Socioeconomic Indicators for United States Fisheries and Fishing Communities

by Ronald Felthoven and Stephen Kasperski

Introduction

Over the past decade, the Fisheries Division of the U.S. National Oceanic and Atmospheric Administration (NOAA Fisheries) has prioritized the need to collect and compile information on the fisheries it manages and the communities that are engaged in or dependent upon those fisheries. Social scientists within NOAA Fisheries have been working with regional fishery management councils (Councils) to institutionalize cost and earnings data collections for fishery participants using primary data collections, and to better inform trends in social well-being in relevant communities by conducting field work to gather primary data and better utilize existing secondary data gathered by other agencies. Nascent efforts in each region have varied according to the degree of funding, personnel, and industry cooperation available, and have often worked to characterize populations and issues most germane to their particular fishery management questions. As the data needed to support more complete and sophisticated social science have improved, so have the analytical techniques utilized by researchers within the agency.

In the past few years, NOAA leadership has made it a priority to coordinate with regional scientists to define the most practical and useful indicators that can be developed for the bulk of our fisheries and associated communities, with an eye toward a national status report. Ideally, we could define baseline levels for these indicators and examine how they respond to future perturbations in management, markets, and the environment. The impetus for defining baseline social indicators for fisheries stems not only from improvements in data availability, but also from our desire to better understand the ways in which our policies are affecting stakeholders. In particular, the formal adoption of a policy to implement catch-share management in many of our fisheries, and the requirements of federal laws such as the re-authorized Magnuson-Stevens Fishery Management and Conservation Act (MSA) to assess the impacts of those policies, makes the construction of metrics to track socioeconomic impacts over time more important and timely than ever. This article briefly describes the metrics NOAA Fisheries has constructed, and is planning to construct in coming years, to characterize changes in the socioeconomic health of fisheries and well-being of fishing communities.

Fishery performance indicators

NOAA Fisheries' Office of Science and Technology initiated development of a national set of fishery performance indicators by convening workshops that included economists, anthropologists, and sociologists from each region of the country. The initial scope of the workshops was to identify changes in performance in fisheries managed by catch shares, although the indicators have also been computed for several non-catch share fisheries and will be expanded to nearly all federally managed fisheries in the future. Regional experts identified a substantial number of potential indicators characterizing many aspects of fishery performance that were subsequently classified as being Tier 1, Tier 2, or Tier 3 metrics based on data availability, usefulness, and relative ease in quantifying each indicator. *Tier 1* indicators were defined as metrics for which data were readily available, could be routinely produced and updated, and could be provided for most catch share programs. *Tier 2* indicators were defined as metrics that could be produced using available data, but required additional research before they could be routinely produced. *Tier 3* indicators were determined to be measures that would require large investments in research or new data collection programs. As research and data collection progresses, performance indicators in Tier 2 and Tier 3 will be moved up to Tier 1. To date we have produced a set of Tier 1 performance indicators for all catch share fisheries, which include metrics for catch and landings, fishing effort, and revenue (Table 1).

Tier 1 catch and landings indicators include the quota allocated to the program or Annual Catch Limit (ACL), landings, whether the quota allocated to the program or ACL has been exceeded, and the percentage of the available quota that has been utilized. Although changes in quota or ACL are used as an indicator, quotas are based on biological conditions that may be increased or reduced independent of any particular management program (*e.g.*, catch shares). However, catch share programs are typically accompanied by increased monitoring of catches at the vessel or shareholder level. This improvement in catch accounting means that ACLs may be less likely to be exceeded under a catch share program. Similarly, the percent of ACL used may increase under catch share programs, particularly if the fishery had been closed due to bycatch limits and the catch share program includes bycatch allocations or reduction incentives.

Fishing effort indicators include the number of entities that hold shares, the number of active vessels, season length, number of trips, and time spent at sea. Some of the effort data are used to convey information on changes in fishing capacity. Councils frequently note the need to reduce capacity and end the race to fish when implementing catch share programs. Two dimensions that often change drastically after introducing catch share management are

the number of active vessels and season length. However, Councils may also be concerned with accumulation of quota shares among fewer owners or geographic consolidation, which can lead to social dislocation and changes in the vocational structure and opportunities of a community. Tier 1 indicators also include information on whether excessive share accumulation limits have been set, and report the amount of fees collected for cost recovery purposes. Quantifying the number of entities holding shares, as well as noting the presence or absence of an accumulation cap, is a useful step toward examining the degree of ownership accumulation in catch share programs.

The effort indicators also describe the size of the temporal window in which the fishery is prosecuted, which can generate both biological and market repercussions. Extending the length of the fishing season is often cited as a Council objective associated with the transition to catch shares; longer seasons often imply improved timing on the marketing and sale of seafood products as well as improving vessel safety, as fishermen may choose when and where to fish as weather conditions allow. In this regard, season length needs to be interpreted in conjunction with other indicators of improved economic performance or vessel safety and not necessarily as a stand-alone indicator. Although the current set of catch share indicators does not include any specific measure for vessel safety, an in-depth study of changes in accident rates was conducted as part of the 5-year review undertaken by the North Pacific Fishery Management Council for the Bering Sea and Aleutian Islands Crab IFQ Program. That study found that the longer fishing season resulted in a number of changes to the operational manner in which the fishery was prosecuted, leading to safer working conditions for crew and participating vessels (https://alaskafisheries.noaa.gov/npfmc/PDFdocuments/catch_shares/Crab/5YearRev1210.pdf).

A set of landings revenue indicators is also computed to convey changes in the economic returns of the fishery. Revenue indicators include total annual revenues from all species in the catch share program, aggregate revenues received from non-catch share program species while on a fishing trip where catch share species were landed, as well as aggregate revenues derived from non-catch share program species on all other trips. Although profit or "net revenues" is a more desirable metric, data limitations preclude computing this in most federally managed fisheries. Interpreting revenue trends without knowing how costs have changed can be a bit dicey, and since fishing revenues are the joint realization of both landed quantity and market

Table 1 Definitions for Tier 1 performance indicators of catch share programs.

Indicators	Definitions
Catch and Landings	
Allocated quota	Annual quota of combined catch share program species, in terms of weight
Aggregate landings	Annual total weight of combined catch share program species generated by vessels that fish quota
ACL exceeded (Y/N)	Was the ACL exceeded for any species/stock within the catch share program? (Y/N)
% Utilization	Portion of target species TAC that is caught and retained within a fishing year; aggregate landings/quota allocated to catch share program
Fishing effort	
Entities holding share	Annual total number of entities/individuals/vessel owners/permit holders receiving quota share at the beginning of the year
Active vessels	Annual number of vessels that fish quota and landing one or more pounds of any catch share program species
Season length	Number of days per calendar year or fishing year, as defined above, that the catch share program fishery is open
Trips	Annual total number of trips taken by vessels fishing quota on which one or more pounds of any catch share program species were landed
Days at sea	Annual total number of days absent on trips taken by vessels fishing quota on which one or more pounds of any catch share program species were landed
Landing revenue	
Aggregate revenue from catch share species	Annual total ex-vessel revenue of combined catch share program species generated by vessels that fish quota
Aggregate revenue from non-catch share species	Aggregate ex-vessel revenue from non-catch share species caught on catch share program trips
Non-catch share revenue	Aggregate ex-vessel revenue from non-catch share species on all non-catch share program trips
Average price	Aggregate ex-vessel revenue from catch share species/aggregate landings
Revenue per active vessel	Aggregate ex-vessel revenue/active vessels
Revenue per trip	Aggregate ex-vessel revenue/trip
Revenue per day at sea	Aggregate ex-vessel revenue/day at sea
Other	
Cost recovery fee	Amount collected for cost recovery
Share cap in place (Y/N)	An ownership share and/or allocation cap is any measure consistent with the MSA LAPP purpose and intent whether or not the catch share program is required to have an excessive share cap (Y/N)

demand, some counterintuitive patterns can arise in the indicators without a clear reason for the trend. If the market price were only affected by harvested quantities of catch share species, then price changes would be a consistent inverse indicator of catch share landings; prices would increase as catch share landings decline and prices would decrease as catch share landings increase. However, prices are affected not only by factors attributable to catch shares, but are also affected by external factors such as changing supplies of species that may be market substitutes for catch share species, international markets, changes in consumer preferences, and income.

In addition to the direct computation of revenues, we also calculate a set of derived indicators such as revenue per vessel, revenue per trip, and revenue per day. Each of these indicators combines two indicators to calculate an average. In each case the numerator is total revenue which may be subject to the same uncertainties noted above for price. The denominator of each of these indicators is a measure of input required (boats, trips, days) to produce total catch share revenues. As such, they are each proxies for economic efficiency or productivity, albeit crude. A more direct indicator of efficiency would require information on input use and/or operating costs.

One of the primary difficulties in interpreting nearly the all of the indicators in the context of "catch share performance" is that many changes have occurred in fisheries aside from the introduction of catch shares. Lacking a natural experiment, sophisticated models are often required to effectively isolate the impact of catch shares programs in any given fishery. Many of the performance indictors we are developing reflect influences beyond those attributable to a catch share program. In most cases, one must have some basic understanding of the fishery and related markets in order to properly interpret and source observed trends. As such, although the indicators present a reduced form presentation of a lot of information, appropriate use and understanding of the indicators necessitates a careful read of the narrative accompanying the indicators. This makes the production of annual reports relatively time consuming, as the supporting narrative benefits from input and information gathered from a broad swath of scientists and fishery management staff who understand the different dimensions reflected in the suite of indicators.

Community vulnerability and resiliency indicators

In addition to the fishery-based indicators discussed above, social scientists within NOAA Fisheries are developing community-based indicators of vulnerability and resiliency. Vulnerability is generally defined as a community's exposure to experience impacts from a hazard event or other disturbance, and the sensitivity of the community to that type of hazard event or other disturbance. Resiliency refers to the capacity for communities to adapt successfully to changes caused by a disturbance, but not necessarily returning to their pre-disturbance characteristics. By classifying the type of vulnerability and resiliency exhibited by communities, scientists can give better advice on coping or mitigation strategies to alter a community's risk or exposure profile.

These community-based indicators provide a pragmatic approach toward standardization of data and analysis for assessment of some of the long–term effects of management actions on fishing communities. Historically, the ability to conduct such analysis has been limited due to the lack of quantitative social data. The use of indicators to monitor sustainability and other measures of well-being within marine fisheries has been promoted within international fisheries management (Garcia and Staples, 2000) and there have been some cases of its use within U.S. fisheries, mainly in the Southeast (Jepson and Jacob, 2007; Jacob and Jepson, 2009; Jacob *et al.*, 2010; 2013). These social indices are intended to improve the analytical rigor of fisheries Social Impact Assessments (SIA), through analysis of adherence to National Standard 8 of the MSA and Executive Order 12898 on Environmental Justice in components of Environmental Impact Statements. Given the short time frame in which such analyses are often conducted, an advantage to this approach is that the majority of the data used to construct these indices is readily accessible secondary data and can be compiled quickly to create measures of social vulnerability and to update community profiles.

Following the SIA work of Pollnac *et al*. (2006), NOAA social scientists have jointly developed these vulnerability and resiliency indicators for the Southeast and Northeast regions of the U.S. The Pacific Islands, Pacific, and North Pacific regions of the U.S. are now conducting similar work, albeit with slightly different data that are unique to their particular region. Once all of the regions around the U.S. have produced their regional indicators, national-level indicators of community vulnerability and resiliency will be developed to explore general characteristics of a community that make it more or less vulnerable and resilient. As this is an evolving process, once the national or regional vulnerability and resiliency indicators are developed, it is important to incorporate community stakeholder feedback through a ground-truthing exercise, as in Smith *et al*. (2011), where researchers visit a selection of communities to assess the appropriateness and adequacy the current set of vulnerability indicators. This ground-truthing process serves as a test of the external validity of the results through in-community education and outreach.

It would be ideal to be able to recreate these indicators annually so that changes in fisheries, fisheries management, and other factors that affect communities are taken into account. However, non-fisheries secondary data used to create the social indicators primarily come from the American Community Survey (ACS) of the U.S. Census Bureau. The ACS does not provide annual statistics for communities with populations less than 65,000, which eliminates many fishing communities in the U.S., but does

provide annual 3-year estimates of places with populations greater than 20,000, and annual 5-year estimates for all areas. Therefore, to incorporate the same data for all communities, the 5-year estimates of secondary data (from 2005–2009) are used to create the social indicators. As the multi-year averages should not be compared from one year to the next due to 4 years of data overlapping between the annual 5-year estimates, the second observation that can be used to compare with the original social indicators under development will be the 2010–2014 5-year estimates from the ACS.

Next steps

A national report defining and summarizing fishery performance indicators has been drafted by the Office of Science and Technology and is currently undergoing internal review prior to publication. As we begin to construct the Tier 1 indicators for a greater number of non-catch share fisheries, we anticipate developing a report summarizing those trends as well. NOAA Fisheries social scientists will continue to conduct vulnerability and resiliency studies in a greater number of regions, and will begin ground-truthing those indicators with input from community members in regions where work has already been undertaken. We also plan to add new metrics to the suite of performance indicators in the next year, including Gini coefficients to convey information about the distribution and concentration of revenues, and productivity measures that were recommended by a productivity measurement working group (Mamula and Walden, 2013). Some researchers such as Himes-Cornell and Kasperski (in prep.) are also working to extend the community vulnerability and resiliency framework to incorporate other sources of change that affect communities, such as impacts from climate change in Alaska. Working groups have also been established to improve and better utilize the information currently gathered on quota leases and sales. Such data can be very informative regarding trends in overall fishery profitability, as long as the reported prices control for in-kind compensation or other factors that must be considered along with the reported prices. Many of the catch share programs allocate quota directly to cooperatives which can freely trade quotas among members without requirements to report pricing to NOAA. While this eases the administrative burden on industry, we lose the potential to observe a summary statistic representing fishery profitability and its trends.

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