

**DEFINING SOCIAL AND ECONOMIC PERFORMANCE MEASURES FOR CATCH SHARE SYSTEMS  
IN THE NORTHEAST U.S.**

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**ABSTRACT**

Catch share systems are being encouraged and considered in a variety of United States (U.S.) fisheries. Scientists, policy makers, and stakeholders (including fishermen and non-governmental environmental organizations) have different views about potential social and economic impacts and outcomes of these output-oriented systems. Thus identifying and evaluating impacts over time is essential to assess and improve such systems and determine whether intended outcomes are realized. During 2009-2010 Social Sciences Branch (SSB) staff at the National Marine Fisheries Service (NMFS) Northeast Fisheries Science Center (NEFSC) in Woods Hole, Massachusetts engaged in a multiphase process to identify and define meaningful measures of social and economic performance of catch share systems, as well as indicators and information sources to guide the ongoing evaluation of these programs. The principal performance measures identified in this process are financial viability, distributional outcomes, stewardship, governance, and well-being. Here we review the current state of catch shares in the Northeast U.S., describe the methodology used in identifying performance measures and associated indicators, and present the social and economic performance measure monitoring plan that will guide future investment in social science research at the NEFSC.

**Keywords: catch shares, property rights, social and economic impacts, performance measures, U.S. fisheries**

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**Introduction: Catch Shares Gaining Momentum**

Property rights regimes for fisheries are not new and have been implemented in a variety of contexts. They typically involve the allocation of a share of the available fish (quota systems) or a fishing territory (Territorial Use Rights Fisheries or TURFs), though in industrial fisheries quotas are far more common. A quota share of the Total Allowable Catch (TAC) can be allocated to individuals or groups (Clay and Olson 2008, Townsend et al. 2008). Examples range from individual transferable quotas (ITQs) to various community quotas (e.g., Wingard 2000, Pinto da Silva 2004, Charles et al. 2007, Mansfield 2007, Langdon 2008, Hermansen and Dreyer 2010) to all kinds of variations in between. A quota can be allocated in perpetuity or annually. It can be granted only as a use right, or also as a property that can be sold and/or traded. Outcomes may be different for community rather than individual quotas (Trondsen 2004; Bromley 2005). Recently, instead of property rights regimes some have begun speaking of “catch shares” (re. Costello et al. 2008, EDF 2009, Meridian Institute 2010), though the two phrases appear to cover the same range of regimes or systems.

In the U.S. in 2010, under the administration of President Barack Obama and his NOAA Administrator Jane Lubchenco, catch shares are being highly encouraged as a core strategy to improve the status of environmental factors such as fish stock status and habitat, and also the social and economic status of communities and individual

fishermen (see NOAA Draft Catch Share Policy<sup>1</sup>). Catch shares are a deviation from a previous reliance on input controls (e.g., trip catch limits, limiting time at sea), and promise to reconnect incentives for conservation via rights or privilege based management. In this paper we focus solely on the social and economic outcomes of such programs and how they can best be measured.

Efforts to identify performance measures and track catch share performance are in different stages of development in each of the six NMFS regions (Northeast, Northwest, Southeast, Southwest, Pacific, and Alaska). While there are some commonalities in these approaches, differences are intended to reflect the wide range of socio-economic contexts in which measures are being applied. For the purposes of this document, we restrict our discussion primarily to the situation in NMFS' Northeast Region.

Currently 14 catch share plans are in place in the U.S.<sup>2</sup>, constituting approximately 25 percent of the U.S. fisheries measured by value (NMFS databases). Four of these are in the Northeast: the surfclam/ocean quahog ITQ (*Spisula solidissima/Arctica islandica*) (since 1990), the Mid-Atlantic golden tilefish ITQ (*Lopholatilus chamaeleonticeps*) (since 2009), the Atlantic sea scallop IFQ (*Placopecten magellanicus*) (since 2010), and the Multispecies (groundfish)<sup>3</sup> sectors (since 2010). Groundfish is the largest program in number of permit holders and includes 17 group quota or 'sector' allocations. Also in the Northeast, at the state level, a pilot sector allocation system began in 2009 in the Rhode Island summer flounder (*Paralichthys dentatus*) fishery. Other catch share management programs are being considered and implemented in other U.S. fisheries over the next few years, including additional programs slated for the Northeast Region.

### **Need for Social and Economic Performance Measures to Assess Impacts and Adapt Management**

Given the significance of this management paradigm shift, and its potential implications for social, cultural and economic systems associated with regional fisheries, the SSB invested staff time and resources during 2009-2010 to create a Performance Monitoring and Evaluation Plan and associated research agenda. This dovetails with fishing industry concerns: "Will sectors perform better than DAS [Days-at-Sea management], and what metrics will be used to measure this performance?" (Keiley 2010:3). Catch shares have received extensive coverage in the regional press and been the subject of numerous recent meetings and workshops. This controversy has served as a constant reminder of the critical importance of careful crafting and implementation of our plan.

The Magnuson-Steven Fishery Conservation and Management Act<sup>4</sup> (MSA) requires U.S. fisheries to adhere to 10 National Standards (16 U.S.C. 1851 MSA § 301) – conserve fish while achieving optimum yield, manage related stocks as a unit, not discriminate between States, consider economic efficiency, take into account variations between fisheries, minimize costs, take into account the importance of fishery resources to fishing communities, minimize bycatch and promote safety at sea, and in the case of fisheries managed under Limited Access Privilege Programs (LAPPs) (16 U.S.C. 1802 MSA § 3(26)) -- reduce capacity if needed, promote safety and social, economic benefits, ensure fair/equitable initial allocations, sustain participation of small owner-operated fishing vessels/their fishing communities, avoid excessive geographic/other consolidation, assist entry-level/small vessel owner-operators, captains, crew, and fishing communities (16 U.S.C. 1853a MSA § 303A).

In the U.S., Fishery Management Plans (FMPs) are developed by eight regional Fishery Management Councils (Councils), though final approval must come from the Secretary of Commerce based on input from National Marine Fisheries Service. Objectives for FMPs vary widely across Councils and across FMPs within Councils, and in some cases are inconsistent. For instance, within the Northeast Region the goals and objectives for catch share programs include: control capacity, achieve economic efficiency, encourage diversity of the fishing fleet, minimize adverse impacts on fishing communities and shore side infrastructure, promote stewardship, minimize bycatch, provide incentives to self-govern, reduce the need for Council-mandated measures, simplify management, prevent excessive consolidation that would eliminate the day boat fishery, control fishing mortality, prevent overcapitalization and limit new entrants, and allow for regulatory flexibility and adaptation.

Additionally, while goals and objectives are defined in the initial stages of the development of an FMP amendment or framework, this is no guarantee that design elements to achieve these goals are effectively integrated into the regulatory action. Importantly, after implementation, typically no formal process exists for evaluating whether the objectives are actually achieved.

Since many of the stated goals and objectives for these types of management approaches pertain to social and economic considerations, it follows that social and economic outcomes should be tracked when catch share programs are implemented. Managers have an obligation to consider how their decisions affect the human context of the fishery. Where there is success, features of those programs might be emulated. Where problems are identified, managers need to know what the particular issues are, how things have changed, and what tools are available to them to address these problems.

### **Defining performance measures and indicators for the Northeast Region**

The process of identifying catch share performance measures and indicators for the Northeast Region began in 2009 and was completed in mid-2010. This plan is not static and will be revisited periodically to ensure that it remains relevant. The intention of this plan is to evaluate the social and economic outcomes of both catch share and non-catch share fisheries, as it is not enough to know if catch share fisheries provide intended outcomes. We also need to know whether they perform better on these measures than do fisheries managed under other regimes.

The process of creating performance measures consisted of five steps. *Step 1:* In May 2009 a group of SSB staff conducted a literature search and proposed a draft set of performance measures to the SSB as a whole. *Step 2:* Between June 2009 and June 2010, this draft plan was vetted in multiple iterations with the full SSB staff and further refined. Approximately 10 group meetings were held to discuss issues, resolve inconsistencies and reflect on new information and input coming in from outside sources. *Step 3:* In September 2009, the SSB held a workshop in Woods Hole, Massachusetts bringing together key academics from around the country to discuss the draft plan, debate alternatives and improvements to the plan, and revise and refine it based on a broad range of scientific experience and input. *Step 4:* In November 2009, several SSB staff represented the Branch at a national NMFS workshop on social and economic indicators for catch shares, there providing our input and taking home revisions based on the national discussion. As a result, components of this plan are consistent with efforts from other regions and can be compared nationally over time. *Step 5:* Between October 2009 and April 2010, an outreach effort was conducted to integrate input from a wide range of stakeholders and ultimately ensure that identified performance measures were salient and key areas were covered in the emerging plan.

The importance of Step 5, while always understood by us as social scientists, was supported by the GAO (2006) report finding that stakeholder participation in Council processes has generally been insufficient, and is especially critical where the development (and in our case assessment) of quota-based fisheries is concerned (re. World Bank 2008:47). The GAO (*ibid.*) further recommended that NMFS develop a formal stakeholder participation policy and/or provide the Councils with guidance or training on how to develop and use a strategic approach to enhance stakeholder participation. To that end, presentations were made to the New England Fishery Management Council and the NMFS Northeast Regional Office to reach Council members and policy makers. A presentation was also made to a fishermen's discussion of catch shares in Portsmouth, New Hampshire (held under the auspices of New Hampshire Sea Grant and the Northeast Consortium<sup>5</sup>). The SSB also hosted a wide variety of speakers knowledgeable about catch share impacts at the NEFSC's seminar series and used these opportunities to get targeted feedback on key elements of the plan. Further, we created a website<sup>6</sup> to provide background information to the public and solicit additional input.

Finally, out of concern that outreach efforts had been focused on individuals who commonly attend and participate in meetings, the SSB worked with the community outreach group of the Gulf of Maine Research Institute to target stakeholders less likely to participate in mainstream initiatives<sup>7</sup>. Such groups included vessel crew and shore side businesses, and were identified via snowball sampling, a special nonprobability method used when – among other reasons - no good sample frame exists. Initial subjects are identified in a targeted search and later subjects are identified by initial subjects, until a desired sample size is reached or suggested subjects begin to repeat. Some of the most repeated comments were on the need to look at crew, not just vessel owners, and the need to track what happens to people who leave the fishery. Is it by choice? Do they feel forced out? What sorts of livelihoods do they find after leaving? These efforts were further publicized by a three page article in the regional fisheries newspaper (Plante 2010).

### **Guiding Literatures**

How well are people, businesses, and communities doing in relation to a particular fishery? The literature contains many examples of studies that address specific issues and provide evidence of and theoretical reasoning for cause and effect linkages. While our choices of indicators are driven by a desire to establish cause/effect, we recognize there are limitations. Our primary purpose is to measure changes in outcomes that both represent human “performance” and are likely to be a result, at least in part, of the decisions made by fisheries managers. Research aimed at improving our indicators and further exploring cause/effect is also a component of the overall SSB performance measure plan.

To identify the issues to track, we reviewed three major literatures or sources of guidance. These were: 1) U.S. fishery law and agency policy statements, 2) academic and non-governmental organization (NGO) literature, and 3) FMP objectives for catch share programs implemented in Northeast U.S. fisheries. The following paragraphs provide a very brief overview of these sources.

### **Previous Use of Performance Measures in Fisheries**

Social and economic indicators became popular in policymaking in the 1960s (Gruenwald et al. 1997). Researchers then and since have sought to develop indices that both speak to policy needs and have the academic rigor necessary to allow meaningful analyses (Smith and Clay 2010).

Fisheries-specific examples include the Jepson and Jacob (2007) vulnerability index (re. Jacob and Jepson 2009), the Canadian Genuine Progress Index (GPI) (e.g., Charles et al. 2009) focusing on resilience, the Pollnac et al. (2006[2008]) Fisheries Social Impact Assessment (SIA) Model focusing on well-being, the Tuler et al. (2008) analysis of vulnerability, the Mahon et al. (2010) approach to governance characteristics of large marine ecosystems (LMEs), the World Bank (2008) case for fisheries reform, and multiple studies of job satisfaction (see Pollnac and Poggie 2008 and Smith and Clay 2010, and references therein).

Specific to catch shares, the Environmental Defense Fund (EDF) (2007) developed indicators of performance and applied them to all U.S. catch share programs. These indicators include measures of compliance, safety, capacity, season length, boat yields, revenues, employment, and ownership concentration.

One point of interest is that most (though not all) of these indices rely on government data sources (e.g. community-level demographic and poverty data, landings, citations issued), which generally provide only objective measures. This is because “there continues to be a challenge in obtaining socioeconomic and institutional data to develop appropriate indicators” (Charles et al. 2009:47). Studies have shown that people’s subjective experiences are often at odds with their objective condition (Brickman et al. 1978; Graham 2009). Thus indices without a subjective measure may miss important trends as well as differences between groups (Stiglitz et al. 2009; Smith and Clay 2010).

In identifying indicators to use in the Northeast Region, we took care to ensure relevance for fisheries in general. However, as a point of departure, we began with studies related to documented or claimed positive or negative impacts of catch shares, given their current relevance and controversy.

### **Academic and NGO Literature on Impacts of Catch Shares**

The economics literature contains a variety of theoretical papers that provide a rationale for why property rights/catch shares will lead to improved economic outcomes in fisheries (e.g., Gordon 1954, Scott 1955, Clark 1980). There are also multiple case studies in both economics and anthropology (see Shotton 2000 and Townsend et al. 2008 for two good compendia). Arnason (2008:35) argues that efficiency in property rights regimes derives from “(i) reduced fishing effort, (ii) reduced fishing capital, (iii) larger fish stocks, (iv) higher quality of landed catch and (v) better co-ordination between supply of landings and market demand.” But economic impacts are not the only type of impacts to individuals, institutions and communities, and even economic impacts may not be evenly distributed across the social landscape due to situational economic and cultural factors (Olson In prep.). While consolidation may lead to economic benefits, there have been a number of sociocultural concerns expressed including the distributional equity of such gains. There are concerns that larger scale fishermen will have an advantage over smaller scale in acquiring catch shares (e.g., Bromley 2005: 224), though this may be due to an assessment of the number of vessels rather than firms (Brandt 2005). Even where design principles are intended to limit accumulation by large vessels, this can still occur (McCay 2004).

Eythórsson (1996:217) finds consolidation in the Icelandic limited access ITQ fleet. The amount of consolidation was limited, however, because an open access option remained and many small-scale vessels selected this. He also finds associated land-based jobs decreased and crew income dropped (Eythórsson 2000). Arnason (2008) on the other hand finds evidence to suggest that Iceland's ITQ system has created benefits in other sectors of the economy, as measured by increases in GDP linked to increases in ITQ wealth. And elsewhere Kompas and Che (2003) find that crew benefited from quota trading in the form of increased share payments. Branch et al. (2006: 1657) also find income may increase but time at sea also increases – potentially impacting home and community life. Employment levels for crew generally decrease (e.g., Brandt and Ding 2008: 744) and crew who remain in the fishery may find their pay system changes from shares to wages (e.g., Bradshaw 2004), changing them from co-venturers to employees, who have less control over the fishing operation.

In cases where incomes are lower or quota prices are high there can be wide ranging impacts on households and communities (Pollnac et al. 2006[2008]), including limiting the ability of deckhands to work their way up to captain (Philips et al. 2002). Other cultural norms may also be changed by limited access or catch shares (e.g., Maurstad 2000). Finally, individual quotas can lead to geographical concentration of quota in larger ports (e.g., McCay 2004), thus negatively affecting smaller and more rural fishing communities both economically and socially (Lowe and Carothers, 2009). This is at the same time that some (e.g., EDF 2007, 2009) are promoting catch shares as increasing profits and sustaining communities. Arnason (2005) finds property essential to economic growth and efficiency, but notes that rights invested in communities may work better in some cases than ITQs.

Fox et al. (2002) examine changes in profitability according to these components in the British Columbia halibut (*Hippoglossus stenolepis*) fishery: output prices, variable input prices, fixed inputs, and productivity. Initial drops were followed by increases when transferability was introduced. Grafton (1996) discusses the outcomes of ITQs in terms of changes in fishing effort, profitability, employment in both harvesting and processing, and compliance with ITQ regulation, generally finding positive outcomes. Geen and Nayar (1989) show increased profitability in the southern bluefin tuna (*Thunnus maccoyii* (Castlenau)) industry with an ITQ, despite a severe decline in abundance. Gauvin et al. (1994) show that post-ITQ prices in the wreckfish (*Polyprion americanus*) fishery were higher and less variable due to reduced temporal variability in landings.

Gauvin et al. (*ibid.*) also find supporting evidence for increased stewardship. Dupont and Grafton (2001:218) suggest “that rights-based management, since 1993, has encouraged fishers to better allocate their catches over the fishing season and increased the quality and price for their product.” Costello et al. (2008) claim that catch share fisheries are less prone to collapse, and from there make the presumption that this shows greater stewardship on the part of fishermen. NRC (2003; re. Worm et al. 2009:583) says catch shares may improve compliance – certainly part of stewardship, though arguably not all of it. Grafton et al. 2006 (re: Johnston and Sutinen 2009 and references in Olson (In prep.)) suggest more broadly that catch shares may improve ecological stewardship.

Branch (2009), however finds both supporting and contradicting examples for stewardship. Chu (2008), further, finds little evidence for changes in stock population levels after the introduction of catch shares. Essington (2010:754) notes that this shows the complexity of factors that influence stock populations, and suggests that catch shares are not necessarily the key factor (re. Macinko and Whitmore 2009). Essington (2010) himself finds that catch share fisheries tend to have more predictable and consistent landings but “there was little evidence for higher population levels, lower exploitation intensity, or increased landings” (*ibid.*, p. 756) - though more stable landings may mean management is being more effective at maintaining stocks at their TACs or reference points (*ibid.*). Further, since many captains are hired rather than being owners, the presumed incentives due to ownership may not apply (Phillips et al. 2002; Bradshaw 2004; re. Brandt and Ding 2008: 746).

Catch share programs may lead to higher monitoring and enforcement costs for the fishing industry and higher organizational costs in the case of sectors/cooperatives, but lower costs for government (James 2008). Some have said safety will be improved (NRC 1999; Sigler and Lunsford 2001; EDF 2007, 2009) but Windle et al. (2008: 707) find in their review of six different fisheries that impacts of ITQs on safety were mixed.

## **Final Performance Measures and Associated Indicators**

Based on the review of literature and outreach efforts, we identify five performance measures that consistently emerged, along with a set of individual indicators on key components of these measures. The five overarching measures are: 1) Financial Viability, 2) Distributional Outcomes, 3) Stewardship, 4) Governance and 5) Well-being. While not surprising or particularly remarkable, they largely mirror those identified as critical during other outreach efforts over the years, such as an effort conducted by the North Atlantic Marine Alliance (NAMA) to identify a vision for the groundfish fisheries in the Northeast U.S. (NAMA 2005). This suggests that these areas of performance have been and continue to be salient to a broad range of stakeholders, and key in evaluating the social and economic performance of catch shares and other approaches to fisheries management. These performance measures effectively capture the range of concerns within the sociocultural and economic realms, both as overall concerns for fisheries management in general, and also as areas important to target for studies of catch share fisheries in particular. Table 1 provides definitions for each performance measure. In Table 2 we provide specific indicators for each performance measure and a proposed approach for defining each indicator.

We define a “performance measure” as a general issue or outcome related to a management program. Such a measure may relate to the stated goals of a program, to the requirements of fisheries laws, or to concerns identified by stakeholders. Together, the five measures are the categories of issues/outcomes that describe the human dimension of fisheries.

“Indicators” are specific components of performance measure categories that are thought to provide reliable, though not definitive, indications or supporting evidence that an outcome has changed. For any indicator, several complementary approaches may be used. For example, stewardship of the resource is thought to be affected by the implementation of a catch share program, and therefore is included as one of our performance measures. Change in the amount of by-catch is an indicator of a change in stewardship. However, tracking by-catch alone is not a sufficient measure of changes in stewardship and other indicators are identified.

**Table 1: Performance Measure Definitions**

<b>Performance Measure</b>	<b>Definition</b>
Financial Viability	The financial condition of fishing vessel owners and crew, fishing households, businesses that provide fishing-related goods and services (e.g., fuel, ice, gear, insurance), and businesses in the marketing chain (processors, dealers, retailers).
Distributional Outcomes	The outcomes and implications related to how the benefits and costs of a catch share program are distributed among individuals, groups, and communities. Major focus is on access/exclusion to quota and fishing opportunities, concentration of quota, and employment opportunities.
Stewardship	The degree to which participants use the resource in a careful and responsible way. Additionally, the degree to which participants have a sense of stewardship.
Governance	The degree to which stakeholders participate in the process of decision-making and implementation, the transparency and legitimacy of that process, the effectiveness and complexity of regulations, and the degree of adaptability/flexibility of the management process. An additional component of governance is the cost to government to implement a management program and the cost to participants.
Well-being	The degree to which an individual, family, or larger social grouping (e.g., firm, community) can be characterized as being healthy (sound and functional), happy, and prosperous (Pollnac et al. 2006[2008]).

**Table 2: Social and Economic Performance Measures and Indicators**

<b>Financial Viability</b>	
<b>Indicators</b>	<b>Proposed Approach (some or all of these may be used)</b>
Profitability and productivity	<ul style="list-style-type: none"> <li>▪ Malmquist index* (Technical measure of transformation of inputs into outputs)</li> <li>▪ Capacity utilization</li> <li>▪ Revenue per unit effort</li> <li>▪ Revenue per active vessel*</li> <li>▪ Revenue per vessel day*</li> </ul>

	<ul style="list-style-type: none"> <li>▪ Lease price*</li> <li>▪ Share price*</li> <li>▪ Lease or share price to ex-vessel price*</li> <li>▪ Fishing capacity of active vessels*</li> </ul>
Landings distributions over time	<ul style="list-style-type: none"> <li>▪ Chart distribution of landings over time</li> </ul>
<b>Distributional Outcomes</b>	
<b>Indicators</b>	<b>Proposed Approach (some or all of these may be used)</b>
Employment trends	<ul style="list-style-type: none"> <li>▪ Total annual fishermen days*</li> <li>▪ Employment demographics*</li> <li>▪ Total number of active crew*</li> <li>▪ Average crew earnings by day*</li> <li>▪ Total crew earnings as a percent of net revenue*</li> <li>▪ Changes in crew duties/ payment arrangements</li> <li>▪ Survey participants about opportunities for new entrants (crew and owners)</li> </ul>
Ownership trends	<ul style="list-style-type: none"> <li>▪ Industrial concentration (Gini coefficient and Herfindahl index)</li> <li>▪ Revenue by vessel type &amp; community/geographic location</li> </ul>
Price of quota/ability to purchase quota	<ul style="list-style-type: none"> <li>▪ Lease and share prices</li> <li>▪ Debt ratio (total debt/total assets)</li> <li>▪ Survey participants about ability to purchase quota</li> </ul>
Community scale outcomes	<ul style="list-style-type: none"> <li>▪ Revenue by communities that depend on fisheries*</li> </ul>
<b>Governance</b>	
<b>Indicators</b>	<b>Proposed Approach (some or all of these may be used)</b>
Participation in governance	<ul style="list-style-type: none"> <li>▪ Survey participants about perception of degree of influence, levels of attendance at meetings, and participation in leadership</li> </ul>
Effectiveness	<ul style="list-style-type: none"> <li>▪ Number of regulatory infractions</li> <li>▪ Quota overages*/underages</li> </ul>
Transparency/Legitimacy	<ul style="list-style-type: none"> <li>▪ Survey participants about perceptions of transparency/legitimacy of governance systems</li> </ul>
Conflict	<ul style="list-style-type: none"> <li>▪ Survey participants about changes in the level of conflict</li> </ul>
Adaptability/Flexibility	<ul style="list-style-type: none"> <li>▪ Survey participants about regulatory adaptability/flexibility</li> </ul>
Management costs	<ul style="list-style-type: none"> <li>▪ Survey participants about cost to participate in fishery</li> <li>▪ Percent of total fisheries revenue spent on participation costs.</li> <li>▪ Survey participants about time spent participating in process, understanding process, attending meetings.</li> <li>▪ Number and/or frequency (time between) of amendments and frameworks per year</li> </ul>
Management complexity	<ul style="list-style-type: none"> <li>▪ Size of amendments/frameworks</li> <li>▪ Survey participants about perception of management complexity</li> </ul>
<b>Stewardship</b>	
<b>Indicators</b>	<b>Proposed Approach (some or all of these may be used)</b>
Compliance	<ul style="list-style-type: none"> <li>▪ Develop compliance index based on enforcement statistics</li> </ul>
Bycatch/Discards/Highgrading	<ul style="list-style-type: none"> <li>▪ Measure with existing monitoring data</li> </ul>
Conservation ethic	<ul style="list-style-type: none"> <li>▪ Survey participants about perception of compliance</li> </ul>
Activities that benefit the stock	<ul style="list-style-type: none"> <li>▪ Survey participants about going beyond the regulations and engaging in other activities that improve the condition of the stock</li> </ul>
<b>Well-being</b>	
<b>Indicators</b>	<b>Proposed Approach (some or all of these may be used)</b>
Health status and access to health insurance	<ul style="list-style-type: none"> <li>▪ Survey participants about health insurance coverage</li> <li>▪ Develop index based on community level health statistics</li> </ul>
Community level indicators	<ul style="list-style-type: none"> <li>▪ Develop index based on community level crime, poverty, unemployment, education, and conflict</li> </ul>
Port infrastructure	<ul style="list-style-type: none"> <li>▪ Profile relevant ports</li> </ul>
Job Satisfaction	<ul style="list-style-type: none"> <li>▪ Survey participants about job satisfaction</li> </ul>
Changes in social networks and	<ul style="list-style-type: none"> <li>▪ Survey participants about social networks</li> </ul>

relationships	
Safety	<ul style="list-style-type: none"> <li>▪ Number of fisheries-related injuries/hospitalizations*</li> <li>▪ Number of fisheries-related fatalities*</li> <li>▪ Number of vessels lost*</li> <li>▪ Damage costs*</li> <li>▪ Survey participants about perception of riskier/safer fishing practices</li> </ul>

\*Variables agreed upon nationally by NMFS social scientist working group.

**Implementing the performance monitoring and evaluation plan**

Some of the indicators in the table above can be obtained or calculated from existing data to at least some extent. For example, NMFS landings databases include vessel tonnage, gear, species, pounds and market categories landed, and port of landing. Permit databases include permit owner name and residence, fisheries for which permits are held, and names and demographic data on vessel captains. An add-on to the permits provides information on fixed costs (e.g., permit fees, association dues, maintenance, communications, interest, mooring, travel, automobile, office space) and observer logs note trip costs (e.g., food, fuel, oil, water, bait, ice, supplies, gear damage) and captain years of experience. Vessel trip reports provide number of crew per trip, discards, time and location of trips and gear used. There are also databases on accidents and sinkings, and on infractions. And, of course, details are available on the number, type and length of FMPs and other regulations. Further, there are U.S. Census data by community on factors such as poverty rates, population levels and educational attainment. These variables can be used to begin crafting a number of the indicators in Table 2, e.g., 1) revenue per active vessel for profitability and 2) productivity (Financial Viability); 1) total number of fisherman days for employment trends and 2) revenue by vessel size and community/geographic location for changes in location and/or concentration of landings - or residence of quota holders (Distributional Outcomes); number and/or frequency of amendments and frameworks per year (time between) for management complexity (Governance); number of regulatory infractions for compliance (Stewardship), and 1) number of vessel accidents and 2) poverty rates for health status (Well-being).

Effectively monitoring other performance measures, however, requires the collection of new data. In FY10, limited SSB resources are being used to create two new time series surveys to cover a range of basic sociocultural variables: one for vessel owners (permit holders), who are often captains, and the other for vessel crew. Given that the latter population is largely unknown (there is no crew registry in the Northeast U.S. nor are crew unionized or otherwise organized), ethnographic work will be conducted to identify the best means of conducting research on this population as well as identifying early impacts of catch share programs on this group. The surveys will build in part on two pilot surveys already in progress. One is a social capital survey of all groundfish permit holders. The other is a well-being/job satisfaction/environmental stewardship survey being conducted in Maine, New Hampshire, Massachusetts, and Rhode Island, and targeting current and former fishermen as well as some fishing household members and shore side support employees. The fishing vessel fixed cost survey will also be revised in 2010/2011, providing the opportunity to collect additional economic information related to performance measures.

More such initiatives will be needed in order to implement the full plan over time. Additionally, there are areas of research where surveys are impractical or inappropriate due to the nature of the research question or the population involved. To begin to fill these gaps, additional work is underway including research on consolidation and the concept of excessive shares, and the on-going collection of oral histories related to fisheries stakeholders to document the human experience in fisheries. These oral histories are or will eventually be (depending on confidentiality) housed in an SSB/ Headquarters Office of Science and Technology collaborative database Voices from the Fisheries (VFF) at <http://www.st.nmfs.noaa.gov/voicesfromthefisheries/>.

**Challenges, Limitations & Opportunities**

In implementing indicators created with both existing data and new data, we face significant challenges. Not all existing databases were created with social science research in mind, and so are not always set up as needed for our use. Even where data are not so problematic there are technical challenges. For instance, constructing productivity indices requires data on vessel inputs (e.g., length, horsepower, crew size) and outputs (i.e., what is caught). Often these data are not available for all vessels, and the analyst needs to decide which input data to use. Because fishing vessels are typically multi-product firms (i.e., they catch more than one species), additional decisions are needed to aggregate outputs into appropriate species groups. Then, questions need to be addressed such as whether there are



enough vessels in a group to construct an index and how to choose the appropriate base year for comparison purposes. Thus, although in principle methods and data exist to construct economic indicators such as productivity change, additional research may be necessary to determine how to best construct the indicators.

In addition to technical challenges, bureaucratic processes must be adhered to when involving human subjects in research. These often lengthen the research process substantially. For example, in order to implement a survey with more than nine subjects, the survey must undergo a lengthy (up to 12-18 month) approval process by the Office of Management and Budget (OMB) under the Paperwork Reduction Act (PRA; 44 USC § 3501 *et seq.*). This can be frustrating when baselines are lost or other key moments cannot be captured within an ideal timeline.

As mentioned previously, a significant challenge we face in reaching crew is that there is no sample frame from which to design a standard survey sampling approach. There is no registry of crew that would provide the size of the population or contact information. Creative sampling approaches, possibly based on intercept surveys, must be designed in order to obtain a representative sample of this unknown population. In conjunction with such approaches to the crew survey, the SSB is exploring the idea of a crew registry with the NMFS Northeast Regional Office and the Councils. Additionally, outreach efforts continue with crew, as mentioned previously, to determine the best method of reaching out to this segment of the industry over time.

Finally, while the SSB is well placed to conduct the ongoing data collection necessary for long-term monitoring and trend analysis, this is difficult in a constantly changing funding environment. The SSB, just as the rest of the federal government, must wait until final budgets are passed through Congress each year before committing funds. Even if funding amounts are sufficient, they may arrive at too late a date to be used for certain types of activities. Effective long-term monitoring will require sufficient and sustained funding.

The NEFSC has long been interested in better long-term monitoring and evaluation of Northeast fisheries in general. We need to know not only what the actual impacts of catch shares are, but how these compare to the outcomes of other management regimes. With the establishment of our performance measures and associated indicators, the SSB is now poised to evaluate these outcomes in the Northeast in the most scientifically defensible manner. Our findings can then serve as guideposts for future management planning.

By working with a variety of stakeholder groups, the SSB has developed a set of performance measures and associated indicators that are salient to all parties. As we proceed, effective communication of results to all stakeholders will be key in ensuring that sound social science is used to improve the quality of fisheries management in general and catch share programs in particular.

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## ENDNOTES

<sup>1</sup> [http://www.nmfs.noaa.gov/sfa/domes\\_fish/catchshare/docs/draft\\_noaa\\_cs\\_policy.pdf](http://www.nmfs.noaa.gov/sfa/domes_fish/catchshare/docs/draft_noaa_cs_policy.pdf) (accessed 23 Mar 2010)

<sup>2</sup> [http://www.nmfs.noaa.gov/sfa/domes\\_fish/catchshare/index.htm](http://www.nmfs.noaa.gov/sfa/domes_fish/catchshare/index.htm) (accessed May 19, 2010).

<sup>3</sup> This FMP covers Winter Flounder (Blackback, Lemon Sole) (*Pleuronectes americanus*), Atlantic Cod (*Gadus morhua*), Dab (American Plaice) (*Hippoglossoides platessoides*), Haddock (*Melanogrammus aeglefinus*), Ocean Pout (*Macrozoarces americanus*), Pollock (*Pollachius virens*), Redfish (*Sebastes fasciatus*), Red Hake (Ling) (*Urophycis chuss*), Windowpane Flounder (Sand Flounder) (*Scophthalmus aquosus*), Witch Flounder (Gray Sole) (*Glyptocephalus cynoglossus*), Yellowtail Flounder (*Limanda ferruginea*), White hake (*Urophycis tenuis*), Atlantic Halibut (*Hippoglossus hippoglossus*) and Atlantic Wolffish (*Anarhichas lupus*).

<sup>4</sup> [http://www.nmfs.noaa.gov/msa2005/docs/MSA\\_amended\\_msa%2020070112\\_FINAL.pdf](http://www.nmfs.noaa.gov/msa2005/docs/MSA_amended_msa%2020070112_FINAL.pdf) (accessed 6 Mar 2008)

<sup>5</sup> <http://www.northeastconsortium.org/index.shtml> (accessed Jun 25, 2010)

<sup>6</sup> <http://www.nefsc.noaa.gov/read/socialsci/catchshares/> (accessed 23 Mar 2010) - we chose to place "catch shares" in the path as we thought it might capture a higher number of casual searches.

<sup>7</sup> See report at [http://www.gmri.org/community\\_socioeconomics](http://www.gmri.org/community_socioeconomics).