State of the Science FACT SHEET

Stock Assessments: Science for Sustainable Fisheries

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION • UNITED STATES DEPARTMENT OF COMMERCE

Stock assessments *are the scientific foundation of successful and sustainable fishery harvest management. Stock assessments measure the impact of fishing on fish and shellfish stocks. They project harvest levels that maximize the number of fish that can be caught every year while preventing overfishing (i.e., removing too many fish), protecting the marine ecosystem, and, where necessary, rebuilding overfished (i.e. depleted) stocks.*

Context for Stock Assessments

The Magnuson-Stevens Fishery Conservation and Management Act (MSA) governs marine fisheries management in U.S. federal waters. In 2015, stocks managed under MSA jurisdiction generated $5.17 billion in revenue, supported nearly 1.2 million jobs, and provided recreational opportunities for nearly 9 million anglers.[1] The MSA requires that the best scientific information available serve as the basis for determining annual catch limits that optimize fishery yield and prevent overfishing. Stock assessments provide this basis by addressing four fundamental questions:

a) What target harvest rate (e.g., percent removal per year) best balances resource conservation and use?
b) Has a stock declined into an overfished condition?
c) Does a stock's recent harvest rate exceed sustainable levels (i.e., is overfishing occurring)?
d) What projected amount of catch is most likely to achieve the target harvest rate and other fishery management targets?

Stock Assessment Process

NOAA Fisheries scientists assess roughly 200 U.S. fish and shellfish stocks each year. Each stock assessment has three main steps: 1) data collection and processing; 2) assessment modeling; and 3) developing, reviewing, and communicating recommendations (Figure 1). Each step requires technical expertise as well as coordination and collaboration with partners and stakeholders.

1: Data Collection and Processing

Stock assessment models use data from commercial and recreational fisheries and from scientific surveys of fish stocks and their ecosystems. Scientists collect data on:

ABUNDANCE – the number of fish in a given stock

BIOLOGY – information on fish reproduction, growth, movement, and natural mortality

CATCH – the total removal of fish by fishing activity

Scientific surveys are the principal method used to collect abundance data, wherein scientists measure the numbers of each stock of fish in an area. These fishery-independent surveys, conducted aboard NOAA ships, chartered commercial fishing vessels, or by collaborative partners (e.g. research universities), follow a statistical sampling design that measures abundance throughout a stock's range. NOAA Fisheries is increasingly using technologies, such as hydroacoustics and optical imaging from robotic platforms, to improve the scope and calibration of these surveys.

NOAA Fishery Survey Vessel Henry B. Bigelow at sea. Photo credit: NOAA

When survey data are not available, stock assessments may use fishery catch rates as a proxy to track abundance trends. These data are more challenging to calibrate because fishing operations do not follow an experimental sampling design and fishing methods vary between vessels and over time.

NOAA Fisheries collects biological data through a variety of efforts including scientific surveys, at-sea fishery observer programs, dockside fishery monitoring programs, cooperative research with the fishing industry, and research programs conducted by academia and state agencies. Biological data provide information about body growth, reproduction and natural mortality of fish in a stock.

Fish data collection on a bottom trawl survey. Photo credit: NOAA

NOAA Fisheries collects catch data from commercial, recreational, and tribal fisheries to estimate the amount of fish removed from stocks each year. The proportion of the total catch taken by a particular sector varies across stocks. Dockside samplers and landing sales receipts are used to monitor commercial landed catch; at-sea observers monitor discarded catch and bycatch of untargeted species. Telephone and mail interview surveys are used to collect recreational fishing effort data. Data recorded by fishermen (i.e., logbook records) provide additional information about fishing locations, gears, and catches. NOAA Fisheries is enhancing the accuracy and timeliness of these data through the systematic use of electronic monitoring and reporting (e.g., onboard cameras and digital devices).

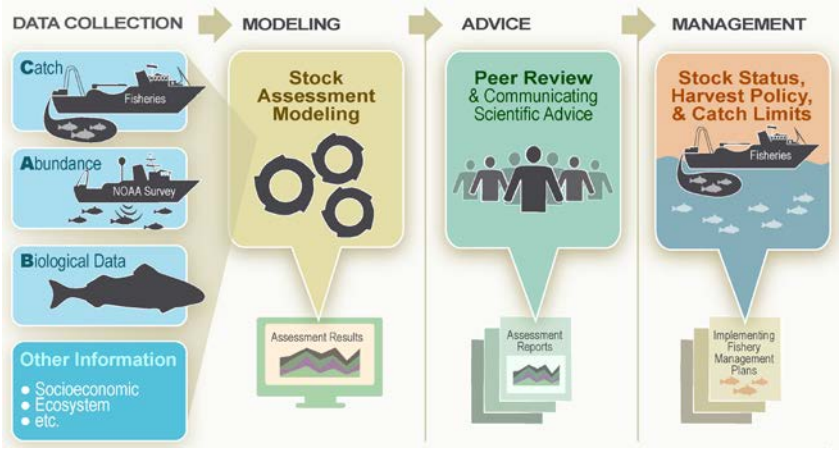

Figure 1: *The three main steps of the stock assessment process, data collection, modeling, and the provision of peer-reviewed scientific advice, are used by managers to implement sustainable fishery harvest management.*

2: Stock Assessment Modeling

Stock assessment models are mathematical representations of fish stocks. They use the data collected in Step 1 to estimate the abundance and health of a fish stock. They also project future stock levels that consider the impacts of future catch upon it. Those estimates in turn support decisions such as stock status relative to management limits and provide short-term population projections.

Data availability determines the complexity of the model used in an assessment. Models with only catch and life history data can provide basic advice on harvest levels. When time series of stock abundance are available, the evaluation of overfishing and overfished status is improved. The most detailed advice uses age-structured data that show the effects of fishing on different ages of fish and refines the projection of the target catch level to account for natural fluctuations in stock abundance.

3: Developing and Communicating Advice

NOAA Fisheries' stock assessments strive to be transparent, well documented, and conducted in a way that provides stakeholders with multiple engagement opportunities. A precautionary approach guides the development of catch advice in which greater uncertainty leads to reductions in target catch levels. Assessments are influential in fishery management decisions and receive heavy scrutiny from scientists, the fishing industry, anglers, conservationists, and fishery managers. Thus, it is important to characterize and explain the degree of uncertainty in assessment results.

Peer reviews of assessments provide an independent evaluation of the quality of the methods and data used. These reviews build trust that assessment results represent the best scientific information available. New assessments and newly employed methods receive comprehensive reviews, while routine assessment updates undergo review processes that are more streamlined. Stock assessment and peer review reports are publicly available to constituents and managers.

Future of Stock Assessments

Stock assessments are an evolving science and NOAA Fisheries is continually working to advance its stock assessment enterprise. Increased demands for more timely scientific information have outpaced growth in funding, staffing, and data collection capacity. To meet these demands, NOAA Fisheries' *Next Generation Stock Assessment*[2] framework increases efficiency by streamlining and prioritizing the assessment process. NOAA Fisheries' *Prioritizing Fish Stock Assessments*[3] describes a process that helps balance the scope and frequency of stock assessments in a way that effectively uses available resources.

The scope of assessments is also expanding. Traditional stock assessments provide detailed looks at individual stocks in isolation. Ecosystem-Based Fishery Management[4] (EBFM) expands the scope of stock assessments by addressing social and economic factors that affect fisheries; improving understanding of habitat, environmental and ecosystem factors that affect fish stock productivity; and analyzing cumulative effects of fishing on an ecosystem. This is an important step in improving our understanding of how broad-scale ecosystem changes will influence fish and fisheries, and will help ensure long-term harvest sustainability.

For the most current information, please visit: https://www.fisheries.noaa.gov/topic/population-assessments

Citations

[1]https://www.fisheries.noaa.gov/feature-story/fisheries-economics-united-states-2015

[2]http://www.st.nmfs.noaa.gov/stock-assessment/future-of-stock-assessment

[3]http://www.st.nmfs.noaa.gov/Assets/stock/documents/PrioritizingFishStockAssessments_FinalWeb.pdf

[4]http://www.st.nmfs.noaa.gov/ecosystems/ebfm/creating-an-ebfm-management-policy