regulatory measures of the State of Maine, principally the public health provisions. This approach would accommodate the difference in scale. However, the approach was ultimately opposed by the Mid Atlantic council because it would have set a precedent by subdividing the Exclusive Economic Zone.

It would take seven years of often difficult negotiations before a solution acceptable to the Mid Atlantic council and the State of Maine could be reached. Amendment 10 which was finally approved in the summer of 1998, established several measures including: 1) a management zone; 2) a limited entry permit system; 3) an

annual quota of 100,000 bushels; 4) a Maine Mahogany Quahog Advisory Panel, and; 5) a number of harvest and landing restrictions, authorities and prohibitions.

To even a casual observer, Amendment 10 does not appear to be particularly equitable given the history of the mahogany quahog fishery, yet the ultimate success in developing Amendment 10 is largely credited to the Maine mahogany quahog fishermen (Estabrook, 1998). That fishermen in Maine consider their achievement a success speaks volumes about the flawed biological, social and economic principles that undergird the Magnuson Act. The Act is designed to standardize management approaches over extensive geographic ranges and does not enable discrete accommodations to scale and complexity. Given that the realistic alternative was an indirect elimination of the fishery were it to have been brought fully under the burden of the ITQ provisions of Amendment 8, it is understandable that Maine fishermen ultimately worked to bring about Amendment 10 to the Surf Clam and Ocean Quahog Management plan.

However, Maine fishermen were presented with a Hobson's Choice; there is no reasonable basis other than language in the Magnuson Act for inclusion of the Maine fishery in the Amendment 8 management unit. In fact, even the Mid Atlantic Fishery Management Council admitted that the "management tools developed during the first twenty years of federal management for surf clams and ocean quahogs do not fit the Maine fishery well" (MAFMC, 1997: 3). "The small-scale eastern Maine ocean quahog fishery differs profoundly from the large-scale industrial EEZ ocean quahog fishery ... " (MAFMC, 1997: 12). "Amendment 8 requires that ocean quahogs be landed in 60-cubic-foot metal cages ... (t)he small Maine one and two man boats can not safely

accommodate cages on their deck” (MAFMC, 1997: 13). “During public hearings it became painfully obvious that the quota estimates were inappropriate...” (MAFMC, 1997: 14). Furthermore, the MAFMC admitted that the fishery operates under very rigorous regulation of the State of Maine due to the public health issues associated with paralytic shellfish poisoning, that the market for the Maine mahogany quahog is different than that of the industrial fishery, and that even the age and growth parameters of the resource are vastly different.

Nevertheless, the Mid Atlantic council, the National Marine Fisheries Service and the State of Maine ultimately conceded the language of National Standard 3, holding that a fishery must to the extent practicable be managed as a unit throughout its range. Rather than risk admonition for violating this provision and adopt one of the alternative approaches available (declaration of *de minimus* status or outright exemption) the federal management system brought the Maine mahogany quahog fishery under a limited entry quota-based management program that was inappropriate to its scale and complexity.

The true impetus for the Mid Atlantic council’s steadfast approach, however, had less to do with the provisions of National Standard 3 and much more to do with the financial realities of the value associated with shares of the ITQ. Several of the early negotiation sessions between the State of Maine, which I represented at the time, and the Mid Atlantic fishery included attorneys and bankers representing several of the large processing plants and chowder manufactures. These large corporations had no concern whatsoever about the Maine mahogany fishery in so much as the market place was concerned. Their real concern was of the proverbial *Camel’s Nose* that would make its

way *under the tent* of Amendment 8 were the Maine fishery to be exempted from the ITQ program. Were this to happen, it was argued that others with a much less legitimate claim to exemption would petition for and perhaps be exempted from the program as well. The shares of ITQ owned by these corporations had value and were used as collateral in the financial market place. It was reasoned and indeed vigorously argued that the integrity of the ITQ program must be maintained, not cynically to preserve the integrity of National Standard 3, but to maintain the value of ocean quahog shares.

Although the management plan developed by the Mid Atlantic Fishery Management Council addresses biological standard as is required, Amendment 10 merely established an additional 100,000 bushels of quota based loosely upon the harvest history in the Maine fishery (MAFMC, 1997) and not based upon stock assessment as assessment of the stock in the Maine region had not been conducted by either the state or the federal government. There was little need to oblige the *best science* standard of the Magnuson Stevens Act because there did not exist a concern that the resource would be overfished. The basis for bringing the Maine fishery into the management unit was not biological, but economic and principally to avoid a “potential dissipation of revenues due to a future increase in the number of non-ITQ entrants” (Federal Register, 1998: 9773). In this case, the federal officials were sympathetic to the special nature of the Maine fishery and had attempted to devise a mechanism to enable it to operate outside the Mid Atlantic Council’s management plan. However, the Mid Atlantic Council had become enamored of the ITQ approach to management and its processing plant constituents were adamant that ITQ-based management be applied

to all aspects of the quahog fishery. Forced in large measure by the language of National Standard 3 that a fishery be managed as a unit throughout its range (MSFCMA, 1976: § 301 (a)(3)) federal officials, the State of Maine, and Maine fishermen ultimately relented and accepted Amendment 10.

Summary

The entire history of the mahogany quahog fishery has occurred within the past 30 years. In this the fishery is extremely unique as compared with other fisheries of the region. During this time, there has been one overriding issue influencing the management of this resource; the public health monitoring program of the state. The management program imposed upon the fishery during the period of federalization that commenced in 1990 is superfluous and belays serious flaws in the way the Magnuson Stevens Act is used.

Essentially the ITQ program as applied in Maine is more a community based quota held by the state, and individuals in the Maine fishery are not required to participate on an individual basis. The reality of Amendment 10 is that it does not pose significant burdens upon the Maine fishery and many in the fishery feel that the approach has brought stability to the fishery (Porter, 2001). The resource appears to be robust; the most recent stock assessment has concluded that the Atlantic coast stock is not overfished and that overfishing is not occurring (NMFS, 2000). Furthermore, the number of participants in the fishery remains low. This fishery clearly demonstrates that where scale and complexity are low, transaction costs involved as parties negotiate for control rules can be more readily overcome regardless of symmetries of information and power.

Despite the fact that the fishery will continue to operate essentially as before imposition of Amendment 8, the fishery has nevertheless been federalized through government fiat and subjected to an unnecessary form of management simply to comport with a national standard. This outcome is difficult to characterize as management success nor is it possible to attribute resource success to management of the Maine fishery.

Chapter 7

CONCLUSION

Major fisheries throughout the world are subject to excessive harvest levels and here in New England valuable fisheries resources have been chronically overfished. These fisheries have been under scientific management by governmental entities for decades, therefore, we are witnessing not just an abuse of public property, but a failure of government as well. Not all management efforts have resulted in failure, however, and there are examples of fisheries that have been managed quite successfully. The central question here is what circumstances bring about success or failure. There is one body of literature focused on the motives and behavior of fishermen, another on the motives and behavior of the government, and still a third on the generation of institutions. However, there has been little work done to link these fields. This thesis contributes by adding another dimension to our understanding of the differential.

A fishery is by definition, the interaction of fish and fishermen; its management is an effort to control exploitation so as to affect the biological status of a fish stock. In practice fisheries management concerns the regulation of human activities and it consequently presents a two dimensional problem. One dimension concerns fishermen who are in all too many cases motivated to over exploit the resource. The second dimension concerns how rules are generated to modify this behavior. Chapter 2 raises the question of responsibility, reviewing the theory of open access fisheries and the collective action dilemma where what is rational for the individual leads to disaster for society. Chapter 2 also presents the theory of transaction cost economics, describing significant asymmetries that exist between parties negotiating for fisheries management.

In essence, it is argued here that fishermen are not solely responsible, they are rationally motivated by incentives offered by government institutions to pursue the fisheries as they do. Changing this behavior requires institutions that offer selective incentives to overcome the dilemma of collective action.

In Chapter 3 the current fishery management program and the role of government is presented. This chapter describes the public policy tools typically utilized to manage marine fisheries, the actions and motivations of government agents, and why a government-centered approach to fishery management is not always successful. The government is variously perceived as monolith, as a collectivity of individuals, as a culture, as a collection of interest groups, and as a political environment. The government, because of all of these various *personalities*, is subject to an institutional inertia that *is* the cost of transaction within the public sector. The failure of government in the fishery management context has received much less emphasis in the fisheries related literature than have the reasons that fishermen overexploit the resource. Nevertheless, it deserves scrutiny considering that many failing fish stocks have been under some form of government-sponsored management for decades.

The government can attempt to manage using command and control techniques, however, this approach fails to acknowledge that the behavior of fishermen stems from institutional incentives. Command and control has not proven to be particularly successful because it is lacking in positive incentives. In order to achieve positive results managers must acknowledge that fisheries management is a process of bargaining with stakeholders for the provision of public goods. Public goods in this

context are the management plans and regulations necessary for resource conservation. Where all parties to the negotiation have equal or complementary information about the status of the resource and about the actions and motivations of others party to the transaction, where scale and complexity of the fishery are low and where the relative power position of the parties are symmetrical, management institutions can be developed with lower transaction costs.

Chapter 4 presents a means of mitigating the transaction cost impacts of managing a large scale highly complex fishery. This approach referred to as co-management moves the management decision-making closer to the harvester level. In essence, this is a means of reducing the scale and complexity of the fishery by enabling a more *real time* transfer of information about the resource and about the actions and motivations of others. By delegating to a more local level a greater role in the management process, a sense of ownership interest in the process and in its outcome are offered as incentives. These selective incentives serve to provided fishermen with attributes of property rights that promote a sense of stewardship, thus altering the *rational choice* behavior that causes the dilemma of collective action in the fisheries. The co-management approach does not eliminate transaction costs, but it does provide a means of reducing costs such that they can be more readily overcome in the fishery management bargaining process.

Chapters 5 and 6 present a broad overview of the New England fisheries and their physical and human ecologies to provide a context for the detailed examination of their management. Utilizing an extended case study method, the contemporary management of the Maine mahogany quahog fishery, the New England lobster fishery

and the Northeast groundfish fishery is described. In the case of the lobster fishery where the extant management institution evolved over the course of more than a century, the temporal account is very detailed drawing attention to the jurisdictional shift that has occurred over the past 160 years. In the case of the groundfish fishery where domestic management has evolved only since the advent of the Magnuson Stevens Act, the temporal account is less detailed whereas focus is upon the changes that have occurred to the management institution. Federal management of the mahogany quahog is a very recent phenomenon and, consequently, its case study is primarily focused upon the impact of a single management action.

Information, Scale and Power Asymmetries

Informational Asymmetries

As presented in Chapter 2, among the most significant source of costs in the fisheries management transaction context is information asymmetry which can be a matter of one party to the negotiation having less information than another party as suggested by Williamson (1975, 1979). This type of informational asymmetry can be exacerbated by complexities of scale and information transfer within large organizations and between organizations that are mismatched as to size. Information can also be asymmetrical in the way that parties to a negotiation perceive their *world* and how it operates, an informational asymmetry North (1990b) refers to as "instrumental rationality." This asymmetry of perception is particularly problematic in the fisheries with respect to the definition and assessment of risk, the way in which risk is perceived by stakeholder groups, and the response of stakeholders to the assessed risks. Simply

put, fishermen and scientists have differing perceptions of and understandings about the ocean and its resources, thus their respective prescriptions for its management differ. Where these differences are significant and can not be resolved in the management process, negotiation costs can be high. Although semantically different meanings can be ascribed to the use of the word symmetry in relation to information-based transaction costs (including those of unequal amounts of information, those induced by mismatches of scale, and those of incongruent perceptions) for the purposes of this thesis and for ease of presentation, all of these information-based problems have been included and characterized under the rubric of symmetry.

There are two venues of concern here with respect to informational asymmetries: those that occur within the fishery between competing fishermen and those that are science based and occur in the fishery management bargaining process. The fisheries are rife with informational asymmetries – such is the nature of what is in essence a hunter/gatherer/trapper enterprise. Fishermen are in market as well as spatial competition with others and thus, for strategic reasons, information is to be closely guarded, although it is sometimes cooperatively shared and developed depending upon the temporal and spatial scale. Anderson (1972: 139) has argued that the competitive exploitation of common property resources “tends to restrict the flow of important information, thereby causing apparent inefficiencies in the rational integration and use of costly capital equipment.” However, both Anderson and later Stuster (1978) point out that, while the use of prevarication by fishermen tends to waste resources of capital and labor, in the competitive environment of the fisheries there is a rational and strategic basis for its use. Because prevarication abounds, there is little basis upon

which to accurately predict the actions and motivation of others, thus the default behavior of fishermen is self-interested opportunism which creates transaction costs as predicted by Williamson.

The most significant source of information asymmetry in the management context concerns 1) the status of the resource and 2) what controls fish stocks. Fishery managers are compelled by provisions of the Magnuson Stevens Act to define objective and measurable criteria to indicate a fish stock's well being, whether it is overfished or in the process of becoming overfished. Decision-making is to be based upon the "best science" so as to enable decision makers to "prevent overfishing." However, this best science is subject to significant rates of error and the biological stock assessments are generally considered imperfect thus requiring extrapolation "beyond the levels of precision for which the science is designed" (Hanna et al., 2000: 131-132).

Because the management measures generally attempt to control catch rates and harvest levels, the fishing community has been skeptical of the underlying science. However, it is not simply that fishermen do not understand the science, but that they have different conceptions of the problem and scientific results do not always reflect what fishermen have seen on the fishing grounds. In the fishing enterprise where there is a "basic distrust of all information tendered" there is also an unequal distribution of knowledge about the "ecological characteristics and associated fish particulars" (Anderson, 1972: 136) thus significant information asymmetries exist. This unequal understanding of the biological and ecological condition affects the perception of and response to assumptions of resource status by fishermen, other stakeholders and the government and is a significant source of cost in the fishery management exchange.

The three New England fisheries examined here have fared differently with respect to science-based informational asymmetries. Within the mahogany quahog fishery, information about the action of other participants is readily available primarily as a result of scale. There are only 66 fishermen permitted to operate in the fishery (Holt, 2002) and the State of Maine's toxin monitoring program serves to narrowly circumscribe the geographical bounds of the fishing area. It can be argued, however, that informational asymmetries were maximal during the bargaining process that led to Amendment 8. The mahogany quahog sector of the ocean quahog fishery had no information about the management institution, no knowledge about the ITQ program, and no opportunity to participate in the bargaining process. In the mahogany quahog fishery, the concept of *overfishing* and *best science* is almost irrelevant and the attendant definitions of maximum sustainable yield and optimum yield contained within Amendment 10 have no real bearing inasmuch as management of the fishery is concerned. No assessment of the stock off the Maine coast has been conducted and the National Marine Fisheries Service acknowledges that "the condition of the resource there is unknown" (NMFS, 2000).

With respect to the lobster fishery, although it is extensive in geographic range and highly complex, its operational characteristics (territoriality and harbor gangs) are such that there is a significant amount of familiarity between participants. The primarily day boat trap nature of this fishery presents opportunities to overcome some of the informational asymmetries that exist, and the current management strategy utilizes area-based management thus the significant inter-sector (inshore-offshore) informational asymmetries are somewhat mitigated. However, with respect to

management, there is not agreement within the scientific community, let alone the industry, that the established overfishing definition is appropriate. Consequently, the negotiation for management measures that took place within the federal venue ultimately led the federal government to relinquish management authority for lobster to the ASMFC. That informational asymmetry continues to effect the commission-based management process, although recent action may reduce this asymmetry somewhat.

With respect to the groundfish fishery, its geographic range is extensive and the consequent intra-fishery informational asymmetries are significant although there are some gear and other operational characteristics that tend to mitigate this. With respect to management, there is a significant asymmetry of information between stakeholders and this is particularly confounded by interpretations of law. The Council's scientific committee has taken the position that "the relationship between stock biomass and subsequent recruitment is poorly understood and it is difficult to confidently identify what biomass would correspond to maximum sustainable yield" (SSC, 2001). Despite this scientific conclusion that biological reference points are difficult to determine and may lack merit, the Court found in the recent Conservation Law Foundation groundfish lawsuit that a stock recruitment relationship *does* exist and thus the attendant overfishing reference points and control rules *do* have merit inasmuch as the law is concerned. The bargaining norm under the amended Magnuson Stevens Act creates significant information asymmetries. The law is information dependent, however, inappropriately scaled to manage such a complex adaptive system as is the groundfish fishery. Where reality is determined by interpretation of the laws of *man* and not the laws of *nature*, costs can become exorbitant.

Asymmetries of Scale

There are two types of scale issues of concern here: those that relate to the size and geographical bounds of the fishery and asymmetries associated with the decision-making authorities of parties to the fishery management bargaining process. Scale as used in the latter case addresses the costs that accrue where mismatches in the decision-making process occur, the tenet being that complex modes of organization are appropriate for complex transactions; simple modes of governance suffice for simple transactions. To mismatch complexities of scale using a simple mode of governance to manage a complex transaction, for example, can lead to contractual failures. On the other hand, costs are incurred without gain where a complex mode of governance is used to manage a simple transaction. As the case studies demonstrate, both of these outcomes are manifest within the New England fisheries.

Scale is important because it effects the manner in which information is transferred. In small scale units people can monitor each other and make rules that can be locally enforced. Moreover, small units can more easily come to consensus on issues. Perhaps most important, where small scale units fish for sedentary species, a sense of ownership develops. The circumstances of scale in the lobster, groundfish and mahogany quahog fisheries differ markedly. The mixed composition of species within the groundfish fishery from which cod, for example, is harvested has proven most vexing in protecting this resource. Management has proven to be particularly difficult because of the highly mobile and geographically dispersed nature of the groundfish fishery. The spatial scale of this fishery, the consequent fact that fishermen operate in virtual isolation from one another and the highly competitive nature of the fishery are

all factors which tend to discourage a sense of ownership interest in resource conservation.

In contrast to the highly dispersed nature of the groundfish fishery where fishermen operate over greater spans of time and space, the lobster fishery is principally a 'day boat' fishery in which fishermen are restricted to certain territories when fishing inshore. The existence of informal territorial rules (see Acheson, 1988) present lobstermen with a situation far different than that of their groundfishing counterparts; a boundary and a sense of ownership interest in the resources within that boundary. This is particularly true in what Acheson calls perimeter defended areas. Because local lobster fishing groups tend to be small with a significant degree of knowledge about the activities of each other, a social environment conducive to solving the collective action dilemma exists.

The Maine mahogany quahog fishery is geographically very circumscribed by fact of resource distribution in what is the northern terminus of the species' range. Since its beginning, the locus of this fishery has remained within a relatively narrow area of well know beds of quahogs in the Downeast portion of the Maine coast. The state monitoring program relies upon an industry-based group to collect samples for toxin analysis by the state agency and, to a large extent, this sampling program dictates where fishing activity will be concentrated. In essence, therefore, boundaries within which fishing occurs are established and significant opportunities to prevent collective action problems exist.

Scale differences have had a profound effect upon the ability of the institution of stewardship to evolve within these fisheries, clearly setting the lobster and mahogany

quahog fisheries apart for the groundfish fishery. Both the lobster and quahog fisheries are primarily pursued within the territorial sea where the problem inherent in open access can be somewhat ameliorated because a territoriality serves as a proxy for property rights. Having a property right, even one that has no legal standing (and one often maintained through coercion and intimidation) has nevertheless provided a means of addressing the collective action dilemma. Territoriality restricts fishermen to a small area where they are well known and where their compliance with the laws can be observed.

The lobster industry has advocated for and has been principally responsible for the development of a number of conservation measures (Acheson, 1997). Interestingly, the measures most strongly advocated for by industry over the years (the so-called V-notch and oversize measures) have principally been those designed to protect a strong spawning stock. Hall-Arber and Finlayson (1997) have characterized this type of user advocacy for conservation measures as a linkage between social and ecological systems; a practical understanding of the connection between the community and the resource it depends upon. Participation in the process of making decisions relating to the management of the resource invests fishermen and fishing communities in the success of management. This linkage has enabled the lobster industry to collectively devise management measures where the industry/government linkage was appropriately scaled. This condition of ownership enabled the regional fishery to overcome large scale highly complex impediments to negotiation through an agreement upon regional management areas and boundaries.

In fact, numerous institutions in the form of rules established through a statutory or regulatory process and informal rules or norms of behavior have evolved to maintain this attitude of “property” in the lobster and to a lesser extent the quahog fishery. Additionally, several institutions in the form of fishermen associations have been established to ensure that these rights are protected. The lobster industry for example has a longstanding history of involvement in the management of “its” resource (Acheson, 1997; Acheson and Knight, 2000) and it is a natural extension of that history that the industry would be prepared to engage in the contemporary approach to management embodied in the adaptive management concept currently utilized under the Atlantic States Marine Fisheries Commission.

In contrast, the groundfishery has principally been an open ocean enterprise pursuing fugitive fishery resources that exist in a vast and remote space. Hall-Arber and Finlayson (1997: 111) point out that in the groundfisheries of both the northeastern United States and Atlantic Canada, fishermen “embrace a strong egalitarian ethos that supports open access to fisheries resources.” The legal regime in this space, until the advent of extended jurisdiction, has held that fishery resources are *res nullius* and thus considered to be the property of no one until actually rendered into a condition of possession. Prior to the enactment of the Magnuson Stevens Act and certainly prior to the Canadian/U.S. boundary delimitation, the New England groundfisherman operated over a substantial part of the Northwest Atlantic. Certainly there have been conflicts, but groundfishermen operating on the high seas have not considered their access to the resource more or less preferential than another’s and thus an ownership interest in the resource has not developed. Because any fish left by one fisherman is subject to capture

by another, there is no incentive to harvest with restraint. In this circumstance there is no individual benefit perceived through individual resource conservation investments. Therefore, it is rational to fish rapaciously. To do otherwise is too costly in the competitive open access groundfishery. Unfortunately, however, what is in the short run best interest of fishermen has led to the destruction of the breeding stock, poor recruitment, lowered catches and, consequently, business failure for many. It is the dilemma of collective action driving the groundfishery and the inability to erect property or ownership institutions and create interest in conservation outcomes that has led to the failure that is groundfish management. Edwards (1994: 263) has concluded that "... exclusion is essential to a common property institution. When possessing either de facto or de jure ownership, residual claimants are sometimes able to control access to and exploitation of common pool resources, thereby capitalizing on expected future benefits from restraint, investment, and innovation."

Turning now to asymmetries of scale with respect to decision-making, there is an obvious difference in the way each case study above describes the actions and involvement of fishermen in the fishery management process. This is not just an artifice of the presentation, it is a reflection of the degree of formal involvement fishermen have in the respective management venues. Lobstermen have been directly involved in the management of the lobster fishery since the late 1800s when they began to work for legislation at the state level. In the 1990s they became formally involved in decision-making when the initial Lobster Industry Working Group was formed under the New England Fishery Management Council in 1991. Lobstermen today have a significant direct involvement in the management of the lobster fishery through the

Lobster Conservation Management Teams of the Atlantic States Marine Fisheries Commission and through the Lobster Zone Councils in the State of Maine.

By contrast, groundfishermen have had no formal involvement in the process. To be sure, they have been actively involved in the fishery management forum -- the groundfish industry has exerted significant influence within the management arena. However, the groundfish industry operates essentially as do all other private parties interested in the matters at hand; through the administrative and rule-making process, through the courts, or through interest group politics and influence. Their direct participation in the decision-making process, other than in an advisory capacity, has not been provided in the current management institution.

The mahogany quahog fishermen have been afforded even less involvement in the federal process than their groundfishing counterparts. They were not involved in the development of the Mid Atlantic Fishery Management Council's Amendment 8, nor were they even aware that it had been developed. Nevertheless, at the state level they have significant decision-making involvement in the public health monitoring program and thus a basis exists for a sense of ownership interest in outcomes.

Asymmetries of Power

The degree to which fishermen have been involved in the fishery management bargaining process, while a measure of symmetry of scale with respect to decision-making authority, is also a measure of relative power between parties involved in the fishery management exchange. Power as it has been defined here is the ability to affect by some means the alternatives available to others party to the bargaining process (Knight, 1992: 41). In the case studies there is significant evidence of power

asymmetries. For example, fishermen exert power by innovating in their fishing practice or by violating rules as a means of circumventing the effect of a control and, in so doing, undermine the putative benefits of the rule. These actions affect the alternatives available to the government which must either revise the rule or increase enforcement as a countervail. Fishermen as well as other stakeholders can affect the alternatives available to a government agency by seeking legislative intervention to press for change or to overturn agency action via statutory amendment. Of course, all stakeholders have available and do pursue judicial intervention to compel government action and, in so doing, affect available alternatives.

The government for its part, has significant power via its legislative and rule-making authority. Where it has the authority to effect change via fiat, its power to influence alternatives is significant, especially where it has the necessary enforcement capability. But even where it is subject to a protracted administrative process, the government still wields significant power in that it controls the administrative apparatus. This *monopoly* position with respect to apparatus and control of intangible services is the principal-agent problem discussed in Chapter 3. It is a significant source of power asymmetry in the public sector and Edwards (1994) has found examples in natural resource and fisheries agencies where stakeholders have been undercut so as to maintain agency authority.

The asymmetrical position of power occupied by the government in the fishery management bargaining process tends to exacerbate other asymmetries of information and scale. For example, the personal interests of many within the National Marine Fisheries Service is responsible for the agency's original focus upon biological

objectives and the consequent science-based thrust within the management arena today. Examples of the agency's insular attitude are seen in the way in which it relentlessly advanced its lobster overfishing definition, the manner in which it implemented the 602 Guidelines, and that it unilaterally sought a consent decree in the CLF lawsuit without consulting the Council, its fishery management partner.

As a countervail to government action, the lobster industry reacted in a number of ways: it sought to have management jurisdiction removed from federal purview, it worked vigilantly against the federal 10 percent egg per recruit overfishing definition, and when that effort appeared to be failing; it sought to verify the conservation value of measures ignored by NMFS including V-notch protection, the oversize measure, and escape vents. The "strong egalitarian ethos" in favor of open access reported by Hall-Arber and Finlayson (1997) and the fact that the groundfish industry had been subject to virtually no management control by the federal government set the stage for power struggles between the industry and government almost immediately upon enactment of Magnuson Stevens. The industry was as ill-prepared for the advent of government intervention as the federal government was for its new role as regulator. Efforts by the government to exert its new power were typically met by industry's efforts to shift the balance of power through innovation, evasion and politics. These distributional fights between industry and government have been costly in terms of both fiscal and fishery resources.

Each of the three fisheries examined exhibit asymmetries of power that have had a significant impact upon the bargaining process and the fishery management outcomes. The initial management approach taken by the State of Maine with respect to the

mahogany quahog fishery reflected a primary concern about public health and little if any concern about the biological status of the resource. The management program that the fishery is now subjected to under provisions of the Mid Atlantic Fishery Management Council's ITQ program is inappropriate to the scale and operational characteristics of this fishery. It profoundly differs from the mid-Atlantic fishery it was designed for, a biological basis for the imposition of a quota-based limited access approach is non-existent, and the management mechanism foisted upon the Maine fishery operates such that it does not afford Maine fishermen with standing equal to that of fishermen in the mid-Atlantic region. The federal policy prescriptions to "manage" this very small and very unique fishery were based solely upon a requirement that, consistent with the National Standard 3, a species must be managed as a unit throughout its range. The Amendment 10 approach to the Maine mahogany quahog fishery was unnecessary and is a contrivance wholly predicated upon a desire to ensure that individual corporations maintain the share of privileges they acquired through the allocation process. In this circumstance, the balance of power was absolutely in favor of the federal fishery management program.

In the lobster fishery, the primary public policy tools were passed by the Maine Legislature in the aftermath of distribution fights between sectors of the fishery. Although most laws were initially developed and advocated for by the industry to address economic issues, the minimum gauge size, V-notch and maximum gauge size, escape vent and biodegradable vent all contribute to enhancement of the biological objective to maintain the spawning stock biomass, although some of these measures have been in dispute between different sectors of the scientific community. The balance

of power has historically been in flux between sectors of the industry, however, as the case study demonstrates, power has also been in flux between the state and federal governments. These shifts have been presaged by incentives, sometimes negative and at other times positive. Although the federal government maintains some power to influence lobster management through the Atlantic Coastal Fisheries Cooperative Management Act, the balance of power has been shifted back towards state primacy under the Atlantic States Marine Fisheries Commission and, under the adaptive management approach, that power is significantly shared with the lobster industry through the Lobster Conservation Management Teams.

In stark contrast to the lobster case study where the balance of power shifted towards the state and industry, the case of groundfish management is a study of conservation efforts spiraling downward as a result of perverse countervailing incentives. Federal power was exerted almost immediately upon implementation of the Magnuson Stevens Act and initially the industry acquiesced because the new management regime was worth the price of foreign exclusion from the fishing grounds. However, once the true price of federal control became evident to the industry, it sought to shift the balance of power in its favor through innovation, violation, and ultimately through congressional intervention.

Shifts in the balance of power have occurred from the outset of management under the Magnuson Stevens Act. A report done for the Heinz Center (Hanna et al., 2000: 88) suggests that the council system has been too “open and responsive to constituent pressure” and Cicin-Sain and Knecht (2000: 123) point out that the balance of power rested with an industry “that would come to dominate most of the councils” by

the mid-1980s. A report recently issued by the Marine Conservation Network (Zeman, 2001) states that the eight regional councils have ignored “the obligation to reform fisheries management” and that the crisis in the fisheries caused by this has been “compounded by NMFS’s lack of leadership.” The National Marine Fisheries Service has indeed attempted to administer the national fishery management program in a top-down command and control fashion, however, as explained in Chapter 2 the command and control approach generally leads to failure, largely because the approach fails to overcome transaction costs, and thus no effective rules are developed.

The public policy pendulum continues to swing such that now, as a result of the recent decision in the Conservation Law Foundation’s groundfish lawsuit, the balance of power in the groundfish fishery management exchange clearly rests with the conservation community and its fishery management partner, the federal courts.

Summation

Lobster Case Study

The history of lobster management is framed here somewhat differently than is done by Acheson (1997), nevertheless, the salient point is that the conditions of scale and of information and power asymmetries have shifted between the industry and the state government, between the state and federal governments, and between the industry and the federal government over the course of this industry’s 160-plus year history. During the first period prior to the involvement of the federal government, all of the important management measures currently used for lobster conservation were

developed at the state level. The scale and complexity of the Maine fishery increased rapidly after its initiation in the 1840s. Acheson points out that during its early history, management measures largely emanated from the industry as a whole or from major factions of the industry aligned with state government officials. Power with respect to negotiating position was, therefore, relatively symmetrical. Issues of information asymmetry, specifically that which was related to the status of the resource, were minimal and there was general agreement between the scientific community and the industry on measures necessary for management. Most measures that were adopted resulted from distribution fights between sectors of the industry with policy entrepreneurs, both within and outside government, having significant influence in advancing particular measures, especially when aligned with major factions of the industry.

In the early 1980s, a coincidence of interests between policy entrepreneurs within government seeking to advance biological goals (a 3 ½ inch minimum size) and industry policy entrepreneurs seeking to secure preferred management measures (V-notching and maximum size) shifted primacy for lobster management, perhaps unwittingly, from the state level to the federal government. During this period the federal government was at odds with other parties involved in the negotiation for fishery management measures. This included the industry on a regional basis which was often aligned with state government policy entrepreneurs. An 18-year distribution fight resulted from information asymmetries with respect to the status of the resource and measures necessary to conserve it, and power asymmetries with respect to the manner in which the Magnuson Stevens Act was interpreted and the measures adopted pursuant to

it. Scale contributed significantly to the transaction costs in that the uniform management measures and control rules adopted under the federal regime effected various sectors of the industry differently throughout the extensive geographic range of the industry thus making agreement difficult to achieve. The generally upward spiraling interaction between industry and government during the early years of the industry's history which resulted in the development of conservation rules, gave way during this period to negative countervailing incentives offered by each side of the negotiation. Industry had less direct influence within the federal venue at this time than it previously had at the state level and reacted with obstinacy and political gamesmanship to counter the brinkmanship strategy of the government. However, it was during this period that the industry developed regional capabilities that positioned it to transition into the third period of lobster management which has spiraled progressively upward since the adoption of co-management principles.

This current period of lobster management is one characterized by a devolution of management authority from the federal level back to the state level under the aegis of the Atlantic State Marine Fisheries Commission. Many of the scale problems have been resolved through the use of area management and power asymmetries have been greatly reduced as a result of the co-management and industry/government collaboration at the regional level through the Lobster Conservation Management Teams. To some extent the information asymmetries that added costs to the negotiation process under the Council have been lessened under the Commission, particularly so now that the Lobster Fishery Management Plan acknowledges the conservation value of the V-notch and oversize measures (ASMFC, 2001e). However, information asymmetries continue to

exist with respect to the scientific basis of the overfishing definition, namely the 10 percent egg per recruit goal. Nevertheless, the current period is one of significant advances towards institutional and resource success.

Groundfish Case Study

The history of groundfish management provides a significant counterpoint to that of the lobster fishery. Framed here in four time periods, its history stands in stark contrast to that of the lobster case study in that it was subject to virtually no management control, particularly by the federal government, for the first 200 years of United States history. Following enactment of the Magnuson Stevens Act in 1976, the history of groundfish management can be characterized by varying degrees of government-centered top-down control upon an industry that lacked a history of collaboration and cooperation in the development of management measures and thus was ill-prepared for the advent of government intervention. The early years of federal management including the years of quotas, the laissez faire Interim Plan, and the initial adoption of the Multispecies Fishery Management Plan in 1986 are characterized by significant distribution fights between the industry and a federal government that was ill-prepared for its new role as regulator. During this period, the industry increased the government's transaction costs through innovation, evasion and political gamesmanship. The net effect of early federal groundfish management was to produce a fleet with an enhanced capacity to exploit fish stocks, setting the stage for serious institutional and resource demise.

Commencing in 1987 with the first amendment to the new management plan and extending to December 2001 when the federal court took control of the fishery, the next

period of groundfish management can be characterize as one of extreme conflict and costly distribution fights between industry and government. Information asymmetries with respect to the status of the resource and about prescriptive measures concerning sustainability were extreme. During this period the federal government and other stakeholders to the fishery management bargaining process began to assert significant power through statutory, regulatory and judicial action that altered the opportunities available to the industry. The transaction costs for all sides of the fishery management exchange during this period escalated to a level that thwarted the development of effective management measures as demonstrated by the extensive interactive modification to the management strategy. During this period, the groundfish stocks of the Northeast Atlantic coast suffered serious decline and the face of the New England fishing industry was changed greatly.

Further reductions in fishing effort are likely during the current period in groundfish management that commenced with the Court decision in the recent Conservation Law Foundation suit against the federal government. Regardless of the specific suite of measures the Court selects as a remedy in this case, further reductions will come at an extreme cost to the industry and to the fishing dependent communities where participation in the fishery has declined by as much as 50 percent in many New England ports since implementation of Amendment 5 in 1994 (NEFMC, 2001a). Despite years of effort and numerous revisions to the groundfish management plan to accommodate exigencies in the fishery over the course of twenty-five years, the institution and the resource has truly become a metaphor for management failure.

Mahogany Quahog Case Study

Though certainly not as historically extensive and dramatic in complexity as are the case histories of the lobster and groundfish fisheries, the history of mahogany quahog management is particularly interesting in that it exposes serious flaws in the national fishery management program. This is an extremely small-scale fishery with fewer than 100 participants and a geographic range of less than 1000 square miles. It is subject to extensive control by the state for public health purposes and it operates within a unique market niche. The sole basis for subjecting this fishery to a complex federal management plan is a provision of federal law that insist that a fishery be managed as a unit throughout its range, regardless of practical realities that militate against a unified approach.

Unlike the other fisheries examined here, there have been no discernable distribution fights over the resource, the control measures adopted had little to do with the biological condition of the resource, and the control measures did not emanate from market competitive factors between sectors of the industry. The information and power asymmetries with respect to the fishery management bargaining process in this case have been extreme as have the transaction costs imposed upon the industry. The participants in the fishery had no knowledge of or opportunity to participate in the management forum and the imposition of controls occurred via government fiat. Nevertheless, the fishery continues to operate essentially unchanged.

Synthesis: Case Studies, Hypothesis, and Sub-hypotheses

It is my hypothesis that the relative success of fishery management can be explained in terms of the interaction between fishermen and the government: the

relative power of each in the fishery management exchange; the degree information and perceptions about the fishery are comparable; the scale and complexity of the fishery to be managed; and the ability of the institutions in which they work to reduce transaction costs and devise rules that solve the collective action dilemma. Where this industry/government interaction is fraught with high transaction costs that inhibit the negotiation for effective rules, a devolution of authority in the management decision-making process to a more local level of the fishery will provide a means of overcoming impediments and lead to more successful outcomes. Attendant to this principal hypothesis are the following four sub-hypotheses: in large scale highly complex fisheries where asymmetries of power and information exist, the fishery management bargaining process will be marked by high transaction costs that will be overcome only with great difficulty. In this situation, there is a high probability that the interaction between parties to the negotiation will spiral downward leading to an institutional failure. Where information about the resource is asymmetrical, but where power symmetries exist, it may be possible to negotiate effective resource conservation rules, however, transaction costs will remain high thus the bargaining process will be protracted. In this circumstance, transaction costs can be more easily overcome if the effects of scale can be reduced. In large scale fisheries where the fishing industry and government have similar understandings of resource status and where symmetrical power with respect to decision-making authority exists, transaction costs can be more readily overcome leading to more effective institutional outcomes. In small scale low complexity fisheries, transaction costs involved as parties negotiate for control rules will be relatively low or readily overcome regardless of symmetries of information and

power. These hypothetical fishery management conditions are presented graphically in Table 1.

		SCALE		POWER		INFORMATION		OUTCOME
		Large	Small	Symmetry	Asymmetry	Symmetry	Asymmetry	
HYPOTHETICAL CONDITION	1							High transaction costs not easily overcome / bargaining process spirals down ward towards institutional failure
	2							High transaction costs possible to overcome but with difficulty / bargaining process will be protracted but can produce success
	3							High transaction cost more readily overcome / bargaining process spirals up wards tow ards institutional success
	4			both conditions applicable		both conditions applicable		Transaction costs in the bargaining process will be low or easily overcome with high probability of success

Table 1: Hypothetical fishery management conditions with respect to scale, power and information.

In the contemporary lobster fishery, informational asymmetries between industry and government have been lessened, institutions (boundaries) have been available to reduce scale, and other institutions were erected (co-management) to minimize power asymmetries. Despite high transaction costs and a protracted bargaining process, effective conservation rules have been negotiated. In the large scale highly complex groundfish fishery, information and power asymmetries have generated transaction costs that have not been overcome despite years of iterative changes to the management institution. In the mahogany quahog fishery, initially low transaction costs were significantly increased due to the imposition of a flawed management approach, yet these costs were insufficient to alter this very small scale low complexity fishery.

The case studies reveal information and power asymmetries in each of the three fisheries examined, particularly since the advent of the Magnuson Stevens Act. During

the early history of lobster management, these asymmetries were minimal as the industry and agents of the state were often aligned in their understanding of the status of the resource and of prescriptive remedies. Following the period of federalization, the New England lobster fishery emerged with an enhanced management institution capable of addressing collective action issues and creating significant opportunities for resource sustainability. This, however, did not come about easily or without significant cost during the 18 year period that the fishery was subject to federal control. The management institution in the Northeast groundfish fishery, by contrast, has spiraled downward in response to perverse countervailing incentives, leading to chronic overfishing of the resource. The Maine mahogany quahog fishery is an interesting counterpoint in that it remains relatively stable despite a faulty management institution. What sets these three fisheries apart is the degree to which institutions were in place or erected to overcome transaction costs.

Sub-Hypothesis 1: Data from the lobster fishery buttresses several hypothetical conditions. During the period of federal control between the mid-1980s and late 1990s management of the lobster fishery exhibited conditions characteristic of a Sub-Hypothesis 1 fishery – both power and information pertaining to the fishery management bargaining process were asymmetrical and issues associated with scale and complexity were not remedied. Likewise, the groundfish fishery demonstrates the first hypothetical condition in that the management bargaining process for this large scale highly complex fishery has been and remains subject to asymmetries of power and information. Management of both the lobster fishery during the 18 years of federal control and the groundfish fishery since the advent of the Magnuson Stevens Act is

marked by high transaction costs and a downward spiral in the interaction between negotiating partners.

Sub-Hypothesis 2: Contemporary management of the lobster fishery including the transition from federal control to management under the aegis of the Atlantic States Marine Fisheries Commission demonstrates conditions characteristic of a Sub-Hypothesis 2 fishery – it has been possible to negotiate effective resource conservation rules over time and in the face of significant informational transaction costs because symmetries of power have been established and the effects of scale and complexity have been reduced through the adaptive area management approach.

Sub-Hypothesis 3: The early history of lobster management within the State of Maine demonstrates conditions characteristic of a Sub-Hypothesis 3 fishery – asymmetries of power and information were minimal, most management measures emanated from the industry and major factions of the industry were aligned with state government officials in efforts to establish control rules. Throughout the first 130 years of the Maine lobster fishery, the condition of the resource fluctuated, however, the management institution spiraled upward to produce management measures that sustain the resource today.

Sub-Hypothesis 4: The mahogany quahog fishery case study supports the fourth hypothetical condition in that the transaction costs involved as parties negotiated for control rules in this very small scale low complexity fishery were easily overcome despite the fact that significant asymmetries of information and power existed.

This case study analysis supports the hypothesis that the relative success of fishery management can be explained in terms of the interaction between fishermen and

the government. Where transaction costs become too high for these parties to overcome when negotiating for control rules, an alternative management mechanism is necessary. One alternative that holds promise would provide parties to the fishery management bargaining process with equitable standing through a devolution of the government's management authority. This co-management approach would utilize nearly independent nested entities to transmit the devolved authority to a more local level of the fishery thus enabling more efficient use of information and feedback mechanisms essential to overcoming the dilemma of collective action in our fisheries.

Clearly this case study analysis is not an absolute test of my hypothesis – that awaits a quantitative experiment supported by statistical analysis. What this analysis does provide, however, is a good case for devolution of authority from the perspective that a more local organization will work better to conserve resources. But it does not make a theoretical case for why a centralized approach has not worked. Theoretical explanations of this nature are limited in the literature and developing a transaction cost framework for their explanation is beyond the scope of this thesis. This is, nevertheless, an important question providing opportunity for future research.

Final Comments

Chapter 8 proposes a new model of fisheries management, one that directly involves stakeholders in all aspects of fisheries management decision-making. What is proposed is a technical framework that will enable this to occur. However, in order for the stakeholders in the fisheries to become fully integrated into this new model, there must be a structural mechanism at the most local level to enable individuals to effectively participate in the process. Co-management is not structure – it is merely the

concept of shared responsibility. What is necessary are the logistics identified by Pinkerton (1994a): clear boundaries, clear criteria for participation in the management unit, units of appropriate scale to the human resource and the ecology of the area, and a clear understanding of how benefits accrue. In some fisheries, these logistics exists. In others they are woefully lacking.

Looking again at the fisheries focused upon here, the lobster industry/government interaction has been in flux over the 160 year history of this fishery and so too has its management. When authority for management decision-making was lodged at the federal level between the 1980s and the mid 1990s, the management institution failed. When authority was shared between the industry and government (de facto from 1880 through the 1970s and de jure since the late 1990s), the fishery management institution has more successfully overcome transaction cost impediments.

Today the lobster industry is well organized and there are well delineated management units in place within local areas, within territorial waters, and in federal waters as well. There are very clear criteria for participation in local, state and regional management units. The scale of the human resource and the ecology of the area is appropriate. Finally, there is a clear understanding of how benefits will accrue, although all of the mechanisms necessary to achieve these benefits are not yet fully in place. There are a number of nearly decomposable institutions arranged in a hierarchical or nested fashion relative to the decision-making process. At the most local level there are formal and informal units (cooperatives and harbor gangs, etc.) that make decisions affecting their immediate area. These local units engage directly in

management decision-making within a broader arena through lobster zone councils and the ballot process established as part of the zonal management approach. The intra- and inter-zone activities and their relation to the state-level fishery as a whole is under the purview of the Lobster Advisory Council which serves as a council of councils comprised of representatives of each zone council. Representatives of zone councils, the Lobster Advisory Council, industry trade organizations, and individual lobstermen serve as members of the Lobster Conservation Management Teams (LCMTs) established under the Atlantic States Marine Fisheries Commission and, with respect to the State of Maine, a lobster industry representative serves as a member of the ASMFC policy board which functions essentially as a council of councils relative to the seven LCMTs. Considering the institutions in place, the collective action problem has been minimized in the New England lobster fishery and this fishery can be characterized as a co-managed.

The Maine mahogany quahog fishery is not structurally complex. However, there are very clear and very narrow boundaries, clear criteria for participation in the management unit, units of appropriate scale to the human resource and the ecology of the area, and a clear understanding of how benefits accrue. Although a formal structure is provided for under the terms of the Mid Atlantic Council's management plan, it has proven to be superfluous and necessary decision-making is accomplished by participants in the fishery in an informal fashion. Given that this fishery has relatively few participants and that it currently operates under what is essentially a community-based quota system, the problems of collective action are not operative within this fishery and many attributes of co-management are present.

The New England groundfish fishery is well organized but there are no delineated management units in place within local areas, within territorial waters or in federal waters which is part and parcel of the problem that has vexed management of this very complex fishery. There are no boundaries other than those of coastline, Hague line and closed areas. There is no clear criterion for participation in the fishery other than that associated with the permit system. Participants in the fishery freely operate over a vast area thus the scale of the human resource relative to the ecology of the area is inappropriate. And, most disturbingly, because of the significant number of valid but inactive permits issued for this fishery, the latent effort that could return to the fishery has made it impossible for active participants to realize how conservation benefits might accrue. Although there are groundfish industry participants serving on the regional councils and industry representatives involved in the advisory panels, there is no formal structure, other than industry trade organizations, through which individual fishermen may engage in the decision-making process. Regrettably, the only means by which stakeholders can engage in the decision-making process relative to this fishery is through the legally defined procedural process, the courts, and through political influence.

The lack of appropriately scaled institutions has caused management of the groundfish fishery to be among the most dysfunctional in the world. To overcome the inherent collective action problems, a new management system is required, however, institution building may be difficult given exigencies of the fishery. The ability to contrive numerous hierarchical decision-making bodies, as is available in the lobster fishery for example, will be hampered by the long-standing *res nullius* nature of the

fishery and the egalitarian ethos supporting open access. However, the paradigm shift proposed, one providing efficient and cost-effective fishery management, accountability and cost recovery, and devolution of authorities for fishery management decision-making, can help. If so, it may be possible to overcome many of the problems caused by the failure of the current model to allow for direct involvement of stakeholders and the inability of the current model to address the problem of collective action.

At the time of this writing, opportunities for positive change in the Northeast groundfish management institution are possible with respect to the Conservation Law Foundation groundfish lawsuit. The federal judge in this case commented that the “disputes are so complex that the usual way for reaching a consensus on federal regulations will simply not work” (PPH, 2002) thus she has agreed to award intervenor status to thirteen groups including fishermen organizations (CCT, 2002). Plaintiffs, defendants and intervenors are expected to participate in an Alternative Dispute Resolution forum to determine whether or not they will consent to mediation. Should this case move towards mediation, the various stakeholders involved (conservationists, fishermen, the National Marine Fisheries Service, and the New England states) will have relatively equal *standing* in the negotiating process within this *new* fisheries *management* forum.

It is also possible that some co-management features may be adopted as part of the New England Fishery Management Council’s approach to groundfish management in light of this lawsuit. During recent full Council and Groundfish Committee meetings, significant discussion has taken place concerning the need to address the collective action dilemma through an areal management approach. Furthermore, in a

fashion reminiscent of the lobster effort management teams, the Council has agreed that fishermen should be directly involved in making area-specific decisions about management strategies.

Both the mediation process and developments within the council forum warrant careful examination as a further test of the hypothetical institutional benefits that can be derived where power and information is symmetrical between parties negotiating for fisheries management and where the effects of scale can be reduced through areal partitioning.

Chapter 8

RECOMMENDATIONS

An Alternative Fishery Management Model

Where symmetry with respect to public-private authorities and responsibilities can be achieved, the resultant industry-government interface can bring about positive fisheries management outcomes. Key to this approach, however, is an acknowledgement that fisheries management is about human behavior and not the management of fish stocks *per se*. Acknowledgement of this principle contemplates management activities emanating from local-level stakeholders, thus certain political conditions, including a degree of local control and a clear definition of local power, must be met in order for success to be achieved in our fisheries management endeavor. However, it is unreasonable to contemplate a fisheries management institution that is exclusively operative at the local level. Our Federalist government is a complex system of hierarchically linked but nearly independent entities. Our fisheries are equally complex and span a continuum from small scale community-based to region-wide industrial scale. Vesting local-level stakeholders with management responsibility and authority, therefore, must accommodate these complexities. Clearly it will require a modification of our extant management institutions. If the results of this dissertation are correct, then a devolution of authority from the central government to newly created entities is necessary to overcome the transaction cost impediments to resolving the dilemma of collective action in marine fisheries. Devolving this centrally-held authority would necessitate a polycentric system as formulated by Ostrom, Tiebout and Warren; one that will enable authority to be transmitted to the local level through a

system of ‘nested’ enterprises. The linkages between these enterprises would form the basis of efficient operation, especially in the use of information, including the feedback mechanisms, essential to learning about and adapting to changes in a fishery.

A model for this system of nested enterprises is the Federal Reserve System created with passage of the Federal Reserve Act in 1913 following years of periodic financial panics, bank failures, bankruptcies and economic downturns. The System’s initial purpose was to serve as the nation’s central bank and to establish effective supervision of banking throughout the United States. Over time, its role has been expanded to include involvement with national objectives of economic growth, employment, price stability, and interest rate moderation.

The System is independent in that its decisions are not subject to ratification by another entity of government, being best described as “independent within the government” (BoG, 1994). Its authority is delegated by Congress and thus it operates within the overall framework of the government’s objectives and is subject to Congressional oversight. The Federal Reserve System is composed of a central entity in Washington, D.C., twelve regional Federal Reserve Banks and twenty-five Branches located throughout the nation. The Central Bank, each Reserve Bank and all Branch Banks are managed by separate and independent Boards of Governors/Directors, and each entity relies upon advisory and working committees, including three councils establish by statute to advise the Central Bank. Structurally, the Federal Reserve is a system of hierarchically linked but nearly independent entities; a public-private organization designed as such to ensure a broad national perspective on economic activity (BoG, 1994).

A system designed to transmit devolved authority from a central government to local stakeholders in the management of marine fisheries exists in Australia. In 1991 the fisheries management arena in that country was dramatically altered, statutorily devolving the decision-making authority to stakeholders and moving away from the traditional government-centered approach towards one of co-management. The experience of those involved in the new approach support the premise that co-management can achieve multiple objectives in a complex fisheries environment (Willock, 1996). In fact, many attributes of the new Australian management system are aligned with attributes of successful multiparty systems. These systems recognize different interests that exist among groups of stakeholders and come about where goals and equitable standing are agreed upon and where the government facilitates the sharing of management resources, including information (Pinkerton, 1994a: 2367-2369). Specifically, logistical issues have been addressed and administrative institutions involving stakeholders have been provided, certain costs related to management activities have been assumed and shared by stakeholders, and certain political conditions, including a degree of local control and a clear definition of local power, have been established.

The fisheries of Australia prior to enactment of the 1991 Act had exhibited many of the same problems seen in fisheries around the globe. For example, the eastern gemfish which had supported a significant demersal finfish fishery in the early 1970s suffered recruitment collapse necessitating rapid reductions in quotas causing industry discontent, widespread protests, and significant conflict within the management and enforcement arenas. Defiance and disregard for management measures and industry's

lack of confidence in scientific assessments led to overruns of total allowable catches by as much as 250 percent (Willock, 1996: 9).

Fisheries at the time were managed by a federal agency functioning primarily as a command and control regulatory body with decision-making authority held at the bureaucratic/political level and vested in a Minister of Fisheries. Penultimate authority was held by agency biologist upon whom the minister heavily relied. The objectives of the statutory authority guiding management at the time were much the same as those of the Magnuson Stevens Act. They were focused upon conservation, prevention of over-exploitation, and an achievement of optimum utilization. The 1991 Act altered the conditions of management dramatically, infusing the system with objectives of efficient and cost effective management, accountability, and cost recovery (Willock, 1996: 2). This new direction in Australian fisheries management also exhibits “nested” (Ostrom, 1990) and “nearly decomposable” (Simon, 1969; 1996) institutions that affirm stakeholder involvement in the decision-making process.

Decision-making authority has been removed from the federal ministerial level and is now vested in a Board of Directors of the newly established Australia Fisheries Management Authority. This board is comprised of members appointed on the basis of nominations by a selection committee of both government and industry representatives. Nominees are chosen for their expertise in fishing or fishing related activities, fisheries science, resource management, or economics and business management. The Board has assumed the authority, once held exclusively by the minister, to establish, amend or revoke fishery management plans. Although the minister maintains a role in accepting management plans, the only two grounds upon which a plan can be rejected are failure

on the part of the Authority to conduct adequate consultation or failure of the plan to comport with the Authority's corporate or operational plan (Willock, 1996: 4).

Management advice is received by the Board from Management Advisory Committees and Consultative Committees established for each fishery. These committees are statutorily constituted, their decision-making power thus affirmed, and they play a central role in the management of fisheries. Because the committees serve as the focal point for stakeholder involvement, and as the Board is obliged to receive and act upon the advice of these committees, stakeholders at the local level have real decision-making authority. However, their participation in the decision-making process is not merely affirmed as a result of this administrative arrangement. Real decision-making authority is primarily as a result of the inclusion of cost recovery in the Australia Fishery Management Authority's objectives. The commercial sector pays 100 percent of all recoverable management expenses such as logbook and licensing programs, the administrative costs of the management advisory committees, and other general management costs including enforcement. The federal government pays only for expenses associated with benefits derived by society in general (Willock, 1996: 3).

The budgetary process established to support this cost recovery program has opened to detailed scrutiny the innermost bureaucratic mechanisms of government. Stakeholders now have a vested interest in the budgetary process and can see the relationship between fees charged and services rendered. The financial accounting system accurately portrays expenses and the budgetary process requires review and approval by the Management Advisory Committees for each fishery. Budgets, therefore, contain detailed projections for costs of services such as salaries, research,

enforcement/surveillance, and licensing, etc. This transparent budgetary process has enabled the industry to clearly see the costs of management, including the costs of enforcement violations, and it has promoted more efficient and effective operation of the management institution. Overall, this co-management model has demonstrated an improvement in communication with stakeholders, better use of their expertise, and it has prompted their commitment to work within the fisheries management objectives. Stakeholders have an ownership interest in management decisions and this has enabled the development of strategies more aligned with the needs of managing complex fisheries (Willock, 1996: 11).

An Alternative National Fishery Management Program

The Australian fisheries approach has most often been touted in this country because of its extensive use of individual transferable quotas, but its co-management institution has largely been ignored (Cicin-Sain and Knecht, 2000: 219, 273, 306). Transferable quotas are merely a management tool, supported by some and opposed by others primarily because of their potential socio-economic impacts. The management institution, however, can not be overlooked because it does have very real and practical application to fisheries management in the United States.

The most direct approach to apply the Australian model in this country would be through a new legislative program, one cut from whole cloth, and not one cobbled together from our current model. This is to suggest repeal of Title III of the Magnuson Stevens Act and a comprehensive re-establishment of the national fishery management program. This approach was utilized in Australia, not just to enable the new institution,

but to emphatically demonstrate that a paradigm shift was to take place and, with it, a cultural change integral to stakeholder acceptance of the shared management approach. Advocating such an approach in this country would be considered heretical to some. therefore, an approach that proposes necessary modifications of the Magnuson Stevens Act to enable the institution of co-management within the existing statutory structure is presented here. The purpose of this exercise is not to propose specific amendatory language, but to provide conceptual guidance as to those aspects of the Magnuson Stevens Act that would require modification to support an alternative national fishery management program.

National Standards

Obviously a modification of legislative objectives in support of efficient and cost-effective fishery management, accountability and cost recovery, and devolution of authorities for fishery management decision-making is necessary to this model. Thus objectives in the form of national standards must be articulated. These standards must ensure accountability through devolution of authority and expressly state that recovery of costs in managing the fisheries is to be achieved. The former is not provided for at all within the existing national standards while the latter is addressed in a contrary fashion. For instance, some may have assumed that the establishment of a regional council system was tantamount to devolution of decision-making authority. However, in fact of law and in the reality of its implementation, the regional councils are merely advisory in nature. It is true that they operate with a significant patina of authority. Nevertheless, in the final analysis regional fishery management councils serve merely to provide the Secretary of Commerce with advice. With respect to cost recovery,

although efficiency of utilization and cost minimization are addressed in National Standards 5 and 7, an affirmative statement that achievement of targets in relation to recovery of costs is necessary. Both of these existing standards are equivocal and Section 304 (d) of the Magnuson Stevens Act explicitly limits cost recovery significantly.

It should be acknowledged that this new model assumes that components of fisheries (sectors or perhaps geographic areas) may be managed differently and that fishermen in different components of the same fishery may have varying needs for or expectation of rights (access or ownership interest, etc.). As presented previously, certain logistical issues such as clear boundaries, clear criteria for participation in the management unit, units of appropriate scale to the human resource and the ecology of the area, and a clear understanding of how benefits accrue, must be resolved as a prerequisite to successful co-management. However, this would be extremely difficult to bring about given the National Standard 3 requirement that all fish within a stock be managed as a unit throughout the stock's range and the National Standard 4 proscription against discriminating conservation and management measures. Clearly these standards will need to be modified for co-management to be fully available within the context of fisheries managed under the Magnuson Stevens Act.

Management Authority

A means to devolve authority to an entity other than the Secretary of Commerce would be provided in this model. For the purpose of this exercise, a fisheries management authority is proposed, thus statutory language providing for its establishment, its objective and functions, powers and authorities is necessary. This

section would address the authority's corporate structure, constitution, construction and rules of procedure pertaining to membership, term of office, administrative matters including administrative staff, and conduct of the authority's business. It is through this section that devolution of authority is accomplished, what the commerce secretary's responsibilities are, and how those responsibilities integrate with those of the new authority. As contemplated here, the authority's board of directors would draw its membership from relevant stakeholder groups (including the commercial fisheries) and have responsibility for setting the policy framework and ensuring that legislative obligations are met. The commerce secretary (in reality the fisheries service) would operate at arm's length from the day-to-day decision-making of fisheries management with this responsibility passing to the authority's managing director. Essentially, all responsibilities currently vested in the secretary under Title III of Magnuson Stevens would be devolved to the authority. Accountability to the public for the management of public trust resources, however, would continue, ultimately through the Congress, but primarily via the secretary's review and approval of the authority's corporate plan and annual operational plan. In addition, the secretary would maintain a role, albeit limited, in accepting final fishery management plans.

The day-to-day decision-making of fisheries management would in this model be shared by the authority with management advisory committees that are, essentially, a variation on the existing regional fishery management council theme. As contemplated here, this would require few, but nevertheless significant changes in the existing Section 302 of the Magnuson Stevens Act within which the council system is established and its functions, responsibilities, structure, rules of procedure, and administrative matters are

stipulated. Importantly, the regional directors of the National Marine Fisheries Service for the geographic area within which councils are located would no longer have voting privileges as a member of the council. Instead, regional directors would be nonvoting members similar to representatives of other federal agencies. The debate about whether the regional directors (who essentially serve as representative of the Secretary of Commerce) should have voting privileges is longstanding, having been discussed by legislators and agency heads throughout the Act's early legislative history (U.S. Congress 1976; Schoning 2000). The only real authority the councils currently possess relative to the secretary is with respect to emergency and interim measures and only when it votes in unanimity for such action. In point of fact, this authority is unavailable because the regional director will typically cast a contrary vote so as to preserve the secretary's discretion. The purpose contemplated here for removing this voting privilege is to maintain the secretary at arm's length from the day-to-day decision making and thus bolster a council's decision-making authority.

I also propose that the means of selecting and appointing members to a council be altered such that nominations be made by a selection committee of both government and stakeholder representatives from each constituent state. Similar to nominees to the authority, nominees to a council should be chosen by the authority for their expertise in fishing or fishing related activities, fisheries science, resource management, or economics and business management, etc. Furthermore, I propose that the existing language (Section 302(g)(5)) that relegates council committees to advisory status be amended to enable these committees and panels to assume decision-making authority where appropriate and thus affording stakeholders a much more direct role. These three

levels of decision-making authority, committees linked to councils that are linked to the fisheries management authority are nested and nearly decomposable institutions that affirm stakeholder involvement in the decision-making process.

Cost Recovery

Participation of stakeholders in the decision-making process, however, is not merely affirmed as a result of administrative arrangement and nested institutions. Real decision-making authority comes about when stakeholders share the burden of the costs of management including its budgeting and accounting. In this model, participants in the fishery would cover the cost of all recoverable management expenses while the federal government would pay only for expenses associated with benefits derived by society in general. The budgetary process that would be established to support this cost recovery program would be opened to detailed scrutiny of the innermost bureaucratic mechanisms of government. Stakeholders would have a vested interest in the budgetary process and would thus see the relationship between fees charged and services rendered. The financial accounting system would accurately portray expenses and the budgetary process would require review and approval by the various species committees and the regional councils. This transparent budgetary process would contain detailed projections for costs of services such as salaries, research, enforcement/surveillance, and licensing, etc. and enable the industry to clearly see the costs of management, including the costs of enforcement violations.

A national fishery cost recovery program will require a new section of the Magnuson Stevens Act, one that articulates its purpose and establishes an account or fund into which monies of the authority will be deposited. This section will express the

means by which fees and levies will be assessed and how those monies will be utilized, the purposes for which authority funds may be used and what services of the federal government are deductible. It is assumed here that existing levies such as foreign fishing fees, appropriate customs duties, and permit fees etc. will be deposited into this account, that direct appropriation by the congress may be possible, and that the authority would be authorized to borrow funds and have bonding authority, including the authority to give security over all or parts of its assets.

Although this approach contemplates that participants in the fishery will bear responsibility for some of the costs associated with its management, it is not intended here to propose the levy or fee, the formula that would be used to derive its value, or how it would be assessed. Clearly, this determination will require a significant public policy debate and will not be arrived at easily. As demonstrated in the presentation on costs in Chapter 3, to offset the year 2000 budget of the National Marine Fisheries Service with a fee assessed against the ex-vessel value of domestic fisheries products landed in that year, a fee of 12 cents on every dollar received by fishermen would be required. Previous experience in public debate concerning fees associated with the fisheries convinces me that commercial and recreational fishermen would be reticent to accept any fee. To gain their acceptance, the public policy debate will have to be recast and cost recovery will have to be expressed as a part of a broader effort to bring stability to the fisheries, to provide users of the resource with a rational expectation of how their activities will be regulated, and to enable them to make strategic and rational choices about how best to conduct their enterprises. This can only be accomplished when the stakeholders are given a direct opportunity to make decisions relative to the

management of fisheries. Given the growing obligations and changing imperatives relative to the federal budget, it is not reasonable to assume that federal fisheries will continue to be managed without cost recovery, at least not as they are currently managed. In the current environment, the pressure is mounting to vest greater command and control authority for fisheries management authority within the federal government. Iterative amendments to the Magnuson Stevens Act over the years, particularly the enactment of the Sustainable Fisheries Act, is testament to this fact. The Australian model upon which this proposal is built is founded upon the same values as is the Magnuson Stevens Act. However, unlike the Magnuson Stevens Act, the fisheries management system in Australia is functional.

Applying the Model in New England

Thus far, this model has not addressed how it would integrate the states and, more specifically, the Atlantic States Marine Fisheries Commission. The role of the commission in this model poses a challenge, but the challenge is one of overlap. Prior to the enactment of the Atlantic Coastal Fisheries Cooperative Management Act the issue of overlap with the Atlantic coast councils and the redundancy of management effort was less significant. Fishery management plans of the commission and implementation measures adopted by member states related principally to fisheries and fishing areas not under the council's purview. However, enactment of ACFCMA enabled the commission, through action of the Secretary, to exercise control over fisheries prosecuted within federal waters. Furthermore, some fisheries are managed jointly by the commission and the council while others are managed independently by

one institution but have an impact upon the management activities of the other. This management complexity was evident in the lobster fishery case study. That same complexity exists in other fisheries such as summer flounder and northern shrimp. This is not to suggest that one management institution is better than the other as an institution, but that within the context of a new fishery management model, the overlap must be addressed.

The ASMFC appears to be a much more expeditious forum within which to develop management plans. However, the full ASMFC fishery management process, including implementation of management measures, is not necessarily more expeditious than that conducted within the federal venue. It is true that at the federal level administrative and procedural requirements imposed upon the process of fishery management has been an impediment to the system. It is also true that the ASMFC can conduct its business in a far more expeditious fashion. But that is because ASMFC, as an institution, has fewer administrative and procedural obstacles to overcome. However, all management action taken pursuant to ASMFC-developed management plans must be implemented through the administrative and/or legislative process of its member states. The proscriptive/prescriptive procedural requirements of some of these states are no less an obstacle to expeditious management action than are those at the federal level. Thus, in totality of plan development and implementation, ASMFC is not necessarily a more direct management institution.

ASMFC was established in a much different era than was the regional council system. Although both institutions were established to manage fisheries resources, their respective focus differs as a function of the juridical breath of the territorial sea that

defines their jurisdiction. They also differ significantly in their structure and mode of operation reflecting primarily their different purposes. The councils were established to provide advice to the national government and, although quasi-independent, councils are nevertheless a creature of the federal management system. The ASMFC was established to coordinate the management activities of the states and it is, therefore, a creature of that level of government. Throughout most of its history, the ASMFC was perceived as principally focused upon those coastal inter-jurisdictional fisheries considered to be of primary interest to the recreational sector. Since enactment of the Magnuson Stevens Act, and especially within the past 10 years, ASMFC has taken a more prominent position in the management of commercially important fisheries. In addressing the overlap that currently exists, it is not simply a matter of eliminating one institution and transferring its management responsibilities to the other. What is proposed here is a paradigm shift in the way that fisheries, all fisheries, are to be managed. To do so, it is most appropriate to consider that the councils will be constituted differently than they are currently. This also assumes that the role of the ASMFC will be incorporated within the hierarchy of nested nearly decomposable institutions of the new fishery management system.

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BIOGRAPHY OF THE AUTHOR

William J. Brennan was raised in Castine, Maine and graduated from the Kents Hill School in 1970. He attended the University of Maine and graduated in 1977 with a Bachelor's degree in Marine Biology. He received a Masters degree in Marine Affairs from the University of Rhode Island in 1985 and then returned to the University of Maine in the Fall of 1997 to enter the graduate program in Ecology and Environmental Science.

Prior to pursuing his undergraduate studies, Bill worked for several years in the U.S. Merchant Marine and in the commercial fisheries. After receiving his Bachelor's degree, he began his career as a fisheries scientist with the National Marine Fisheries Service at its laboratory in Woods Hole, Massachusetts. During this period, most of his work was devoted to a collaborative fisheries research program with the former Soviet Union, spending several months each year working aboard Russian research vessels. He continued his work as a federal scientist at the National Marine Fisheries Service laboratory in Narragansett, Rhode Island while pursuing his Masters degree at the University of Rhode Island.

After receiving his graduate degree, Bill served on the staff of U.S. Congressman John R. McKernan, Jr. (1st District Maine) and for several years was responsible for managing the Congressman's legislative activities including matters before the Merchant Marine and Fisheries Committee of the U.S. House of Representatives. In 1986, Bill was appointed by newly elected Governor McKernan to serve in his Cabinet as Commissioner of the Maine Department of Marine Resources, a

position he held for eight years. In this capacity, he managed the agency's diverse mission of research, management, enforcement and education and advised the governor and legislature on matters of marine fisheries policy. He also served as a member of and advisor to several marine and environmental boards and commissions at the state, national and international level.

Upon leaving his state government position, Bill opened a private consulting firm, W.J. Brennan Associates, in Portland, Maine providing policy guidance to businesses and governments in the marine and environmental policy field. He was also appointed to several boards including the New England Fishery Management Council, the Aquaculture and Marine Technology Board, and the Maine Oil Spill Advisory Committee. In 1999, he was appointed the Sawyer Professor of Ocean Studies at the Maine Maritime Academy and began his academic residency at the college that September where he has taught and conducted research in the marine policy field. Bill is a candidate for the Doctor of Philosophy degree in Ecology and Environmental Sciences from The University of Maine in May, 2002.