Catch Shares in New England

Key Questions and Lessons Learned from Existing Programs

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A report prepared by

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Contents

Acronyms

Key Term	Acronym
Adaptive management program	**AMP**
Allocation advisory panel	**AAP**
Annual catch entitlement	**ACE**
Australian Fisheries Management Authority	**AFMA**
Cape Cod Commercial Hook Fishermen's Association	**CCCHFA**
Cape Cod Fixed Gear Sector	**CCFG**
Community Development Quota	**CDQ**
Community Quota Entity	**CQE**
Days at sea	**DAS**
Department of Fisheries and Oceans	**DFO**
Exclusive Economic Zone	**EEZ**
Fishery management plan	**FMP**
Georges Bank	**GB**
Georges Bank Cod Hook Sector	**GBCH**
Gross registered tons	**GRT**
Gulf of Alaska Coastal Communities Coalition	**GOAC3**
Individual fishing quota	**IFQ**
Individual quota	**IQ**
Individual transferable quota	**ITQ**
Individual vessel quota	**IVQ**
Limited access privilege program	**LAPP**
National Marine Fisheries Service	**NMFS**
National Oceanic and Atmospheric Administration	**NOAA**
New England Fishery Management Council	**NEFMC**
Pacific Fishery Management Council	**PFMC**
Pacific Whiting Conservation Cooperative	**PWCC**
Potential sector contribution	**PSC**
Southeast trawl	**SET**
Total allowable catch	**TAC**

Executive Summary

Fisheries managers and stakeholders in New England are in the process of employing catch shares as an alternative to effort controls in a range of commercial fisheries in the region. A catch shares program is currently being developed and implemented for the New England groundfish fishery, and similar programs are being considered for other fisheries in the region.

Fisheries often transition to catch shares when they are in crisis. For the groundfish fishery in New England, the transition has been prompted by concerns about the status of stocks and health of the resource, problems with the existing effort control management system based on days at sea, declining socioeconomic trends, and a belief among decision makers that catch shares—in the form of sectors in this case—offer a path for achieving a sustainable and profitable groundfish fishery into the future. If designed and monitored effectively, catch shares programs can indeed improve fishing performance, management efforts, and ecosystem health. However, thoughtful design is critical to success. Poorly designed programs can lead to increases in discards and fishing capacity, underreporting of catch, overfishing of non-included species, and excessive consolidation of the fleet that can threaten the viability of traditional fishing communities and fishing practices.

This paper presents the results of an analysis of key issues and questions related to catch shares in New England and case studies of existing catch shares programs in the United States and internationally. The analysis of issues was conducted through conversations with a diversity of stakeholders involved in the development of catch shares in New England and a review of media articles, discussions, and statements from the public at New England Fishery Management Council meetings and other venues. The case studies describe select existing programs in the United States and internationally and identify lessons that can be applied to the New England groundfish fishery and other fisheries considering a transition to catch shares.

Key Issues and Questions for New England

The issue analysis revealed several key concerns and questions related to catch shares programs that are of major interest in New England. While some of the issues are important for all types of fisheries management systems in the U.S., many have particular significance for catch shares systems in New England. The issues and questions addressed fall into several categories, with cost emerging as a cross-cutting concern related to each:

- Initial program design
- Considerations for setting the total allowable catch
- Allocation and transferability
- Monitoring, reporting, and enforcement
- Communication and decision making processes
- Social and economic considerations

These issues and questions have led to complex and contentious debates among stakeholders and managers in New England about the transition to sectors in the groundfish fishery, and depending on the type of catch shares programs that are pursued, will likely emerge for other fisheries as well.

Initial program design, including the setting of clear goals and objectives and establishment of a transition strategy, are critically important. Key considerations relate to setting the total allowable catch (TAC), including adaptive management buffers to account for uncertainty, incentives for participating in cooperative research, and appropriate harvesting policies. Regarding allocation and transferability of quota shares, key issues include the formula and method used for determining initial allocation and how quota can and cannot be transferred among permit holders. The design and cost of monitoring and reporting programs are often of concern for stakeholders, particularly initial start-up costs and high levels of monitoring and reporting. The communication and decision making processes employed in fisheries management often receive sharp criticism from stakeholders. Relationships among stakeholders, scientists, and managers are commonly seen as hampered by a lack of meaningful engagement which leads to skepticism that key information is considered and diverse opinions are heard. While these critiques are common among all manner of fisheries management systems, they are particularly important for catch shares systems where fishermen take greater control and responsibility for fishing decisions. Finally, the social and economic elements of catch shares must be carefully considered. These include the quality and quantity of jobs, industry consolidation, community impacts, and the possibility of buybacks.

Lessons Learned from Existing Catch Shares Programs

The catch shares programs reviewed in this report provide lessons that can be applied to New England fisheries. These programs include:

- Georges Bank Cod Hook and Cape Cod Fixed Gear Sectors
- Scotia-Fundy Inshore Groundfish Mobile Gear Fishery
- Community Preservation in Alaska—Two Approaches
- U.S. Pacific Whiting Fishery
- Icelandic Groundfish Fishery
- Canadian Pacific Groundfish Fishery
- Australia Southeast Trawl Fishery
- A New Catch Shares Program: The U.S. Pacific Groundfish Fishery

Information presented about the case studies includes background on the fisheries, descriptions of the catch shares programs currently being implemented, and lessons learned that are related specifically to the topics of concern for New England identified in the issues analysis.

Several lessons about initial program design can be drawn from the existing programs reviewed. In the instance of the Scotia-Fundy inshore mobile groundfish fishery, program designers did not account for future expansion at the outset, and when the size of the program doubled from six to twelve stocks the added burden of administration, implementation, monitoring, and enforcement caused great difficulty for managers and industry alike. The program did include a detailed appeals process with which stakeholders were generally satisfied, such that no lawsuits followed. Conversely, the Australia southeast trawl fishery did not incorporate an appeals process into its program, and several lawsuits were filed pertaining to allocation. The U.S. Pacific whiting fishery is currently at a turning point. The catcher-processor sector is managed under a successful voluntary cooperative, but managers are in the process of deciding whether to make catch shares cooperatives mandatory for all sectors in the fishery. Should they move forward with this plan, it will be important for managers to carefully consider what is working well in the catcher-processor sector to ensure that new regulations do not negatively impact the functioning of an existing and successful cooperative. The U.S. Pacific groundfish fishery, which is currently transitioning to a hybrid catch shares program, is faced with high costs of administration, which will need to be dealt with moving forward.

Biological considerations and the setting of an appropriate TAC are important for all fisheries, including those managed under catch shares. In some existing programs adaptive management set-asides were used to account for management uncertainty. The U.S. Pacific groundfish fishery is planning to hold back 10% of the TAC, in order to allow future entrants access to the fishery and provide flexibility as management determines the best formula for allocation to coastal communities. The Australia southeast trawl fishery holds back 5%-10% of its TAC, mainly for cooperative research, a gesture that engenders good will among fishermen. An important lesson from the Scotia-Fundy groundfish fishery is that TACs need to be set sufficiently conservatively so that the likelihood of mid-season closures, which undermine fishermen's confidence in the program, is minimized.

Initial allocation and transferability of quota are critical elements, the design of which can either cast a deep shadow over a new catch shares program or provide the key to its success. Australia faced great challenges with allocation in the beginning of its southeast trawl catch shares program. When expanding the program, managers decided to employ a neutral third party to determine initial allocation of orange roughy. However, when the allocation decision was made, managers chose not to follow the recommendations of the neutral committee, upsetting many stakeholders and prompting a series of legal challenges. In the two existing sectors in New England, rolling baselines included at the outset provided an incentive for fishermen to stay out of sectors until their catch histories improved. Fishermen who initially joined the sectors were distressed when their allocations declined as the other fishermen eventually joined. In the Scotia-Fundy inshore mobile gear fishery, a single vessel was allowed to fish under multiple quota licenses through the temporary transfer of quota. This strategy reduced the need for often expensive and ineffective traditional license buybacks and other regulatory approaches.

A key issue related to monitoring and reporting programs is cost. In the Canadian Pacific groundfish fishery, the cost of carrying an observer or purchasing electronic monitoring equipment has been very high. The New England groundfish fishery may encounter similar problems. Even though the National Marine Fisheries Service is funding both at sea and dockside monitoring for the first year of the sector program in New England, industry participants worry that the standard is being set so high that they may not be able to afford to continue the program at the same coverage levels in subsequent years.

Social and economic outcomes greatly impact perceptions of success or failure of a catch shares program. Several of the programs reviewed led to industry consolidation and the decline of small boat fleets. Some try to avoid excessive consolidation by placing limits on quota sales for the early years of implementation in order to allow small boat owners time to organize their businesses and become familiar with how the system operates without feeling coerced to sell quota immediately. Others include ownership caps or owner-operator rules. Some catch shares systems include community-oriented programs that either provide an initial allocation to selected communities or facilitate the purchase of quota for use by fishermen based in certain communities. Several fisheries have undergone vessel buybacks that give fishermen an enhanced opportunity to exit the fishery while removing excess capacity.

Overall, several key components can contribute significantly to determining the success or failure of catch shares programs. Of the programs described in this report, those that were carefully planned, reserved a portion of the TAC for adaptive management, focused on communities, and experienced trust and good communication among managers and industry achieved the greatest levels of success.

Background

Fisheries managers and stakeholders in New England are in the process of employing catch shares as an alternative to effort controls in a range of commercial fisheries in the region. The transition is being prompted by concerns about the status of stocks and health of fisheries resources, widely recognized problems with existing effort control management systems, declining socioeconomic trends for a diversity of fishermen and traditional fishing communities, and a sense among decision makers that catch shares—which can be designed in a variety of ways—can offer a path for achieving sustainable and profitable fisheries into the future. Catch shares are intended to offer benefits over effort controls including more productive, sustainable fish stocks, long-term economic and social benefits, improved stewardship of the resource by fishermen and managers, and improved safety (Babbitt and Greenwood 2008, Bonzon 2009, Johnston and Sutinen 2009). However, catch shares systems have also been criticized for causing unintended problems such as excessive consolidation of the fishery and loss of small fishing operations and community heritage, a sense of privatization of a public good that leads to a false sense of security among fishermen, and high costs and other barriers to entry into fisheries (Ecotrust Canada 2009, Pew 2009). Where implemented, catch shares programs must be designed carefully to maximize the potential benefits and avoid adverse impacts.

Catch shares are defined by the National Oceanic and Atmospheric Administration (NOAA) Catch Shares Task Force as "a general term for several fishery management strategies that allocate a specific portion of the total allowable fishery catch to individuals, cooperatives, communities, or other entities. Each recipient of a catch share is directly accountable to stop fishing when its specific quota is reached" (NOAA 2009). Major categories of catch shares include individual quota programs such as individual transferable quotas (ITQs) and cooperatives such as the sectors being created for the groundfish fishery in New England. A limited access privilege program (LAPP) is a related term used in the reauthorized Magnuson-Stevens Fishery Management and Conservation Act (MSA, Public Law 109-479) for a system whereby entities are granted the privilege to harvest a specific portion of the total allowable catch (TAC). The term includes both individuals and groups or communities that may qualify to receive an allocation or an allotment of the commercial quota or TAC. It is important to note that the MSA requires the New England region specifically to undergo a referendum of fishery participants in order to implement an individual quota system for any fishery in the region.

The New England groundfish fishery is currently engaged in a transition to sectors. Sectors are voluntary cooperatives of groundfish permit holders that receive group allocations of groundfish quota based on the combined catch history associated with the groups' permits. The sectors have been required to develop operations plans and self-administer their quota share, and are scheduled to begin operation in May 2010. After consideration of a variety of options to meet strict rebuilding deadlines under the MSA, sectors were chosen by the New England Fishery Management Council (NEFMC) in Amendment 16 to the Northeast Multispecies Fishery Management Plan (FMP).

The transition to sectors has been fraught with debate and contention, and discussions about catch shares in New England are dominated by the current experience with groundfish. While the region is essentially committed to implementing the groundfish sector system in 2010 as established by Amendment 16, there will be opportunities to modify and improve the system as necessary through future amendments to the Multispecies FMP. In addition, in the coming years decision makers in the region are likely to consider a transition to catch shares for additional New England fisheries. The sooner careful thought and collaborative discussion are devoted to how sectors can be improved and effective new systems can be designed for additional fisheries, the more successful the final product and more fruitful the relationships among stakeholders and managers are likely to be.

Several papers provide recommended design elements of catch shares or discuss aspirations or concerns related to these systems that inform discussions about the transition to catch shares underway nation-wide and in New England (for example, Babbitt and Greenwood 2008, Bonzon 2009, Ecostrust Canada 2009, Johnston and Sutinen 2009, Macinko and Whitmore 2009, Pew 2009, Randall and Grader 2009, Redstone Strategy Group 2007).

In addition, several meetings have been held to share information about catch shares with managers and fishermen in the region. For example, Meridian Institute partnered with the Gulf of Maine Research Institute to convene a workshop on the socioeconomic aspects of catch shares design in December 2009. This meeting brought fishermen from other regions to New England to discuss their experiences with the design, implementation, and operation of catch shares systems. It provided New England fishermen and other concerned stakeholders an opportunity to hear from and have their questions answered by fellow fishermen with a range of perspectives on how fishing operations and communities have been affected by catch shares and which tools and strategies have been most effective in addressing the socioeconomic factors. A summary of the workshop discussions will be available on the Gulf of Maine Research Institute website in early 2010.

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About This Report

This report provides information about selected existing programs in the United States and internationally, and describes lessons learned about issues that are relevant to New England. It is intended to contribute to the body of information decision makers and stakeholders will consider when deciding whether catch shares are appropriate for particular New England fisheries, and if they are, what design elements and lessons learned might be drawn from existing programs.

The section entitled ***Key Issues and Questions for New England*** describes selected questions and concerns related to catch shares that are important for New England fisheries managers and stakeholders to consider. These issues and questions are applicable to any fishery in the region considering catch shares and in some cases to the evolution of groundfish sectors as well. The issues relevant to New England fisheries were identified through conversations held with a diversity of stakeholders and managers in New England in 2009, reviews of media articles and opinion pieces, as well as discussions and statements from the public at NEMFC meetings and other venues. While many of the issues are relevant to the current debate about groundfish sectors, they are not solely focused on the groundfish transition. To address groundfish-specific issues, ***Status of Key Issues for Groundfish Sectors*** provides a description of how Amendment 16 has or has not addressed the general issues identified.

The section entitled ***Lessons Learned from Existing Catch Shares Programs*** describes selected fisheries that have transitioned to catch shares in the United States and internationally, covering the status of the fisheries, background of the programs, and lessons learned in each case. The fisheries described were chosen because they have the potential to contribute lessons that can be applied to New England.

This paper does not intend to capture every issue or question that New England stakeholders have regarding catch shares in general or groundfish sectors specifically, nor does it extrapolate every lesson learned from the existing programs described. Rather, the intention is to concisely address some of the major issues facing implementation of catch shares systems for New England.

Key Issues and Questions for New England

This section provides an overview of selected key issues and questions that are important for New England decision makers and stakeholders to address as they consider both refinements to the new sector system for groundfish and movement of additional fisheries into catch shares. Many of the issues described are relevant for groundfish sectors, and in some cases may be dealt with in subsequent amendments or framework adjustments to the Northeast Multispecies FMP. Other issues or questions described here have already been addressed for groundfish and would be most relevant for those fisheries considering a transition to catch shares that are still in the early stages of conceptualization and design.

The issues below were identified through conversations with a diversity of stakeholders and decision makers in New England, tracking of news articles and publications on the topic, and discussions and statements made at NEFMC meetings. This section focuses in particular on those issues for which lessons can be drawn from existing catch shares systems described in this paper.

Initial Program Design

There are two key aspects of initial program design that appear to be of major concern to stakeholders in New England: clear identification of the goals of catch shares programs (including socioeconomic goals) and establishment of a clear and deliberative strategy for transitioning from effort controls to catch shares.

Goals and Objectives

Setting clear and measurable goals and objectives to guide management is critical to the success of any fisheries management system, including catch shares. The MSA sets broad national goals for fisheries management to which Fishery Management Councils and National Marine Fisheries Service (NMFS) managers must adhere. However, goals and objectives for specific regions and fisheries can vary greatly from place to place. In order for management strategies to achieve and be able to clearly document success, it is important to establish specific goals and objectives at appropriate regional and fishery scales. These should include goals that are biological, ecological, social, and economic, and identified through the Council process with robust and meaningful stakeholder input. Stakeholders in New England have expressed concern that the goals of catch shares systems in the region lack clarity, particularly as related to social and economic factors. While the following key questions for New England are not exclusive to catch shares systems, they are critical to address for the success of any fisheries management approach and therefore are important to highlight here in the context of a transition to catch shares. They include:

- What are the New England region's goals and objectives for fisheries management (including ecological and socioeconomic) both broadly and for particular fisheries?
- By what process will goals and objectives be defined? How will stakeholders be engaged in that process?
- What criteria will be used to determine if catch shares are appropriate for particular New England fisheries, i.e., if catch shares systems can help meet the goals? What kind of catch shares systems would be most successful for those New England fisheries that are appropriate? In cases where individual quota systems are deemed most likely to be effective, how can the MSA's referendum requirement be met?

- What metrics will be used to track progress toward goals and objectives once they are established?
- How will "success" of a catch shares program be defined?

Transition Strategy

Management changes are often difficult and costly for stakeholders as they struggle to understand and work within a shifting regulatory context. A transition from effort controls to catch shares represents significant change, and a well-designed and executed transition strategy can ease the burden of change on fishery participants and managers alike. A transition strategy can facilitate step-wise evaluation of social and economic impacts and adjustment of management strategies to better achieve goals in the early years of implementation. Key questions for New England related to transition include:

- What kind of transition strategy should be put in place to ease a fishery into catch shares?
- Should participation in the catch shares system be voluntary during the early years? With respect to the new groundfish sectors, should the common pool option remain in place in the medium or long-term?
- Should a transition include limits on quota transfers during the early years?
- Should a transition include public funding for administration of catch shares during the early years until a fishery becomes profitable enough for industry to shoulder those costs?
- How can managers take into consideration what is working well under the existing system and salvage those aspects in the transition to a new system?
- How should future growth be planned for in the design of a catch shares system?

Considerations for Setting the Total Allowable Catch

Biological and ecological success of catch shares systems depends in large part on whether the TAC appropriately limits fishing mortality to a sustainable level. There are many complex technical decisions that managers need to make when setting the TAC for a particular stock. In addition, policies related to how that TAC is harvested have important implications for ecosystem health and the long term sustainability of the fishery, such as those related to reducing bycatch and protecting habitat. Some aspects that appear to be of interest in New England are adaptive management set-asides, quota for cooperative research, and policies related to harvesting strategies and bycatch.

Adaptive Management Set-Asides

In order to provide flexibility for decision makers to take future action to address unanticipated impacts of a new catch shares system, adaptive management set-asides can be factored into allocation of the TAC. These set-asides allow a Council to provide quota for research purposes, community preservation efforts, or any number of activities deemed beneficial after implementation of a catch shares system has already begun. If that TAC is not used for these purposes within a certain time period, it can be allocated to fishermen. Key questions for decision makers will be:

- What levels of buffers or set-asides of quota should be implemented to account for management uncertainty and allow for adaptive management?
- For how long should that set aside quota be held before it is used or released to harvesters?

Quota for Cooperative Research

Cooperative research is perceived by many in New England to be an important way for fishermen and scientists to learn from one another, gain a better understanding of a fishery, and provide cost savings for scientists and extra income for fishermen. NOAA has identified increasing cooperative research opportunities as a priority for New England and provided an additional $6 million in 2009 to enhance existing cooperative research projects in the region (NOAA Press Release April 8, 2009). Key questions for stakeholders and decision makers are:

- What incentives will be provided to fishermen to engage in cooperative research?
- Will quota be set aside for this purpose?
- Will there be a bonus for using ones quota for research?

Harvesting Strategies and Policies

To ensure fisheries are healthy and sustainable into the future, and therefore provide maximum benefit to fishermen and the communities they support, habitat and other ecosystem considerations must be taken into account. Use of certain gear types and harvesting strategies have relatively lower impacts on habitat and other key ecosystem features, and incentives or requirements for their use can be applied to catch shares systems. The practice of "high grading," discarding fish of a lesser value in favor of those with a higher market value, is of continuing concern with catch shares programs, particularly in multispecies fisheries such as the groundfish fishery in New England. This requires careful consideration in program design, particularly where at sea monitoring is less than 100%. An important related question is whether the TAC will be applied to catch or landings. Key questions for the region include:

- What incentives should exist for selective harvesting strategies in catch shares systems?
- How can gear selectivity correlate with available biological resources? Where strict gear restrictions are lifted in the transition away from effort controls, what policies to promote lower-impact gear types in catch shares systems can be effectively employed?
- How will bycatch be addressed, and what measures should be put in place to prevent "high grading?"
- Will the TAC be applied to landings or catch?

Allocation and Transferability

Initial allocation of quota and the transferability of quota after it has been allocated are two of the most challenging issues for decision makers and stakeholders to address when transitioning a fishery to catch shares. They are also two of the most important because these decisions will in large part determine what a fishery and fishing economies will look like into the future.

Initial Allocation

A common and significant point of disagreement in transitions to catch shares is the formula for initial allocation of quota because the decision is grounded in varying interests' ideas of what is fair. What seems fair to any one group will often seem unfair to another. For those fisheries in New England considering a transition to catch shares, serious and early consideration of options for initial quota allocation and carefully mediated discussions among stakeholders about options for an allocation formula can make the process less contentious than it otherwise might be. Key questions for fisheries in the region include:

- How should the initial allocation formula be decided? Can stakeholders be engaged more effectively in determining allocation formulas through enhancements to the current Council decision making process?
- What formula should be used for initial allocation?
- In cases where catch history is used in whole or part to determine allocation, how should catch history be determined? How will errors in catch histories be corrected? How will the qualifying time period for determining history be decided? Should there be different qualifying periods for different parts of the fishery?
- Where capacity is used to determine allocation, how will it be calculated?
- How should gear type be taken into consideration?
- What kind of appeals process should be put in place to resolve disagreements about allocation?
- Should quota be allocated to communities or processors, and if so, based on what criteria?
- Should allocation include a set-aside for new entrants into the fishery?

Transferability of Quota

The ability to transfer quota among participants in a catch shares system is important for economic efficiency. Transfers can include permanent changes of ownership and temporary in-season transfers such as trades and leases. Quota transfer is essential for allowing quota holders to reconcile the quantities of quota they have the right to harvest with what they actually catch. With regard to leasing, benefits can include the possibility of a stream of income during retirement and opportunities for new entrants to build up capital to buy quota. There are potential downsides to transfers as well that are important to carefully consider in the design of catch shares systems. These include excessive consolidation that results in the decline of traditional fishing communities and fishing practices, and inflated quota purchasing and leasing prices, among other impacts. Key questions for decision makers include:

- What rules and mechanisms will be put in place for transferability and ownership of quota? Should trading rules be established for eligibility, transparency, restrictions based on capacity or geography, ownership caps, conservation taxes on transfers, starting dates for allowing transfers, and sunset provisions?
- What platforms will be created for leasing? What rules and limitations will be placed on leasing, if any? Should leases be made transparent to the public?
- In the case of sectors, where permanent transfer of quota requires movement of vessels among sectors, does a sector have to accept anyone who wants to join? How does a permit leave a sector?

Monitoring, Reporting, and Enforcement

Reliable catch monitoring and reporting are critical for the success of any fishery management system. They are particularly important for catch shares systems because each fisherman or group of fishermen is responsible and accountable for staying within their quota. Debates about the necessary levels of catch monitoring, monitoring methods, and reporting requirements, how data collected from fishermen will be used in stock assessments, and who should pay for what aspects of the system and when can be highly contentious. Enforcement questions related to sector programs include whether members will be held jointly liable for violations and what appropriate penalties should be. New England decision makers and stakeholders considering the evolution of groundfish sectors or a transition to catch shares in additional fisheries should consider the following key questions:

- What are the primary and secondary goals of a catch monitoring and reporting system?
- What level and type of catch monitoring and reporting systems will be most accurate, reliable, and cost-effective for various catch shares systems?
- Who will pay for monitoring at various points of maturity of catch shares systems?
- How will industry be engaged in the process of designing monitoring, reporting, and enforcement systems?
- How will fishery dependant data be captured from catch shares systems and be used for stock assessments?
- How will discards be accounted for? How will landings be accounted for?
- How is any "observer effect" quantified in systems that rely on on-board observers?
- In fisheries managed under a sector system, what happens if a sector member has a major violation? Is the sector accountable or the individual? What is the penalty schedule?

Communication and Decision Making Processes

A long history of distrust among fishermen, managers, and scientists in New England has made effective communication among the parties and collaborative decision making particularly challenging. Processes to engage stakeholders early in goal and objective setting for fisheries, learning about how catch shares systems can be designed to meet those goals, and collection, analysis and sharing of information by and among stakeholders to track progress toward those goals can help improve important relationships in the region.

Forums for Improving Trust and Collaboration

Improving relationships and collaboration among stakeholders, managers, and scientists involved in New England fisheries will require ongoing, meaningful, authentic, and neutral forums for discussion and decision making. Such forums will require investments of time and resources, neither of which are in abundance in New England at this time. Leaders in the region may determine that the benefits in the long term justify the costs. Key questions they should ask themselves include:

- How can a diversity of stakeholders be productively engaged in setting visions, goals, and objectives for fisheries in general and in catch shares systems in particular?
- What forums can be established for learning about important design elements for catch shares and what outcomes they are likely to produce in particular fisheries?
- How can certain aspects of catch shares systems be designed specifically so that managers and fishermen begin to increase trust in one another?
- How can a catch shares system be designed to allow managers to lift the maximum amount of effort controls and other traditional management measures, ensure sustainable harvesting rates, and provide fishermen with responsibility and accountability for performance?
- Which measures can be most effective in improving communication and cooperation among and within the NEFMC and its various committees, NOAA headquarters and regional office, Northeast Fisheries Science Center, and the full suite of key stakeholders?

Information to Support Decision Making

Ideally, decisions about the design and implementation of catch shares would be based on a range of up-to-date information about the current state of the fishery and fishing economy, as well as projections about the possible outcomes of various catch shares design options. Detailed studies can require large investments of time and money, and waiting for them to be completed can delay management decisions that are required under the law. However, insufficient analysis of baseline conditions, projections for impacts under proposed management systems, and tracking of progress through time, including of social and economic impacts, can hamper the success of management strategies and further degrade relationships with key stakeholders. Questions that should be addressed as soon as possible for fisheries considering a transition to catch shares include:

- What special studies should be conducted early in a decision making process to support design and implementation of catch shares?
- What metrics should be put in place to evaluate baseline conditions and progress toward goals? How will progress reports trigger mid-course adaptations where needed?
- How should information be provided back to fishermen in forms useful for their business decision making?
- How can a catch shares system foster greater understanding among industry members of the science behind management decisions and greater use by managers and scientists of on-the-water knowledge that fishermen can contribute to decision making?

Social and Economic Considerations

Social and economic characteristics that are important to the region's fishing stakeholders and depend on healthy ecosystems for long term success are necessarily constrained by the limitations of the natural environment. Within those limitations, however, are abundant opportunities to define the socioeconomic characteristics that a community, an industry, or a region envisions for the future. Maximizing those opportunities will require explicit identification of region or fishery-specific visions and goals, and implementation of policies to make that vision a reality. It is important to note that social and economic factors should be considered in the design of all aspects of catch shares programs, including those elements described above. Specific social and economic issues in New England are highlighted here to illuminate some of the priority questions that stakeholders and decision makers should consider going forward.

Quantity and Quality of Jobs

New England stakeholders hold a diversity of viewpoints about the ideal characteristics of fishing jobs, fleet composition and diversity, community protection, and other social and economic qualities, and these will be challenging to reconcile. However, unless efforts are made to address these differences and reach some agreement about a vision for New England's fishing fleets and policies to achieve that vision, market forces and regulatory authorities alone will determine the region's future. Should stakeholders and managers come together, key questions of interest would include:

- What is the appropriate and desired mix of vessel and ownership types for particular fisheries in New England, and how can policies under catch shares be designed to achieve that vision?
- How should excessive consolidation be defined, and what measures would be appropriate and effective to prevent it?
- How should the quality of jobs under a catch shares systems be measured (e.g., compensation or consistency)?

- Should crew be given a stake in the fishery as a point of entry to ownership (e.g. through crew allocation)?
- How should social and economic impacts be measured over time? How can data on impacts pre- and post-transition be collected, particularly in light of restrictions related to confidentiality?
- What mechanisms should be used to monitor effort and prevent the unintended transfer of effort from those fisheries transitioning to catch shares to other fisheries?
- How can new entrant-related and small operator-specific issues be addressed? Specifically, what strategies have been employed to provide access to capital to buy quota? Should policies be implemented to stimulate bank lending to fishermen involved in transitions to catch shares? How can quota be collateralized? How will various leasing strategies affect new entrants into catch shares fisheries? What about non-market entry mechanisms?

Community Impacts

A key consideration for stakeholders and managers designing a catch shares system is how they want the region's fishing communities to look in the future. Decision makers should be aware of the costs and benefits of mechanisms for protecting fishing communities. If community preservation efforts are to take place, some key questions that will need to be answered include:

- How should "community" be defined for the purposes of community preservation efforts? And how does the definition chosen affect relationships among and within cooperative arrangements, such as sectors?
- What criteria should be used to determine which communities require special effort to preserve them under a catch shares system, and what measures are most effective at doing so?
- Should quota be initially allocated to communities?
- What options are available for communities after an initial allocation that did not include them has been made? How will the catch shares program officially sanction or support those options?
- Are processor quotas appropriate for protecting communities in New England?
- What policies to protect port infrastructure should be in place?

Buybacks to Reduce Capacity

Some stakeholders in New England are interested in a federal buyback to reduce capacity and ease the transition to catch shares for those exiting the industry. Buybacks can take many forms, and key questions to consider are:

- How will a buyback impact New England if implemented prior to or in conjunction with a transition to catch shares?
- What kind of buyback should be used—who should be eligible, what conditions should be placed on the seller, and how should it be funded?

Citations

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Key Issues in Existing Programs

This matrix identifies the key issues encountered and lessons learned during the development and implementation of existing catch shares programs in the U.S. and around the world that are covered in this report.

Key Issue or Question	Lesson Learned	Existing Catch Shares Programs
Initial Program Design	Goals and Objectives	U.S. Pacific Groundfish Fishery
		Scotia-Fundy Inshore Groundfish Mobile Gear Fishery
		Australia Southeast Trawl Fishery
		U.S. Pacific Whiting Fishery
	High Costs	U.S. Pacific Groundfish Fishery
		Icelandic Groundfish Fishery
Considerations for Setting the TAC	Adaptive Management	Scotia-Fundy Inshore Groundfish Mobile Gear Fishery
		U.S. Pacific Groundfish Fishery
	Quota for Cooperative Research	Georges Bank Cod Hook and Cape Cod Fixed Gear Sectors
	Adaptive Management and Quota for Cooperative Research	Australia Southeast Trawl Fishery
	Harvesting Strategies and Policies	Scotia-Fundy Inshore Groundfish Mobile Gear Fishery
Allocation and Transferability	Initial Allocation	Georges Bank Cod Hook and Cape Cod Fixed Gear Sectors
		Australia Southeast Trawl Fishery
	Transferability of Quota	Scotia-Fundy Inshore Groundfish Mobile Gear Fishery
Monitoring, Reporting, and Enforcement	Cost	Canadian Pacific Groundfish Fishery
		Scotia-Fundy Inshore Groundfish Mobile Gear Fishery
		U.S. Pacific Whiting Fishery
Communication and Decision Making	Trust and collaboration among stakeholders and managers	Georges Bank Cod Hook and Cape Cod Fixed Gear Sectors
		Australia Southeast Trawl Fishery
Social and Economic Considerations	Community Impacts	Community Preservation in Alaska
		Icelandic Groundfish Fishery
		Canadian Pacific Groundfish Fishery
		U.S. Pacific Groundfish Fishery
		U.S. Pacific Whiting Fishery
	Buybacks	U.S. Pacific Groundfish
	Transition	Australia Southeast Trawl Fishery
		Georges Bank Cod Hook and Cape Cod Fixed Gear Sectors

Status of Key Issues for Groundfish Sectors

Discussions about catch shares in New England are often and understandably dominated by the current transition of the groundfish fishery from effort based management to sectors through the recently approved Amendment 16 to the Northeast Multispecies FMP. Many issues highlighted in the previous section, ***Key Issues and Questions for New England,*** have been addressed to some extent by Amendment 16 and there is a sense among many players in the region that the window for improving the sector system for groundfish has already closed. However, it is important to note that opportunities to further amend the groundfish management system—in both small and large ways—will arise in the coming years. As the sector system established by Amendment 16 is implemented and outcomes of the system as currently designed are realized, it will be important for decision makers and stakeholders to revisit key questions and issues as they work to adapt and improve the system over time.

Issues explored in ***Key Issues and Questions for New England*** are relevant for all fisheries transitioning to catch shares, as well as for those, such as groundfish sectors, that have already been designed and will need to adapt and improve over time. This section describes how Amendment 16 does or does not address some of the key issue areas of particular concern to stakeholders in the region. Discussions with stakeholders and decision makers contribute anecdotal information where direct references from the Amendment could not be found.

Key Considerations for Decision Makers

While specific issues for the next iteration of groundfish management will be illuminated with greater specificity in the coming years as sectors are implemented, several overarching considerations should be taken into account right away:

- How specifically will success for the sector system be defined?
- How will the full range of possible impacts of the new system be measured over time?
- How will the system be adapted based on that information?
- How will stakeholders be engaged in documenting impacts and shaping programs?
- What kind of policies will be particularly important to modify or add in the early years of the program? When and how will these be considered?
- How will the system be funded in the long term?

Initial Program Design

Two specific issues related to initial program design are considered: the development of goals and objectives and the transition process from effort controls to a dual common pool and sector-based management system. Amendment 16 identifies five specific goals for sector-based management, which were developed through the traditional Council process:

- Address bycatch issues
- Simplify management
- Give industry greater control over its own fate
- Provide a mechanism for economics to shape the fleet rather than regulations (while working to achieve fishing and biomass targets)
- Prevent excessive consolidation that would eliminate the day boat fishery (Amendment 16, section 4.2.3)

While Amendment 16 does address the collection of monitoring data on catch, bycatch, and landings data from fish tickets and dealer reports, it does not set forward clear metrics that can be used to track progress toward four of the Amendment's five goals. The monitoring specified in the Amendment can be used to track only bycatch.

In switching to catch shares, many existing programs in the U.S. and internationally have implemented a strategy for gradual transition that gives fishermen and managers opportunities to adapt to the new system and to evaluate and amend the system as needed in the early years. The NEFMC intentionally left available to fishermen the option to fish in what is now called the "common pool," the part of the fishery that will continue to be governed by the status quo of effort controls. However, many active fishermen have not viewed this as a sufficient transition strategy. The common belief is that participating in a sector, while somewhat unsatisfactory, will be superior to staying in the common pool. Approximately 50% of groundfish permit holders, representing roughly 96% of the catch history, have joined sectors, leading to an almost complete switch from effort controls to sector-based management in the first year. Fishermen in sectors will be exempt from days at sea (DAS) requirements, trip limits, and potentially some time-area restrictions (Amendment 16, section 4.2.3.1), but the administrative burden of sector management seems unlikely to achieve the Amendment's goal of simplifying fisheries management as a whole.

Some existing catch shares systems have included limits on quota sales in the first years of program implementation as part of a transition strategy. The purpose has been to allow independent fishermen the opportunity to become accustomed to the mechanics of the new management system and redesign their businesses as needed without feeling coerced to sell their quota right away. This kind of policy can limit immediate consolidation while managers and participants adapt. Amendment 16 does not address this type of policy, with the Council simply stating its perspective that transfers of quota are private business transactions among individuals.

Finally, there is the question of public funding for a transition. NOAA has set aside $620,000 for New England for sector start-up costs and the administration of sub-grants to sectors by the Gulf of Maine Research Institute. A small portion of this funding will also be used to conduct a year-end evaluation of a dockside monitoring program. Additionally, private funds from foundations and non-profit organizations have been used to help sectors become organized and functional (September 29, 2009 email from Mark Grant, NOAA).

Considerations for Setting the Total Allowable Catch

In identifying the appropriate TAC for a catch shares program, the biology of managed species must be considered. Whether a management plan will include adaptive management strategies, cooperative research quota, and harvesting strategies and policies will need to be addressed before determining final allocations. Adaptive management typically includes some sort of buffer or quota set-aside in order to account for management uncertainty.

For the groundfish fishery, the NEFMC has chosen to withhold 20% of each sector's annual catch entitlement (ACE) for a period of 61 days at the beginning of each fishing year, to allow for the balancing of catch and any ACE transfers that need to take place among sectors (Amendment 16, section 4.2.3.3.1). Sectors are responsible for monitoring their TAC continuously throughout the year. At the end of the fishing year NMFS will evaluate catch using interactive voice reporting systems, vessel monitoring systems, and any other available information to determine whether a sector has exceeded any of its allocations based on the list of participating vessels submitted in the operations plan (Amendment 16, section 4.2.3.5). At that time, should there be any overages, they will be deducted from the sector's ACE for the subsequent year. If there are no overages, the 20% will be given back to the sector after 61 days. The Council has also reserved the right to use a different method of calculating permit history in the future to allow for adaptive management should additional information or new techniques become available. Amendment 16 does not appear to provide incentives to engage in cooperative research, such as bonuses for using quota for research purposes. Nonetheless, several sectors have decided to set aside a portion of their quota for cooperative research.

Finally, it is largely agreed that harvesting strategies and policies associated with a catch shares program should include incentives for fishing selectively with lower-impact gear and measures for addressing bycatch. For groundfish sectors, bycatch will be addressed with at sea monitoring. For 2010, NOAA will fund 30% coverage for at sea monitoring (August 20, 2009 letter from Nancy Thompson and Patricia Kurkul, NOAA). At sea monitoring is voluntary for the first two years of the program 2010 and 2011, and it becomes mandatory in 2012. In 2011, the last year before at sea monitoring becomes mandatory, an assumed discard rate will be applied to sectors unless an at sea monitoring system (such as a sector's independent monitoring program, a federal monitoring program, or other program that NMFS determines is adequate) provides accurate information on actual discard rates (Amendment 16, section 4.2.3.5.3).

Allocation and Transferability

Initial allocation and transferability of quota are key issues that are often points of contention in the design of catch shares programs. For New England groundfish sectors, each vessel's potential sector contribution (PSC) was calculated individually, and then combined with the other PSCs in each sector to determine the sector ACEs. Each sector's management then determines how to allocate the ACE among the vessels within its sector.

The initial calculation of PSC in New England has been fraught with two main points of controversy. The first is the decision to use catch history as the sole determination of PSC. Some fishermen invested heavily in recent years to purchase additional licenses with the expectation to multiply the quantity of fish they would be able to catch. Many of these licenses are associated with little catch history, and will provide little return on investment under a system in which allocations are based solely on catch history. Additionally, many fishermen have been concerned that their permit history, and thus their PSC, has not been calculated

correctly by NMFS. An appeals process was put in place to address disputed histories, but the process has been criticized for being lengthy and confusing. For example, the deadline for responses from NMFS was initially scheduled for after the deadline to join a sector, causing distress and concern among many industry members. The deadline for fishermen to join sectors has since been pushed back several times.

The second controversy concerned the decision to use two distinct time periods for determining catch history: one for sectors already in existence (a six year permit history from 1996-2001) (Amendment 16, section 4.2.3.3.4) and one for newly formed sectors (an 11 year permit history from 1996-2006) (Amendment 13, page 10 in Federal Register). To the existing sectors this seems like a fair respect for precedent, while the new sectors view this as providing the initial sectors an unfair advantage.

Certain rules for transferability of quota have been included in Amendment 16. Specifically, ACE can be temporarily transferred between sectors to cover overages during the fishing season, and there is no limit to these transfers. This is considered a private business arrangement between sectors, and the amount and type of compensation will not be made public. However, all such transfers must be approved by NMFS, and these approvals will likely be published. Additionally, there can be no permanent transfer of ACE among sectors. The only method for moving quota shares, or a portion of the ACE, is for a vessel to switch from one sector to another, a movement that can only occur outside of the fishing season, prior to the start of the fishing year (Amendment 16, section 4.2.3.7). Finally, should a sector have extra ACE left over at the end of the fishing year, they can carry over up to 10% into the next fishing year.

Monitoring, Reporting, and Enforcement

The design and cost effectiveness of the monitoring and reporting system will be very important for the success of groundfish sectors. Under Amendment 16, each sector's operations plan must detail a strategy and analysis for how the sector will avoid exceeding its ACE. This plan must include provisions for monitoring and enforcement of the sector regulations, including documentation of both landings and discards. This documentation must include detailed information about the sector's independent third-party weighmaster system and monitoring program for discards (Amendment 16, section 4.2.3.2). Additionally, reporting requirements have been implemented to ensure that monitoring of sector catches is timely and accurate. These requirements include:

- Weekly catch reporting to NMFS
- Identification of specific landing ports
- Notice to NMFS when catches approach a defined threshold
- At sea and shoreside monitoring requirements (Amendment 16, section 4.3.7.3)

In the groundfish fishery, dockside monitoring is being required at a 50% random coverage level in year one, followed by 20% random coverage in subsequent years (Sector Dockside Monitoring gust 24, 2009). For at sea monitoring, the first two years of the program 2010 and 2011 are voluntary, becoming mandatory in 2012. The coverage levels for 2012 onward have not yet been defined. However, NMFS recently stated that the agency will cover the cost of 30% of at sea monitoring in 2010 (August 20, 2009 letter from Nancy Thompson and Patricia Kurkul, NOAA).

In addition, NOAA is providing $1.2 million to sectors to help defray the cost of dockside monitoring in fishing year 2010 and will fund the entire at sea monitoring program at 30% coverage for the first year (September 29, 2009 email from Mark Grant, NOAA). Industry members have expressed concern that with NOAA funding the first year at relatively high coverage levels (50% dockside and 30% at sea monitoring),

the program may face great challenges in subsequent years if sectors themselves are responsible for funding the observer program at the same coverage level and not able to do so. Additionally, the drop in coverage over time poses a risk to sector monitoring providers, which must hire and train staff to support a high level of coverage initially and then face a drop in coverage and staff needs in the near future. With regard to enforcement, Amendment 16 provides assurance that fishermen in a sector will not face penalties as a result of actions of fishermen outside their sector.

Communication and Decision Making Processes

Trust and communication among stakeholders and managers is paramount in catch shares programs, as is gathering adequate information to support decision making. Unfortunately, New England is marked by a long history of deep distrust among fishermen and managers. To address this distrust, fishermen and managers have expressed interest in the establishment of forums for meaningful communication and cooperation among stakeholders, scientists, and decision makers. Fishermen are particularly interested in collaborating with managers to set clear visions, goals, and objectives for fisheries and craft methods for achieving those goals. Amendment 16 does not seem to establish new forums for engagement. In fact, the NEFMC has reserved the right to change the method of calculating permit history in the future and this provision may undermine attempts to engender trust or confidence in the system.

Social and Economic Considerations

Many social and economic considerations should be taken into account in the design of catch shares, including the quantity and quality of jobs, the diversity and size of the fleet, community impacts, and ways for fishermen to enter or exit the fishery. One of the goals identified in Amendment 16 is to prevent excessive consolidation that would eliminate the day boat fishery. However, there is no cap on the amount of ACE a sector can obtain (Amendment 16, section 4.2.3.3.1), and Amendment 16 does not address minimum sector size, ownership caps, owner-operator rules, or any other mechanism that appears to be intended to limit consolidation or protect fleet diversity. There also does not appear to be a definition of "excessive consolidation" in the regulation.

Communities are often unintentionally impacted by catch shares programs. Mechanisms to minimize negative impacts can include geographic requirements and allocations of quota to communities. Amendment 16 does not require membership in sectors to be related to geographical or other community affiliation, nor were community-based entities, such as municipalities, allocated a portion of the quota. The proposed rule for Amendment 16 does include a provision, intended to minimize socioeconomic impacts, that would allow a state-owned permit bank to be considered a sector for the purpose of leasing ACE to qualifying harvest sectors. In addition, the Northeast Fishery Science Center's Social Science Branch is working to track social and economic impacts of the sector program, a possible signal that these impacts will be documented and considered in the evolution of the program over time.

Catch shares programs elsewhere have often coincided with a buyback program. Buyback programs can be effective in engendering good will within a community by providing fishermen an exit strategy that includes funding for their next endeavor. While there have been discussions about a buyback in New England, one has not yet been utilized in conjunction with transition to sectors in the groundfish fishery, although they were used in the 1990's in an attempt to reduce capacity in the fishery. If a buyback were to be implemented, details that would need to be addressed include whether a buyback would be government or industry funded, who would qualify for the program, how pricing would be determined, and what restrictions would be placed on those who participate.

Lessons Learned from Existing Catch Shares Programs

This section describes selected fisheries that have transitioned to catch shares in the United States and internationally, covering the status of the fisheries, background of the programs, and lessons learned in each case. The fisheries described were chosen because they have the potential to contribute lessons that can be applied to New England.

Georges Bank Cod Hook and Cape Cod Fixed Gear Sectors

Location:	Georges Bank, Gulf of Maine, and Southern New England
Target species:	Cod, haddock, yellowtail flounder, plaice, witch flounder, winter flounder, white hake, pollock
Gear:	Georges Bank Cod Hook (GBCH): Hook and line gear only (including jigs, handline, and demersal longlines) (FR 2009a). Cape Cod Fixed Gear (CCFG): Hook and line gear and sink gillnets (FR 2009b)
Seasonality:	Year-round, with the exception of spawning season restrictions
Effort:	Number of Members: GBCH - 24 members (fishermen) in FY 2009 (FR 2009a). CCFG – 23 members (fishermen) in FY 2009 (FR 2009b)
2009 Sector TAC:	GBCH – 350.1 mt; 8.09% of the fishery-wide GB cod TAC (FR 2009a) CCFG – 503.8 mt; 11.64% of the fishery-wide GB cod TAC (FR 2009b)

The Georges Bank Cod Hook (GBCH) and Cape Cod Fixed Gear (CCFG) sectors were the first sectors to be implemented in New England and have been operating for several years. While fishermen and managers engaged in the current transition to additional groundfish sectors under Amendment 16 are likely to have a thorough understanding of these first two sectors, those considering a transition to catch shares in other New England fisheries may find this concise summary informative.

The GBCH has been in operation sinc e 2004 (FR 2004) and the CCFG sector since 2006 (FR 2006). Currently, these two sectors operate separately, but as of 2010 they will combine into the Georges Bank Cod Fixed Gear Sector.

Management History

The Northeast Multispecies FMP was initially enacted in 1985. Prior to implementation of the FMP Amendment in 2004 that allowed the creation of sectors, the Georges Bank cod hook and Cape Cod fixed gear fisheries were managed under the general plan with the rest of the fleet.

Under the Northeast Multispecies FMP, 15 species are managed by the NEFMC. Twelve of these species, divided now into 21 stocks (as of 2008), are considered to be "major" under the FMP (NMFS 2002), meaning that their combined annual commercial and recreational landings exceed 200,000 lbs. In 2002, prior to implementation of the first sector, many of these stocks were overexploited, and only five were neither overfished nor subject to overfishing.

The regulations for the Northeast Multispecies FMP are complex, involving restrictions on area, DAS, minimum fish size, possession/landing limits, and gear. Allocations of DAS depend on the baseline of vessels, which is defined as the maximum DAS used by a vessel in any single fishing year from qualifying fishing years 1996 through 2001. The DAS are further broken into A, B, and C categories, with different regulations tied to each.

In April 2004 (FR 2004), the NEFMC passed Amendment 13 to the Northeast Multispecies FMP, which included authorization of the two initial sectors, in addition to implementing hard TACs, DAS and area management, and other regulations for the groundfish fleet. The new sector option would allow fishermen and vessels to form sectors of their own design and receive a fishing allocation based on either catch (hard TACs) or effort (DAS with a defined TAC). The NEFMC allowed for flexibility when creating sectors; they could be based on common fishing practices, vessel size, homeport, or marketing arrangements, among others, but such commonalities were not required.

The initial sectors were created for several reasons. These "group quotas" were intended to alleviate restrictions on individuals and allow fishermen to fish as many or as few days as they wanted, provided their sector did not exceed the hard TAC. It would allow sector members to consolidate operations into fewer vessels, which was intended to instill confidence in sector members that they would not face reductions in catch or effort allowances due to overfishing by non-sector members (thereby ensuring accountability). It would also free sector members from trip limits and some time-area restrictions. Additionally, because the sectors would be allowed to self-govern, there would, in theory, be less need for the NEFMC to mandate additional measures (FR 2004). Other reasons for implementing sectors included the desire to improve conservation and rebuild stocks, prevent loss of traditional fishing community infrastructure, reverse depletion of Georges Bank cod, and facilitate alignment of fishing business objectives with conservation objectives (CCCHFA, unknown).

Current Management Regime

The GBCH sector receives an allocation of up to 20% of the TAC of Georges Bank cod that is distributed to the hook-and-line fishermen of Cape Cod and engages the fishermen in the establishment of harvest rules and regulations. The hook sector was authorized to fish in FYs 2004, 2005, 2006, 2007, and 2008, and, based upon the Georges Bank cod landings history of its members, was allocated 12.60%, 11.70%, 10.03%, 8.02%, and 6.44%, respectively, of the annual Georges Bank cod TAC (FR 2009a). The CCFG sector was authorized to fish in FYs 2006, 2007, and 2008, and, based upon the Georges Bank cod landings history of its members, was allocated <1.0%, 10.7%, and 14.0%, respectively, of the annual Georges Bank cod TACs (FR 2009b). Both sectors are managed by the Cape Cod Commercial Hook Fishermen's Association (CCCHFA). Boats in both sectors are owner-operated, and fishermen develop their own rules and enforcement plans to ensure that neither sector nor individual quotas are exceeded. This strategy prevents a derby style race for the fish.

Each sector member must sign an operations plan and agreement on an annual basis. This plan is a legal agreement between NMFS and the sector members, and it sets out the rules for fishing. A manager appointed by the CCCHFA maintains contact with fishing vessels, tracks landings, and reports to NMFS (NMFS 2004). Currently, Cape Cod's sector fishermen pay between $5,000 and $10,000 annually for membership and management costs, including technologies for monitoring and reporting the quantity of fish caught (Green 2009).

Both sectors are currently required to use DAS when conducting fishing operations, but there are no trip limits for cod, a significant variation from existing common pool regulations. Additionally, vessels participating in the sectors are allowed to fish in some closed areas and during seasonal closures, but must respect the more limited spawning season closures. Monitoring is carried out by the Northeast Fishery Observer Program (GBCH 2009).

The sector plans allocate the hard cod TAC into a monthly quota (8.33% of the total quota is allowed each month). Should a monthly quota not be fulfilled, the excess rolls over into the next month; if the monthly quota is exceeded, the remaining months' quotas are adjusted accordingly. Within sectors, allocation is based on the individual member's fishing history during the qualifying period (GBCH 2009).

Positive results for the two initial sectors provide evidence that catch shares programs have potential for success on a broader scale in New England. Progress has been made for those sectors in preserving the fishermen's economic livelihood and cultural heritage, contributing to the rebuilding of cod stocks in Georges Bank and the broader Gulf of Maine, retaining access for small boat fishermen in the area, creating new opportunities for the fleet, fostering community-based management, and creating a working model for future sector development in New England. A specific example includes fishermen in one sector who have been able to keep $500,000 worth of codfish that would have been thrown back under daily catch rules (Green 2009). The absence of daily catch regulations provides another benefit in that fishermen in a sector are allowed to catch their allocation of the TAC in a shorter time frame, thus saving money on operating costs. Additionally, some fishermen have sold their boats and combined permits with other vessels to effectively share boats (and thus operating costs) while still catching the same amount of fish. New England is in the process of forming 17 additional groundfish sectors, and it is widely assumed that the original two sectors in Cape Cod provided momentum for the creation of additional sectors in Amendment 16 to the Northeast Multispecies FMP.

With regard to stock status, NMFS notes that progress has been made as a result of the full suite of groundfish regulations, with groundfish increasing by 77% since 2004, and the average fishing mortality rate decreasing. Haddock and redfish have recovered well, but winter flounder is at only 10% of its ideal population (Green 2009). According to the most recent Status of U.S. Fisheries report (NMFS 2009), improvements have been made in six out of 21 stocks, but declines have been seen in five others. While there may have been overall improvements in stocks of cod and haddock, overfishing is still occurring and the cod stock in particular continues to be overfished (NMFS 2009). However, as the two Cape Cod sectors have only 8% and 11% of the total TAC, respectively, it is difficult to conclude what, if any, effect their fishing methods have had on the overall status of the stocks. A more telling number will come in a few years, after all 19 sectors are operational, at which point stock status will more accurately reflect the success of the sector program as a whole.

Lessons Learned

Several lessons can be taken from the two initial sector programs in New England. First, one of the most important issues relates to the cost involved with forming a sector. Typically, sectors are required to create operations plans, develop a catch monitoring and reporting system, and complete environmental assessments (Holland 2007). The CCCHFA's two sectors have benefited from private foundation funding to establish and run their sectors, and the members of the CCCHFA have voluntarily taxed themselves on fuel to finance the association. The high costs of establishing and running sectors are a challenge. With the $16M that NOAA designated for the additional 17 sectors, and the stipulation that the first year of sector dockside monitoring costs (FY 2010) will be covered by NMFS, the financial burden is somewhat eased for the other sectors as they prepare to launch in May 2010. However, some of these costs will reemerge in subsequent years and may need to be covered by the industry itself at that time. The two existing sectors in Cape Cod only have TAC for cod. As more sectors are implemented and as more species are incorporated into the sector-held TACs, the implementation, administration, monitoring, and enforcement of the sectors will become more difficult, time-consuming, and expensive.

Another lesson learned from the two initial sectors relates to use of rolling baselines for allocating TAC. At the outset of a program, a rolling baseline provided incentives for some fishermen to remain outside of the sector to improve their catch history. Additionally, permit holders within the sector who made their catch history available to other sector members could expect their future allocations to decline. This is especially a problem for sectors that want to form permit banks to make catch history available to members (Holland 2007). The NEFMC has addressed these problems, and has changed regulations to create fixed and consistent baselines for all sector allocations within a given fishery. This creates security and allows consolidation and reduction of fixed costs (Holland 2007).

A further lesson learned relates to trust among industry participants and managers. ome members of the existing sectors believe that NMFS does not trust fishermen's ability to manage their TAC adequately because even though the sectors have been allocated a hard TAC for their use and distribution, until the 2010 implementation of Amendment 16 of the Northeast Multispecies FMP, they will be required to adhere to DAS while fishing under the TAC. In addition, the sectors are not allowed to use TAC for research purposes, contributing to distrust among fishermen and managers and a need to facilitate increased collaboration between the scientific community and the sector members.

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Scotia-Fundy Inshore Groundfish Mobile Gear Fishery

Location:	Canadian waters of the Bay of Fundy, Georges Bank, and the Scotian Shelf
Target species:	Cod, haddock, pollock, redfish, flatfish, and various other groundfish species
Gear:	Mainly otter trawls, some Scottish and Danish seines
Seasonality:	Year-round
Effort:	Vessels actively fishing in 1991 (268) and in 1998 (137)

Management History

The Scotia-Fundy groundfish fishery is composed of three distinct fleets, the inshore groundfish mobile gear, inshore fixed gear, and offshore fleets. These fleets, which targeted various groundfish species, including cod, pollock, haddock, flatfish, and redfish among other species, grew dramatically in the 1970s and early 1980s. Following adoption of the 200-mile Exclusive Economic Zone (EEZ) in 1977, growth in fishing capacity was encouraged by government financial assistance through loans and subsidies for vessel building from 1978 to 1982 (Dupont and Grafton 2001, Liew 2001). After this period, high fish prices sustained growth of the fishing fleet (Haliday et al. 1992, Dupont and Grafton 2001). Excess capacity began to cause problems for the fleet during the 1980s. A study in 1986 found that the inshore mobile gear sector was four times the size required to harvest the TAC (Barbara, Brander, and Liew 1995). Prior to implementation of the ITQ program, this sector consisted of up to 455 vessels under 65 feet in length (Liew 2001).

Beginning in the 1970s the fishery was regulated by a hard TAC (Dupont and Grafton 2001). During the 1970s and 1980s, the inshore mobile gear groundfish fishery operated under a competitive quota regime, in which license holders fished competitively for the fleet-wide quota. Licenses could be transferred to other full-time fishermen within the same fleet size class and they could be held for two years if the license holder did not have a vessel to use in the fishery. In addition to limited entry licensing, a number of other management measures were implemented to curb fleet capacity, including vessel size limitations, gear restrictions, trip limits, fishing ground closures, and seasonal quotas (Dupont and Grafton 2001, Liew 2001). However, by the late 1980s groundfish stocks off of Nova Scotia showed evidence of severe declines in biomass (DFO 1995). A decline in harvest, particularly of cod and haddock, followed this decline in biomass.

In 1989 the TAC for the inshore mobile gear fishery was reached six months into a twelve month fishing season and the fishery closed until the following year. A task force was convened to address overcapacity of the fleet and low biomass of stocks (Dupont and Grafton 2001, Liew 2001). The task force identified a number of recommendations for the fishery, one of which was to implement an individual quota system for the inshore groundfish mobile gear fleet. The Minister of the Department of Fisheries and Oceans (DFO) implemented an ITQ system to address concerns of fleet overcapacity and overfishing.

Current Management Regime

The ITQ program was implemented in January 1991. While the inshore groundfish mobile gear, inshore fixed gear, and offshore fleets exploit some of the same groundfish stocks, the ITQ program applies only to the inshore mobile gear fleet with vessels less than 65 feet in length. The program was initially implemented for 6 groundfish stocks, including 4 cod stocks, haddock, and pollock, and was later expanded to cover 12 groundfish stocks, including cod, haddock, flounder, redfish, and pollock stocks (Liew 2001). Under the ITQ program, license holders could fish for a specified quota that was allocated on a stock-by-stock basis to their licenses for the year. Allocations were based on percentages of the fleet quota, and varied each year depending on the TAC for that year (Liew 2001). Initially quota could be traded on a temporary basis and, beginning in 1993, permanently. Quota shares could be transferred to fishermen who had already reached their quota; however, quotas remaining at the end of a year could not be carried over to the following year. A limit of 2% of the TAC was placed on the overall quota any one quota-holder could accumulate (Dupont and Grafton 2001).

Fisheries management in the Maritimes region has historically been based on consensus of stakeholders and managers, and it was determined that the formulation of an ITQ system should be no different. As a result, a working group composed of representatives from the fishing industry, provincial governments, and DFO was developed to determine allocation of the catch shares. The working group provided opportunities for license holders to voice their opinions throughout the development process. In developing the ITQ program and allocation determinations no pre-set objectives were identified. The chosen allocation attempted to minimize changes in activity levels and provide access for individuals to fish who had not fished in recent years (Liew 2001).

Allocation of the quota was based on an average of the best two catch years during the 1986-89 fishing seasons (Barbara, Brander, and Liew 1995). Catch histories used were associated with fishing licenses instead of individuals or vessels. A process was developed for three types of appeals: disputes over catch history, dual gear catch history, and extenuating circumstances (Liew 2001). At the onset of the ITQ program, fishermen had 30 days after fish were caught to purchase a temporary quota to cover any portion of their catch for which they had exceeded their quota (Dupont and Grafton 2001). Beginning in 1999 this time limit was extended; however, if quota and catch were not reconciled, penalties were assessed and a fisherman's ITQ for the following year could be reduced (Dupont and Grafton 2001).

Under the ITQ program, fishermen were subject to 100% dockside monitoring by a third party company in addition to occasional at sea surveillance. The expenses of these monitoring requirements were paid for by the fishermen themselves (Dupont and Grafton 2001).

Prior to implementation of the ITQ program there were 455 mobile gear license holders (Dupont and Grafton 2001, Liew 2001). Of these license holders only 325 chose to participate in the ITQ program while 50 license holders decided to fish as "generalists" in the non-ITQ mobile gear fishing pool (Dupont and Grafton 2001). These 50 generalists agreed to pool their individual allocations and fish competitively for the pooled overall allocation (Dupont and Grafton 2001). A remaining 74 dual fixed/mobile gear license holders opted out indefinitely and remained in the non-quota, competitive fixed gear sector of the fishery, and 6 licenses were cancelled.

While no pre-set objectives were defined for the program, there was an overall acceptance of the allocation and appeals processes. Some complaints arose from license holders who disagreed with their catch history records and the low allocation they received. These complaints were handled through the appeals

process, which had clearly established guidelines (Liew 2001). General satisfaction with the process was demonstrated by the continued use of catch history associated with licenses as the basis for allocation decisions when additional stocks were added to the ITQ program after its inception (Liew 2001). This same formula was also used as the primary allocation basis for individual quotas in the Scotia-Fundy Groundfish Fixed Gear Sector fleet in 1997. The involvement of fishermen in the working group which determined allocation of the catch shares and the opportunities for license holders to voice their opinions throughout the development process are widely seen as contributing factors in the acceptance of this ITQ program.

Lessons Learned

A number of changes occurred in the Scotia-Fundy inshore mobile gear fishery after the ITQ program was first implemented that can offer insight into this program and allow for lessons to be drawn for the design of catch shares programs in New England. In a comparative study between vessels in this ITQ program and fixed gear vessels not governed by an ITQ program, researchers found that fishermen in the ITQ program allocated their catch throughout the fishing season, which subsequently increased the quality and price of their product (Barbara, Brander, and Liew 1995; Dupont and Grafton 2001). This program has highlighted the importance of ensuring the durability and security of the catch shares. In 1993, concerns about the biomass of the stock led DFO to close the fishery halfway through the season. This closure prevented some ITQ fishermen from catching their quota, which undermined confidence in the program and created hesitancy in fishermen to spread their quota over the subsequent fishing seasons (Dupont and Grafton 2001). Thus, in implementing catch shares programs, it is important to utilize a sufficiently conservative initial TAC to prevent the need to close the fishery mid-season.

In ITQ programs quotas are traditionally defined for individual species. While the Scotia-Fundy mobile gear ITQ program conforms to this tradition, it also reveals potential problems that are inherent in multispecies fisheries. One can assume that if quotas are imposed on only some of the target species of a multispecies fishery that fishing pressure may be displaced onto non-ITQ stocks. In response to this displaced effort fishery managers would likely subject these stocks to quotas as well, as seen in the expansion of the Scotia-Fundy fishery from 6 to 12 stocks (Dupont and Grafton 2001). Adding stocks to the ITQ program increases the difficulty of administering, implementing, monitoring, and enforcing the management measures. In the Scotia-Fundy fishery, drastic cuts in quota that resulted from large biomass declines did in fact lead fishermen to target other species, including flounder and redfish, which later led to the expansion of the program to cover those stocks (Dupont and Grafton 2001). At the inception of this particular ITQ program, fishermen were permitted to cover excess catch of one species by using quota for another species at a predetermined rate. This practice led to species being targeted and landed for which fishermen had already exceeded their quotas (Barbara, Brander, and Liew 1995). As a result, the practice was prohibited. Spillover effects should be taken into consideration for future multispecies catch shares programs.

Finally, the ITQ program facilitated the voluntary exit of fishermen from the fishery. By the end of 1991, 321 vessels had licenses with quota shares. This number fell to 249 licenses with permanent shares by the end of 1998 (Dupont and Grafton 2001). Actively fishing ITQ vessels decreased from 268 in 1991 to 137 in 1998. This reduction in fishing effort was enabled by provisions in the catch shares program that allowed multiple quota licenses to be fished by a single vessel through the temporary transfer of quota. This strategy reduced the need for traditional license buybacks and other regulatory approaches that have been used in the past to reduce capacity and that have often been expensive and ineffective (Dupont and Grafton 2001). In a fishery that historically suffers from overcapacity and low fish biomass, developing means to effectively reduce fishing effort is an important aspect of a new management program.

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Community Preservation in Alaska – Two Approaches

Community Development Quota

In Alaska's Community Development Quota (CDQ) program, authorized and created by the 2006 Magnuson-Stevens Act reauthorizations, remote communities dependent upon subsistence lifestyles receive a portion of the groundfish, halibut, crab, and salmon TACs to distribute as they see fit. There are 65 communities that participate in this program; each belongs to one of six different CDQ groups. In 2009, the total CDQ allocation was between 7.5% and 10% of the TAC for each species (ARO 2009). The allocations are divided among the six CDQ groups depending on number of communities within the group, number of permitted vessels, and location (State of Alaska 2009).

This program is widely considered a resounding success, generating over $110 million in wages, education, and training benefits. It has also produced $500 million in revenue to fund docks, harbors, and construction of processing facilities, and the asset value of the groups is now over $250 million (State of Alaska 2009). Due to the rough environment in the Bering Sea, many communities that participate in the CDQ program must lease their quota to large industrial vessels that are often not based in the community. Fortunately, the revenues go back into the communities (State of Alaska, 2009).

Community Quota Entity

The Community Quota Entity (CQE) program was established in 2004 as part of an IFQ program for the Alaskan halibut and sablefish fishery to ensure the participation of local communities. Qualifying communities must have fewer than 1,500 inhabitants, no road access, and a demonstrable catch history. No more than 42 communities are allowed to participate (Weber and Iudicello 2005). To ensure broad distribution, each individual quota lease holder can harvest no more than 50,000 lbs each of halibut and sablefish per year (GOAC3 2009). The challenge for CQE communities is that instead of receiving an allocation of quota, each CQE must purchase IFQs from the federal government at the current market rate, and then lease them to local residents. This has proven prohibitively costly for many communities.

All CQE communities belong to the Gulf of Alaska Coastal Communities Coalition (GOAC3), an organization which seeks to protect fishery access, mitigate negative impacts, provide monitoring, and inform and educate. Additionally many members of the Coalition are active participants in the Council system and management bodies. The GOAC3 has developed a revolving loan system to help fund lower income communities and allow them to purchase initial quota shares. One concern is the loss of support for infrastructure as fishery access is consolidated into the hands of non-residents who own property but do not reside in the villages (Weber and Iudicello 2005).

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U.S. Pacific Whiting Fishery

Location:	The highly migratory coastal Pacific whiting stock ranges from southern Baja California to Queen Charlotte Sound in British Columbia, and is the most abundant groundfish in the California Current system (Helser et al. 2008).
Target species:	Pacific Whiting
Gear:	Mid-water trawl, catcher-processors
Seasonality:	The fishery opens in different areas on April 1, April 15, May 15 and June 15 due to northward migration of the species, and remains open until quota is reached (usually not more than 3 months) (FR 2009).
Effort:	Number of Members: 3 companies, 10 vessels (7 active) 2009 Sector TAC: For 2009, the catcher/processors get 34 percent of the commercial optimum yield (27,859 mt) (FR 2009).

Management History

The Pacific whiting fishery has a relatively short history compared to some other species in U.S. fisheries. Prior to 1990, all fishing for the stock was either foreign or joint venture between U.S. harvesters and foreign processor vessels (Sylvia et al. 2008). Between 1960 and the early 1980s, the only fishing on the U.S. Pacific whiting stock was foreign due to the low economic value of the stock. When the Magnuson Act of 1978 limited foreign fishing in the U.S. EEZ, existing domestic infrastructure was not sufficient to support a fishery, so joint venture fisheries were established between U.S. harvesters and foreign processors, including those from the Soviet Union, Poland, and Japan, to allow for processing of the available resource (Sylvia et al. 2008).

In 1990, U.S. catcher-processor factory trawlers joined the fishery, and because of their large capacity, eliminated all joint venture operations by 1991. However, the catcher-processor factory trawlers increased the fishery capacity so much and the TAC was reached so rapidly that the fishing season dropped from eight to three months (PFMC 1997 IN Sylvia et al 2008). Around the same time, three sectors of the fishery emerged: the catcher-processor, the shore-side, and the mothership sectors. A race for fish ensued both within and among the sectors.

Allocation rules changed several times, but in 1994, a limited entry plan went into effect, using a TAC as its basis. This limited entry plan effectively barred all catcher-processor vessels from the fishery as they did not meet the qualifying period for receiving a permit. However, 10 catcher-processors managed to buy back into the fishery, and in the process eliminated 109 smaller vessels, most of which had never participated in the whiting fishery (PFMC 1997 IN Sylvia et al 2008). In 1996, the Pacific Fishery Management Council (PFMC) created a five-year allocation scheme for four sectors: catcher-processors, shoreside, motherships, and tribal. The catcher-processors were allocated 34% of the TAC, which is what they continue to receive in 2009. This eliminated the race for fish among sectors but not within sectors. The derby within sectors decreased season length, increased bycatch, and lowered product quality and product recovery rates (i.e. yield) (Sylvia et al. 2008).

Current Management Regime

In 1997, four companies that operated the 10 catcher-processor vessels in the Pacific whiting fishery formed the Pacific Whiting Conservation Cooperative (PWCC), a non-profit registered in the state of Washington. In order to make the best use of the allocation for their catcher-processor sector (34% of TAC), the PWCC negotiated an agreement assigning a portion of the total allocation to each company. Quota transfers were allowed once individual allocations were made. The companies then consolidated capacity so that only six or seven of 10 vessels have been active each year (PWCC 2009). By providing companies a secure share of the catch, PWCC has essentially ended the derby-style fishing in this sector since vessels can now fish for their share of the allocation at any time without fear of losing out to other vessels. In May 2008, Glacier Fish acquired Alaska Ocean Seafood, dropping the number of companies to three, but maintaining the number of vessels in the sector (Business Wire 2008).

By allowing the companies to fish under optimal conditions of their choosing (such as weather, fish location, schooling characteristics, market demand, etc.), the PWCC fishing cooperative has resulted in decreased bycatch and waste, improved product quality and recovery rates, reduced fishing effort, increased season length, and economic efficiency (PWCC 2009, Sylvia et al. 2008).

PWCC vessels communicate with each other regularly throughout the season to inform other members about the locations of schools of whiting and high bycatch areas. The PWCC works with the private, centralized monitoring service SeaState to report their catch and bycatch data on a real time basis, and SeaState synthesizes the data and reports back to the vessels with hotspots to either avoid or target. This data sharing has worked so well that most years the total bycatch is less than 1% of the total Pacific whiting catch (PWCC 2009).

All members of the PWCC pay a tonnage fee that funds the private monitoring service, observer coverage (all Cooperative vessels carry two NMFS-certified observers at all times), and scientific research, including stock assessment and bycatch avoidance (PWCC 2009, Sylvia 2008). Additionally, members who exceed their quota share are faced with financial penalties (Sylvia et al. 2008).

Lessons Learned

It is important to note at the outset that this fishery is very different from the ideal fishery that many stakeholders envision for New England: a fishery that is diverse, with a robust day boat fleet, and able to support traditional fishing communities. Nonetheless, there are several lessons that can be gleaned from the program. First, there is evidence to show that sector size (number of members) and sector stratification both have an effect on the overall success of catch shares program implementation. The shoreside and mothership sectors both have a fixed set of players and a flexible, sector-allocated right to a portion of the catch, just as the catcher-processor sector does. However, these two sectors had a much larger number of members (49 and 32, as opposed to four), which made coming to an agreement much more difficult. Additionally, within the shoreside and mothership sectors, there are two separate company types—harvesters and processors. This created two strata of companies and made uniform requirements difficult, if not impossible. The two types of operations also exist in the catcher-processor sector, but they are integrated within each company and allow for uniform requirements across the sector (Sylvia et al 2008). Overall, the main lesson learned is that the number and diversity of members can determine a catch shares program's success. Specifically, it appears that the greater the number of members and the more diverse the membership of a sector, the less effective the program is likely to be.

Another issue stems from the voluntary nature of the cooperative. Members can enter and leave at will. However, with the small numbers of members and tenuous agreement that exists, any change would likely disrupt the cooperative enough to dismantle it. For many years, purchasing the required permits to enter the catcher-processor sector was cost prohibitive, providing a safety net for the PWCC and effectively closing an "open" cooperative. However, in late 2006, the fishing vessel Starbound managed to buy the required permits. The entrance of a new company would have changed the dynamics of the cooperative and the fishery, potentially causing its dissolution. The four companies had established a high level of trust among members of the group and introducing a new player would have automatically reintroduced distrust and doubt (Sylvia et al 2008). Fortunately for the cooperative (unfortunately for the FV Starbound), in November 2008 the PFMC issued an emergency ruling that prohibited new entrants to the fishery, blocking the FV Starbound's membership in the PWCC (PFMC 2009). Based on this example, in order for a voluntary cooperative such as the PWCC to continue to function, there should be a binding agreement signed by all participants and some level of observer coverage to ensure the agreement is adhered to and trust is maintained.

Finally, NMFS is investigating other options for either a fishery-wide individual fishing quota (IFQ) program or the development of mandatory fishing cooperatives for all three non-tribal sectors. There are possible ramifications of these decisions. Establishment of an IFQ program would remove the cooperative's primary purpose, that is, the authority to allocate the sector's catch shares among its members. However, depending on how the IFQs were established and how allocation was issued, the PWCC could still exist for the purpose of fostering and supporting cooperation in research and management, including for bycatch avoidance, thus enhancing the value of all of their IFQ rights. Should NMFS implement regulations for the formation of mandatory cooperatives for all three non-tribal sectors, major changes to the existing cooperative structure could ensue, increasing expenses and engendering ill will (Sylvia et al 2008). The major lesson is that the Council should be sure to consider existing voluntary catch shares programs and cooperatives prior to instating mandatory changes and regulations which may negatively affect cooperatives already operating successfully.

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Icelandic Groundfish Fishery

Location:	Waters within the Icelandic EEZ, some waters within the Norwegian and Russian EEZs
Target species:	Cod, haddock, saithe, redfish, flatfish, lumpsucker, monkfish, Greenland halibut, and other demersal species
Gear:	Mostly bottom trawl and longline, some gillnet, handline, and Danish seine
Seasonality:	The fishery opens in different areas on April 1, April 15, May 15 and June 15 due to northward migration of the species, and remains open until quota is reached (usually not more than 3 months) (FR 2009).
Effort:	Two different published sources by The Ministry of Fisheries and Agriculture estimated in 2007 that there were either 1,084 or 1,642 fishing vessels in the Icelandic fleet (Ministry of Fisheries and Agriculture 2008, Icelandic Fisheries 2009a).

Management History

Iceland is a fishing nation whose culture and economy have long been tied to the sea. For years, the productive waters surrounding Iceland attracted fishing fleets from around the world. In 1975, foreign fleets took one-third of the total cod catch (more than 100,000 tons), half the total catch of redfish and saithe, and one-quarter of the total haddock catch (Icelandic Fisheries 2009b).

In May of 1976, Iceland restricted foreign fleet access by instituting a 200-mile EEZ. At the same time, national fisheries managers implemented catch quotas for the major demersal fisheries. These quotas were deemed a failure because they were overly restrictive and unenforceable (Runolfsson and Aranson 2001). A system of individual effort restriction was then imposed in 1977. This system limited the number of days each fishing vessel could fish per year, but it continued to allow new vessels to enter the fishery. With more boats in the fishery, managers were forced to lower the number of DAS allotted to each vessel. In 1981, following the peak of the cod stock, deep-sea trawlers were only allowed to fish 215 days a year, compared to 323 days in 1977 (Ronolfsson and Aranson 2001). This system was economically inefficient and it too was deemed a failure.

To make the groundfish fishery more efficient while at the same time protecting stocks, the Icelandic Parliament granted the Minister of Fisheries the power to restrict access to the fishery and to establish an individual vessel quota (IVQ) system in 1983. IVQs were based on a vessel's historical catches between 1981 and 1983 and were distributed for free to all vessels over 10 gross registered tons (GRT) in the Icelandic groundfish fisheries (Christensen et al. 2009). The IVQ system was initially intended to last for only the year 1984, but it was extended until 1990 with some modifications. Beginning in 1985, vessel owners were given the option to fish under catch quotas or effort quotas. Vessel owners quickly discovered ways to circumvent or manipulate the regulatory system. For example, many switched between catch and effort quotas, maximizing their landings under the effort quota to ensure that they received a higher catch quota.

Current Management Regime

The current management regime for the Icelandic groundfish fishery was established in 1990, with the creation of the Fisheries Management Act. The Act extended the catch quota system indefinitely, made quotas transferable, eliminated the effort quota option, required that all commercial fishing vessels be licensed, and instituted a moratorium on issuing new licenses. The Act also extended this new ITQ system to boats between 6 and 10 GRT. Boats less than 6 GRT were added in 2004 (Aranson 2004).

The ITQ system applies to stocks within the Icelandic EEZ or for which Iceland has national fishing rights. The Ministry of Fisheries establishes a TAC for each species, which is divided among the registered fishing vessels according to each vessel's quota. For cod the TAC is set at 25% of the average fishable biomass of the current year and the estimated fishable biomass of the coming year (Icelandic Fisheries 2009c). In 2007, the Icelandic government set the TAC for cod in the 2007-2008 fishing year at 20% of the fishable biomass (Icelandic Fisheries 2009c).

Each catch quota is fully transferable and divisible so that vessel owners can transfer an entire quota or a portion of a quota to another vessel. Each quota transfer must be registered with the Fisheries Directorate and is subject to quota transfer fees. To ease the transferability of catch quotas, each quota is calculated in "cod equivalents." A cod equivalent is a weight measurement based on the value of a species in proportion to the value of gutted cod, where gutted cod has a value of one (Christensen et al. 2009). Because they are based on the market value of the fish, cod equivalents fluctuate considerably from one fishing year to the next. The Ministry of Fisheries publishes the cod equivalents for each fishing year.

The cod equivalent system is designed to increase flexibility for vessel owners and decrease discards, which are banned in Icelandic fisheries. Vessel owners can catch all other species and deduct their catches from their cod quotas using the cod equivalents (Christensen et al. 2009). This structure only works for fishermen deducting non-cod catches from their cod quotas, not for deducting cod catches from non-cod quotas.

The ITQ system maximizes vessel owners' flexibility by allowing owners to roll up to 20% of their catch quota for each demersal species from one year to the next (Icelandic Fisheries 2009e). If a vessel catches less than 50% of its quota over two consecutive years, however, the quota will be revoked and distributed among the vessels that are still active in the fishery (FAO 2004). In addition, vessel owners are permitted to exceed their annual catch quota for each demersal species by 5%. In such cases, the excess catch will be deducted from their catch quota for the following year (Icelandic Fisheries 2009e).

Since the start of the ITQ system, the number of quota-holding vessel owners in the fishery has decreased from 1,174 in 1993 to 762 in 2007 (Ministry of Fisheries and Agriculture 2008). There are measures in place to prevent excessive consolidation where a small number of fishing companies dominate the fishery. No one owner, or closely-linked group of owners, is allowed to own more than 12% of the catch quotas for cod, 20% of the quota shares of Greenland halibut, saithe, and a haddock or 35% of the redfish quotas (Icelandic Fisheries 2009c). In addition, a single company may not own more than 12% of the value of the combined shares of all of the species with TACs.

In addition to deploying inspectors to supervise fishing voyages, landings, weigh-ins, and the processing of catch, the Directorate of Fisheries depends on the fishermen's reports to closely monitor the fisheries in real-time (Icelandic Fisheries 2009e). Fishermen use electronic logbooks to report their vessel name, registration and call code, fishing gear (type and size), latitude and longitude where they started fishing, catch by weight and species, a date and landing harbor. The Directorate of Fisheries updates this information online every day.

Quota holders are required to pay an annual resource fee for the right to participate in the Icelandic fishery, which is considered a public resource. These resource fees equate to 9.5% of the total value of the landed catch and are divided by the landed cod equivalents to calculate the resource fee for the following year (Icelandic Fisheries 2009c).

In addition to the ITQ system, all Icelandic fisheries are subject to occasional area closures when concentrations of immature fish within the area reach a certain level. Such closures are implemented by the Marine Research Institute and can last up to two weeks.

Lessons Learned

The goals of the Icelandic ITQ system were to increase the efficiency of the fishery and to conserve local stocks, especially cod (Runolfsson and Aranson 2001). The fisheries have certainly become more efficient as a result of the ITQ system, but the results of cod conservation efforts are more difficult to judge. The cod stock peaked in 1980 at 1,500,000 tons, but by 1983, the stock had dropped below 800,000 tons (Christensen et al. 2009). In 1995, after the ITQ system was in place, the cod stock had fallen to 550,000 tons (Christensen et al. 2009). It is important to note, however, that catches exceeded the cod TAC by more than 10% between 1984 and 1996 (Hunt et al. 2002).

According to the most recent report by the Marine Research Institute (Marine Research Institute 2009), the cod stock may be improving. The spawning stock has increased from its all-time low of 120,000 tons in 1993 to an estimated 220,000 tons. The reference biomass at the start of 2009 was estimated to be 700,000 tons, an increase from 550,000 tons between 1992 and 1995 (Marine Research Institute 2009).

The fishery's increased efficiency is apparent in the decreased number of vessels in the fleet. Between 1990 and 2006, the total number of vessels decreased by 28% (Christensen et al. 2009), however, this was not the case initially. Early ITQ regulations excluded small vessels leading many fishermen to downgrade, switching to smaller boats to maximize their catch. Between 1980 and 1984, the number of small vessels jumped from 518 to 825 (Christensen et al. 2009). By 1991, there were 1,325 small vessels and these boats accounted for more than 20% of the total cod catch, compared to 5% of the cod catch in 1983 (Christensen et al. 2009). Over time, however, the Icelandic fishery has come to favor large trawlers. In 2005, Aranson (2005) reported that 6% of the Icelandic fleet (63 trawlers and multi-purpose vessels) caught more than 20% of the total harvest in weight and more than 40% of the total catch in value.

Some members of the Icelandic public have criticized Iceland's ITQ system for marginalizing fishing communities and independent fishermen. Many coastal communities in Iceland have depended on fishing and fish processing for centuries. With larger, more efficient vessels has come the ability to process at sea, putting many land-based processors out of business. Also, those who worked as contract fishermen have found fewer employment opportunities with the switch to a large-scale fishery. To combat these negative impacts, the government instituted community quotas in 2002. Community quotas are small portions of the total catch quota that are distributed to coastal communities annually by the Minister of Fisheries (Christensen et al. 2009). In addition, to encourage support of the local communities, longliners who have local workers prepare their lines on shore are allowed to retain 16% more of their quotas than those who do not (Christensen et al. 2009).

Finally, in response to public pressure, the Icelandic government dropped the moratorium on new fishing licenses, allowing those without catch histories to enter the fishery (Christensen et al. 2009). Nevertheless, this privilege comes at a steep price. These individuals must buy expensive permanent quota shares or temporarily lease quota from others. These costs are prohibitively high for most individuals and so this amendment actually serves to exclude independent fishermen while facilitating entry of corporations or groups of owners (Christensen et al. 2009).

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Canadian Pacific Groundfish Fishery

Location:	Waters off the coast of British Columbia, extending from the coast to Canada's 200-mile EEZ, bounded in the north by the international maritime boundary north of the Queen Charlotte Islands and extending south to the international maritime boundary that splits the waters of the Strait of Juan de Fuca, south of Vancouver Island.
Target species:	Halibut, sablefish, rockfish, lingcod, dogfish, hake, and other demersal species
Gear:	Bottom and Mid-water trawl, hook-and-line, traps
Effort:	Approximately 400 vessels

Management History

British Columbia's groundfish fishery was essentially an ungoverned open-access fishery until the 1970s. In 1976 the Canadian government first attempted to manage the fishery by imposing trip limits. The following year, Canada extended its EEZ to 200 nautical miles, ending the Japanese and Soviet rockfish harvest within Canadian waters. In 1978, Canada first applied annual quotas to the Pacific groundfish fishery and in 1979 the newly-created DFO established license limitations, TACs, trip limits and area, time, and species closures to manage the fishery. Through the 1980s the DFO imposed various area and species quotas and implemented an observer program (Ainsworth and Pitcher 2004).

Throughout the 1980s and 1990s the Pacific groundfish fishery continued to be managed with trip limits. As the stocks were harvested during the year, the amount of fishing time permitted decreased. Overall, this management scheme was a failure (SAFMC Unknown). It reduced fishing time, yet allowed fishermen to exceed TACs. Stocks declined and the cost of fishing increased, leaving the fishing industry unstable (SAFMC Unknown). As a result, in 1997 the DFO established the British Columbia Groundfish Trawl IVQ program. Its goals were to conserve groundfish stocks and make the fishery more stable and profitable.

Current Management Regime

The original IVQ system managed each species individually. Initial allocations of the TAC of each targeted groundfish species were divided so that 80% of the TAC was distributed to vessel owners, 10% went into a crew protection program, and 10% to a community development program (SAFMC Unknown). The catch quota assigned to each vessel was based on the vessel's length and catch history between 1988 and 1992 (DFO 2009). Vessel owners were prohibited from owning more than 2% of the total amount of quota pounds of all species and more than 4% to 10% (depending on the species) of the TAC of a single species (SAFMC Unknown).

The IVQ program includes overage and underage allowances to maximize vessel owners' flexibility. Fishermen who catch more of a species than their quota covers may subtract that overage (in pounds) from the next year's quota. Additionally, if fishermen do not reach their allocation in a season, they may roll the unused portion into the following year (SAFMC Unknown). There is a limit to how much quota fishermen are allowed to roll into or subtract from the following year. If a vessel exceeds its overage allowance, the

following year's quota is reduced by the amount of excess overage. In addition, vessels that exceed their overage allowances are prohibited from fishing until they transfer additional quota to cover the excess overage (SAFMC Unknown).

The IVQ program was successful in increasing individual accountability, improving cooperation among vessel owners, increasing earnings, and keeping catches within TACs (SAFMC Unknown). Still, there were concerns about the conservation and management of the Pacific groundfish fishery (DFO 2009). Spurred by these concerns, the DFO worked with commercial groundfish harvesters to develop a plan that would integrate groundfish management and improve the conservation of the fisheries. Beginning in 2006 the DFO implemented a three-year pilot program of integrated groundfish management. The program, which has been extended through 2010, combines seven groundfish sectors. (The term "sector" here is used in the traditional sense, not in reference to fishing cooperatives as it is used in New England.) The seven sectors were halibut, sablefish, groundfish trawl, lingcod, dogfish, rockfish caught within Georgia, Juan de Fuca, and Johnstone Straits (known as "inside rockfish") and rockfish caught outside of the Straits ("outside rockfish"). The program allows the transfer of quota among these sectors (DFO 2009). There is a cap on the amount of quota that is allowed to be transferred out of each sector. Species not included in the integrated management plan continue to be managed individually under the IVQ program (DFO 2009).

The integrated IVQ program set out to conserve species by eliminating discards and increasing monitoring. Prior to integration, the amount of non-target fish that a vessel could retain was strictly limited. Under integration, fishermen can buy quota for non-target species to cover their bycatch. This system has drastically reduced discards. In the 2006-2007 fishing season, 546,422 sablefish were caught in the halibut fishery and 20,929 halibut and 236,490 rockfish were caught in the sablefish fishery (Fraser and Associates 2008). In total, 200,136 halibut, 585,834 sablefish and 273,207 rockfish were landed as non-target fish in 2006-2007 (Fraser and Associates 2008). In previous years, these fish would have been discarded.

The integrated IVQ program requires 100% at sea monitoring. Fishermen can choose between a human at sea observer and an electronic monitoring system (Fraser and Associates 2008). When vessels use observers, the observer records catch data in a log and uploads it directly to the database. Vessels using an electronic monitoring system must record data using video, sensor, and logbooks. The logbooks are then audited: logbook data are compared with dockside reports and a random sample of 10% of the vessel's video footage and sensor data. If the logbooks match the electronic monitoring system, the data are deemed accurate and they are uploaded to the database. If not, the logbook is ignored and the fishing trip is reconstructed using video footage and sensor data (Fraser and Associates 2008). An audit score is assigned to each trip and an annual score is assigned to each vessel to create a matrix. This matrix allows managers to determine reward and penalty actions, which are often in the form of large fines.

Lessons Learned

The program has achieved its goals in several dimensions. The original sector-by-sector IVQ program successfully promoted cooperation among fishermen, encouraged community involvement, and conserved groundfish species (SAFMC). The integrated IVQ program went further by encouraging fishermen in different sectors to work together, greatly reducing waste and ensuring that catches stay within the established TACs (Fraser and Associates 2008). Prior to integration some fisheries exceeded their TACs, but fisheries managers could not quantify the extent of overharvesting without knowing the amount of fish discarded at sea. The integrated IVQ program discourages discards by allowing fishermen to purchase quota of their non-target fish from other sectors and allows managers to accurately quantify total catch by implementing 100% monitoring coverage (Fraser and Associates 2008).

One negative impact is that Canada's Pacific groundfish fishery has seen a reduction in small boats. Before the IVQ program was implemented, trawl vessels ranged in size from 30 to 150 feet. That range shifted to 50 to 120 feet after initial program implementation (SAFMC Unknown). The integrated IVQ program has also reduced the number of small vessels in the fishery, but the small vessels that have remained in the fishery have greatly increased their production volume and are able to pay the increased costs of monitoring (Fraser and Associates 2008).

Another negative aspect of the integrated IVQ program is the cost. The monitoring cost has increased for fishermen, especially hook-and-line and trap fishermen and those who harvest low volumes or low-value product. Prior to integration, hook-and-line and trap fishermen paid flat registration fees of $2,700 in 2004 and $3,000 in 2005 (Fraser and Associates 2008). Those registration fees covered the cost of targeted observer coverage. The integrated program requires fishermen to pay for an on-board observer ($343 per day at sea) or electronic monitoring equipment. Electronic monitoring requires a registration fee of $975 plus either $8,000 plus installation to purchase the equipment or a rental fee of $65 per day for up to 15 days and $45 for each additional day (Fraser and Associates 2008). Although the high monitoring costs may be negated by greater stability and profitability in the long term, they are significant and potentially prohibitive in the short term for many small operators and prospective new entrants (Fraser and Associates 2008).

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Australia Southeast Trawl Fishery

Location:	Southeastern Australia from Sydney, New South Wales southwestward to Cape Jervis, South Australia (including waters around Tasmania) in depths between 30 and 1200m.
Target species:	Multispecies; More than 100 are caught in the fishery with 17 species or species groups making up more than 80% of the catch and subject to ITQs, including blue-eye and silver trevally; blue grenadier; eastern school whiting; tiger flathead; jackass morwong; ling; ocean perch; orange roughy; redfish; Royal red prawn; and gemfish, dory, and warehou species.
Gear:	Mainly demersal otter trawls, some Danish seines
Seasonality:	Year-round
Effort:	In 2000, 35,500 tons allocated under TACs; approximately 26,200 tons caught (Shotton 2001); In 2007-2008, an estimated 15,200 tons caught (Austrialian Fisheries Management Authority 2009)

Management History

The Australian Southeast Trawl (SET) fishery (now called the Commonwealth Trawl Sector) has a history of commercial exploitation of multiple species dating back to 1915 (Tilzey 1994). A fishery developed for gemfish in the 1970s and 1980s led to the expansion of the New South Wales fleet. Eastern gemfish became the dominant catch of the fishery in the mid-1970s with landings between 3,300 and 5,500 tons between 1977 and 1988 (Shotton 2001). A TAC was placed on gemfish in 1988 due to concerns about overfishing. Nevertheless, the fishery collapsed and has been closed since 1993, with a small exception for unavoidable bycatch (e.g., the TAC was 150 tons in 2001) (Shotton 2001). While not all of the reasons for the collapse of this stock are clear, overfishing was certainly part of the problem.

During this period of intense fishing pressure for gemfish, the fishery also began to target orange roughy and expand southward off of Tasmania. The orange roughy fishery began in 1986 with a peak in landings of 43,900 tons in 1990 (Shotton 2001). A TAC was placed on orange roughy in 1990. Similar to the fate of gemfish, orange roughy was also fished to dangerously low levels, resulting in the species being listed as "conservation dependent" under the Environmental Protection and Biodiversity Conservation Act of 1999 by the Minister for the Environment and Heritage. Blue grenadier became and continues to be the principal catch of the SET fleet along with tiger flathead and silver warehou (AFMA 2009).

Prior to the mid-1980s, few management constraints restricted fishing effort of the SET (Shotton 2001). A number of management measures have since been applied to the SET fishery. In 1985 managers halted the issuance of new licenses in order to control latent effort in the fishery. Yet, the fishery continued to be characterized by overcapacity and overfishing of some species. In 1986 a maximum fishing capacity was established for the fleet so that any operator wishing to increase their vessel's fishing power would need to acquire the capacity from another fisherman (Coutts 1991). Despite this management measure, fleet capacity continued to rise (Tilzey 1994). Between 1986 and 1989, prices and profits in the demersal sector of the fishery declined while operating costs rose (Shotton 2001).

In 1988 several management alternatives were assessed to address overfishing and overcapacity, including modified boat replacement rules, adjustments to fishing sector boundaries, non-transferable individual quotas, license buybacks, and ITQs (Shotton 2001). The assessment showed that an ITQ program would allow for the greatest profits to be earned by the fishery, but this option also required the greatest structural change in the fishery (Shotton 2001). Despite this challenge, the Australian government decided to adopt ITQs. Beginning in 1992 shares of the TAC became allocated individually in the form of ITQs for the 16 major species or species groups (the Cascade Plateau orange roughy ITQ program was not introduced until 2001).

Current Management Regime

Three goals were set forth broadly for the ITQ program:

1. Ensure the conservation of fish resources and the environment in which they live
2. Maximize profitability while exploiting these resources
3. Collect an appropriate charge from fishermen exploiting the common resource for private gain (Adapted from Shotton 2001)

The Australian Fisheries Management Authority (AFMA) later set several specific goals for allocation, which contained objectives for achieving sustainable resource and economic targets but included no social objectives. Three criteria emerged from the AFMA pertaining to quota allocations including (1) criteria should be sensible and reasonable, (2) distributions should avoid redistribution of wealth, and (3) allocation decisions should discourage legal challenge (AFMA 1997, Shotton 2001).

Initial allocations for the SET were based on a formula that utilized both historical catch records and fishery investments. Catch histories were attached to a vessel's license, and if the license was transferred (such as through a vessel sale), then the catch history was also transferred (Shotton 2001). Logbooks were deemed unreliable for catch histories because they were intended primarily for the collection of scientific data. Instead, catch histories were based on certifiable catch revenue records. Investment into the fishery was based on a measure of vessel capacity (cubic number and engine power) that had been used prior to the ITQ program. This factor applied only to the trawl sector of the fleet as each Danish seine was determined to have an equal investment in the fishery (Shotton 2001). At the onset of the ITQ program in 1992 a portion of the TAC (5% to10%) was held back for discretionary use, including for scientific purposes or additional allocations if deemed necessary (Geen, Nielander, and Meany 1993). At the inception of the program ITQs for the SET were made fully transferable between vessel operators, though permanent transfer was not permitted until 1994 (Shotton 2001).

Cascade Plateau orange roughy ITQ allocations were made in 2001, at which time only 14 boats had catch histories for this species. An additional 110 boats in the fleet possessed a license to fish for the species. Many of these vessels were either unsuitable or did not possess the proper gear for fishing orange roughy (Shotton 2001). The allocation for Cascade Plateau orange roughy was divided such that 50% of the TAC was given to vessels with catch histories and the remaining 50% was given to the remaining vessels. One rationale for this allocation was that all of the vessels in the fleet had the right to exploit the resource even if they opted not to do so.

While the number of active trawlers in the SET decreased after ITQs were introduced, fishing effort actually increased (Shotton 2001). Since TACs were based on maximum historical annual catch levels instead of yield estimates, they were probably set too high initially. They remained at these high levels in subsequent fishing years (Tilzey 2000, Shotton 2001). As a result, annual catches for many of the species in the fishery were below the TACs (Shotton 2001). Alternative explanations for catches below TACs include reductions in fish abundance, issues with quota transferability, and barriers in the marketplace (Shotton 2001).

The SET ITQ program has experienced considerable resistance from the fishing industry. Some observers have suggested that using a six year period for catch shares histories may have been too long given how often changes in the participants and practices of the fishery occurred (Geen, Nielander, and Meany, 1993). They also criticize the program because similar management was not extended to other gear types that were fishing for the same target species as the SET. It has also been noted that uncertainty and the speed at which TACs were established led to rushed decisions that lacked consideration of fishery dynamics (Exel and Kaufmann, 1997). For instance, no formal stock assessments were conducted prior to the inception of the ITQ program or the allocation of catch shares.

Accurate determination of catch histories has proven difficult in the SET, which has given rise to criticism of the ITQ program. One reason for dissatisfaction is that ex-vessel sales prior to implementation of the ITQ program often went unreported to avoid taxes. Since it was determined that logbooks would not be considered verifiable catches, fishermen needed to use sales as a means to verify catches. Unreported catches meant verifiable catches were less than actual catches and lower quotas resulted, leading to dissatisfaction among fishermen (Shotton 2001). Other criticism of the ITQ program stems from a perceived shortage of consultation with the industry in the development of the program and the process for allocation. A review committee formed to address dissatisfaction in the fishery came to the conclusion that industry was not sufficiently consulted in the allocation process (Shotton 2001). The resulting criticism undermines management efforts by jeopardizing acceptance of the program and its effectiveness (Exel and Kaufmann 1997).

The ITQ system was challenged in court by two industry groups who contested their quota allocations for orange roughy and gemfish. In both cases, the industry prevailed with the court concluding that there was no justifiable reason for the formula that was used by the government for quota allocations (Kaufmann and Geen 1998). These court cases demonstrated that the AFMA failed to achieve two of the three criteria they set pertaining to allocation of catch shares: that the catch shares allocations should be sensible and reasonable and that the decisions should discourage legal challenge (AFMA 1997, Shotton 2001). The original formula for establishing allocations was deemed void as a result of the first court case in September 1992. In October 1992 the formula was changed so that an operator's share was calculated as an average over the qualifying time period (as opposed to as an average of averages in each of the qualifying years) (Shotton 2001).

Despite changes to the allocation formula, dissatisfaction with the ITQ program continued and the government introduced a limited buyout program in 1995 that redistributed acquired quota among the remaining quota holders. Inshore fishermen were the focus of the redistribution program because they were the most critical of the allocations. In addition to the buyout program, beginning in 1994, permanent transfer of quota was permitted in an effort to address dissatisfaction with the program (Shotton 2001).

Lessons Learned

A number of lessons can be drawn from the trials of the SET. Stakeholder involvement in the design and implementation process is necessary to garner industry acceptance of the management plan (Exel and Kaufmann 1997). Exel and Kaufmann (1997) concluded that it is better to continue use of ineffective input controls than to implement catch shares allocations in a fishery with strong industry opposition. Even with industry support, widespread perception that an allocation has been fair will be difficult to achieve and appeals are likely to continue longer than anticipated. Thus, the appeals process should be designed before implementation and a pre-determined time period for appeals should be considered (Exel and Kaufmann 1997). Additionally, a portion of the quota should be retained in case of successful appeals.

In developing allocation formulas it has been recommended that an independent body separate from fishery managers be involved in decision making. Managers tend to have preferences about who deserves quota and industry perceives decisions made by fisheries managers as biased (Exel and Kaufmann 1997). As a result, if fisheries managers are involved in the decision making process, perceived inequities will make it difficult for managers to work with industry once catch shares allocations are implemented (Exel and Kaufmann 1997).

Because almost a decade occurred between the initial SET ITQ allocations and the Cascade Plateau orange roughy allocations, it was believed that some of the lessons learned could be applied to the orange roughy ITQ program. At the outset of the program an independent Allocation Advisory Panel (AAP) was formed by the AFMA to serve as a neutral body in determining how shares would be allocated to fishermen. While the AFMA determined the general principles that were used in the allocation process, the AAP was responsible for identifying the method of allocation (Shotton 2001). The AAP determined that since all vessels, those with and without catch histories, had licenses to participate in the Cascade Plateau orange roughy, they each should receive an equal share of the allocation. The AFMA disagreed with this view, and because it had retained management authority, it instead modified the allocation so that half of the allocation was given to vessels with catch histories (14 boats) and the other half to those without (110 boats) (Shotton 2001). This led to the A FMA being sued by five vessel operators.

Finally, since most fisheries undergoing movement towards a catch shares program are facing some sort of crisis such as overfishing or overcapacity of the fleet, there is a sense of urgency related to introduction and implementation of ITQs. The SET example demonstrates the difficulty in correcting mistakes that resulted from a management plan based on insufficient data and planning (Shotton 2001). Despite the desire to act quickly, a thorough analysis of biological, social, and economic dynamics should be considered prior to the implementation of a catch shares program.

While the SET ITQ program has been fraught with criticism, particularly in regard to initial allocation of quota, the program remains in existence today and has achieved its objective of ensuring the conservation of fishery resources. Despite the early trials of the program, according to the AFMA (2009) only one species targeted by the fishery today is known to be subject to overfishing and 8 species are classified as uncertain. A remaining 15 species are not subject to overfishing (AFMA 2009). It appears that the SET (now known as the Commonwealth Trawl Sector) ITQ program has grown since its inception, and the lessons learned from this fishery can now be applied to assist other fisheries developing catch shares programs.

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A New Catch Shares Program: The U.S. Pacific Groundfish Fishery

Location:	The management area extends from the shoreline out to the 200-mile U.S. EEZ, along the coasts of California, Oregon, and Washington.
Target species:	More than 90 species, including rockfish, flatfish, roundfish, sharks, skates, and other demersal species
Gear:	Trawls are used to harvest most groundfish, but other gear types in the fishery include troll, longline, hook-and-line, pots, and gillnets.
Effort:	There are four components to the groundfish fishery: limited entry (further separated into trawl and fixed gear sectors), open access (which includes targeted catch using fixed gear and incidental bycatch with both fixed gear and trawl gear), recreational, and tribal (PFMC 2007). There are close to 400 permits involved in the limited entry component of the fishery, including both gear-type sectors. Of those, a little over 300 were active as of November 6, 2009 (NMFS 2009).

Management History

Functional management of the U.S. Pacific groundfish fishery began in the early 1980's and continues to evolve. Management measures have included harvest guidelines, quotas, trip and landing limits, area restrictions, depth restrictions, size limits, seasonal closures, and gear restrictions. In recent years, the groundfish fishery has been severely limited by the need to recover a handful of significantly overfished species, including canary rockfish, yelloweye rockfish, bocaccio, and cowcod, among others.

The U.S. Pacific groundfish fishery is scheduled to transition to a new catch shares and co-op hybrid program on January 1, 2011. While the majority of existing management measures will remain in place, such as gear restrictions and certain area closures, a catch shares program for the limited entry groundfish fishery will replace the current derby-style fishery.

A New Management Regime

The Pacific Fishery Management Council (PFMC) endorsed rationalizing the trawl fishery as a way to increase the economic efficiency of the groundfish fishery and to reduce the incidental catch of overfished groundfish (PFMC 2008a). The stated goal of the IFQ system is to:

> *"Create and implement a capacity rationalization plan that increases net economic benefits, creates individual economic stability, provides for full utilization of the trawl sector allocation, considers environmental impacts, and achieves individual accountability of catch and bycatch" (PFMC 2008a).*

Based on current recommendations, IFQs will be distributed in the form of quota shares. Harvesters holding existing limited entry permits will receive quota shares amounting to 90% of the total groundfish allocation and 80% of the total whiting (or hake) allocation. The remaining 10% of the groundfish quotas will be allocated to an Adaptive Management Program (AMP) while the remaining 20% of the whiting allocation will go to processors (PFMC 2008b).

The AMP quota will be used as needed to mitigate unintended impacts of the new system on communities and processors, among others, and will be divided among the three states of California, Oregon, and Washington (PFMC 2009a). For the first two years of the program the 10% of the quota intended for the AMP will be divided among permit holders while a system is developed to assist communities (PFMC 2009b). Individual allocations will include a combination of quota based on catch and landing history combined and quota derived from the IFQs tied to retired permits from a vessel buyback program (PFMC 2009a). Exact formulas are part of ongoing PFMC discussions.

One of the major objectives of the IFQ program is to improve the efficiency of the fishery. Catch shares in the targeted trawl sector will allow quota-holders to catch groundfish using any legal gear, not just trawls. This allows harvesters with a trawl-based quota to select the gear-type that is most effective for the conditions and market. This type of gear-switching will not be permitted for those harvesters fishing under non-trawl quota shares (PFMC 2009a).

A co-op system is planned for mothership catcher-processor vessels in the whiting sector of the fishery. Smaller catcher vessels will announce their membership with a mothership and will combine quotas with other vessels linked with that mothership. If a catcher vessel does not sign on with a mothership, its quota will be pooled with other non-co-op vessels and all individuals in the non-co-op pool will fish derby-style for the combined quota (PFMC 2008b).

Addressing Key Concerns

Two of the main concerns of any IFQ program are accessibility for future participants and the risk of excessive consolidation. Transferability of quota share (or quota pounds) can help ensure the ability of future participants to gain access to the fishery. Provided a U.S. citizen, resident alien, or U.S. corporation is legally eligible to own a U.S.-documented fishing vessel, the individual or corporation can acquire quota share from another harvester (PFMC 2009c). The eligibility is not limited to actual ownership, so in this way a crewmember could acquire a small amount of quota share and accumulate a larger share incrementally (PFMC 2009b).

Some reduction in the number of individuals holding permits is one of the desired outcomes of the program, and the PFMC cites transferability as an essential way to promote efficient fishing while minimizing bycatch. The theory is that efficient harvesters will prosper and inefficient harvesters with a high incidence of bycatch and an inability to fish up to the limits of their quotas will eventually leave the fishery, selling their permits to the remaining harvesters. Nevertheless, excessive consolidation of catch shares under a single or very small number of individuals or entities is one of the main concerns of IFQs. In order to prevent excessive consolidation, the PFMC recommended establishing a percentage limit for total quota shares within a species and across the groundfish fishery. The PFMC continues discussions about what the exact percentages will be (PFMC 2009a).

The costs of implementing the program are a concern. Estimates for ongoing federal administrative costs range from $2.4 to $2.9 million per year to implement the trawl rationalization program (PFMC 2009a). The benefits of the program in terms of a more sustainable fishery and fleet are expected to outweigh the costs, and a potential fee structure of not more than 3% ex-vessel value should allow the industry to defray program costs without excessive hardship.

Citations

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Conclusion

Several key lessons can be drawn for the New England groundfish fishery as it transitions to sector management and for other fisheries in the region considering a transition to catch shares. In general, the most important is to allow ample time for planning. Often fisheries are in crisis when the transition to catch shares occurs and, as in the Australian southeast trawl fishery, implementation occurs prior to addressing all of the important details. Amendments can be made and regulations changed, but the initial response and effectiveness of the program will set the tone for future success or failure. Unfortunately, legal mandates will often constrain the time available for thoughtful planning.

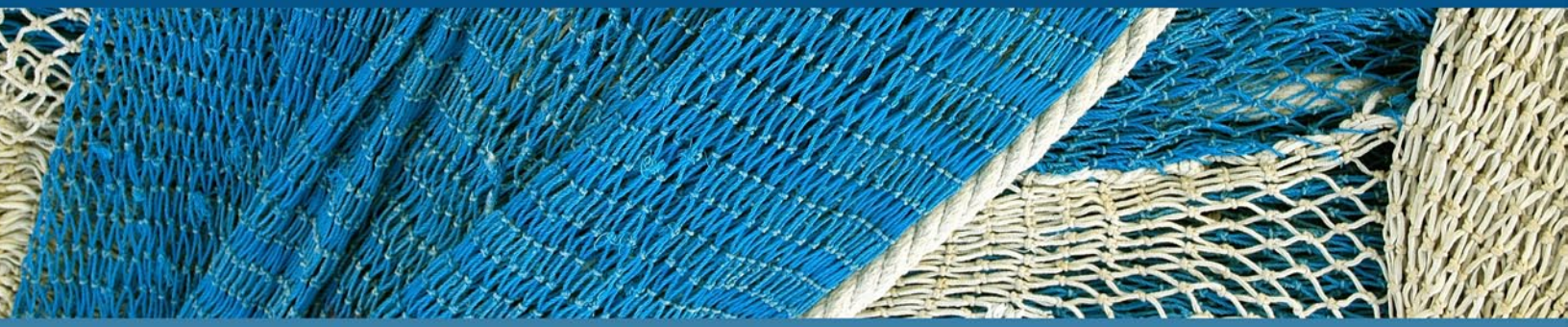
When deciding on initial allocation, the least controversial method for stakeholders appears to be use of a neutral party to determine the allocation formula. Once a decision to use a neutral party has been made, however, that decision must stand or managers risk losing the industry's trust. Limiting transfers of the initial allocation, especially in the early years of a program, may also be beneficial, as it can preserve the small boat fleet while allowing the program to gain momentum without rapid and excessive consolidation. Additionally, there are benefits to setting aside a portion of the TAC for adaptive management, cooperative research, community preservation, and future entrants into the fishery. Buybacks, used previously in New England, can be an effective method for reducing capacity prior to the implementation of a program by allowing fishermen an appealing exit strategy from the fishery. However, this can be expensive, and the details of how a buyback would be executed are critical. Finally, a strong appeals process created at the outset can contribute greatly to engendering trust. If fishermen believe there is an effective mechanism to voice their opinions and file appeals, it may avoid costly lawsuits down the road.

For many fisheries, an explicit geographic focus and policies to preserve traditional fishing communities and fishing practices can contribute to the success of catch shares programs. When fishermen know the other fishermen in the program as neighbors and friends, they are more likely to abide by rules that will benefit everyone. Additionally, keeping a certain amount of the TAC within a community helps protect jobs and fishing-related infrastructure. The challenge for decision makers is to define community and distribute benefits to those entities in a manner that reduces, rather than increases, conflict.

Costs must be carefully watched as a program designed with high levels of monitoring and extensive administration could fail in future years if a fishery does not become as profitable under catch shares as expected. Several catch shares programs have experienced issues with high costs, and the magnitude of the challenge often depends on whether or not they enjoy outside funding at the onset in addition to the industry's ability or inability to fund the program down the road.

Finally, catch shares programs need effective methods and forums for collaboration among the key parties and for gathering information and disseminating it back to fishermen in useful ways. Fishermen are more likely to be supportive of management if they have been meaningfully included in decision making processes and can clearly see the positive results of their data submission requirements.

Design and implementation of catch shares can be challenging for managers and stakeholders alike. In order to reap the many potential benefits and avoid the pitfalls, programs should be designed with careful consideration of a number of priority issues and questions, including those described in this report, and lessons should be drawn from the many existing catch shares programs currently in operation in the U.S. and internationally.



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