State of the Science Fact Sheet

Stock Assessments: Science for Sustainable Fisheries

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION • UNITED STATES DEPARTMENT OF COMMERCE

***Stock assessments** provide science to support sustainable fisheries management. They measure stock status and project harvest levels that optimize yield, prevent overfishing, rebuild depleted stocks, and protect marine ecosystems.*

Context for Stock Assessments

A biological fish stock is a group of fish of the same species that live in the same geographic area and mix enough to breed with each other when mature. A management stock may refer to a biological stock, or a multi-species complex that is managed as a single unit.

The Magnuson-Stevens Fishery Conservation and Management Act (MSA) governs marine fisheries management of nearly 500 fish and shellfish stocks in U.S. federal waters. For 2018, U.S. commercial and recreational marine fisheries generated over $238 billion in sales impacts, contributed $108 billion to gross domestic product, and supported 1.7 million jobs (Figure 1).

The MSA requires NOAA Fisheries to set annual catch limits that optimize fishery yield, prevent overfishing, and are based on the best scientific information available. Stock assessments are the scientific process used to answer three key questions in fisheries management:

1. What harvest rate balances conservation and use?
2. Is a stock above its minimum sustainable size?
3. Is harvest above sustainable levels?

Further, monitoring and assessing each stock provides insight into dynamics in the ecosystem, thus supporting system-level decision-making.

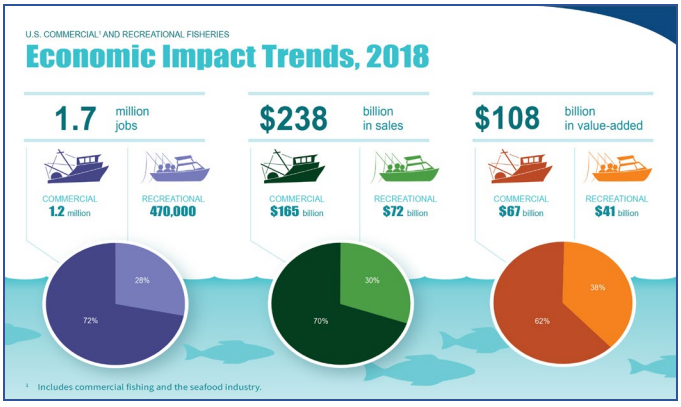

***Figure 1.** Summary of the economic impact of US marine fisheries. Value-added impacts include contributions to the gross domestic product in a region (e.g., fuel and ice purchases). Source: 2018 FEUS*

NOAA Fisheries does not assess every stock annually. Instead, scientists conduct nearly 200 stock assessments each year. The stocks assessed each year change and are prioritized based upon factors such as the time since their last assessment, the amount of available data, and their economic, ecological, and societal value.

Stock Assessment Process

Stock assessments have multiple stages: data collection and processing, modeling, and providing management advice (Figure 2). Each requires coordination and collaboration with partners and stakeholders.

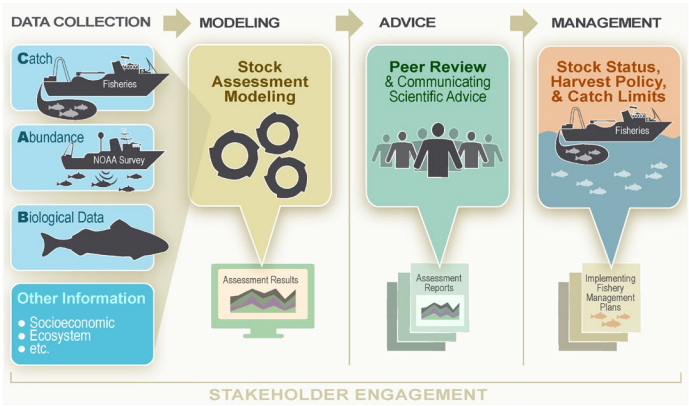

***Figure 2.** The main stages of the stock assessment process, data collection, modeling, and the provision of peer-reviewed scientific advice, are used by managers to implement sustainable fishery harvest management.*

1. Data Collection and Processing

The data collection phase of stock assessments includes the collection and processing of three core data types:

- **Abundance** – the number of fish in a stock
- **Biology** – information on fish reproduction, growth, movement, and natural mortality
- **Catch** – the total removal of fish by fishing

Abundance estimates typically come from data collected by scientific surveys conducted on NOAA ships, chartered commercial fishing vessels, or by collaborative partners. Abundance trends estimated using scientific surveys are generally more accurate than trends estimated using fishery catch rates, because they use a statistical sampling design that accounts for potential biases. However, abundance trends estimated through analysis of fishery catch rates can be used to augment estimates from surveys or when survey data are not available.

Biological data collection occurs during scientific surveys, and by fishery observers, dockside monitoring programs, and collaborative research projects with the fishing industry. Increasing the understanding of a stock's life history and productivity help to better estimate optimum harvest levels.

Catch data from commercial and recreational fisheries are tracked through programs that include dockside monitoring, at-sea observers, telephone and mail interview surveys, and commercial logbooks. These programs collect data on fishing location, gear used, catch size and species, discards, and effort. NOAA Fisheries is also enhancing its systematic use of electronic monitoring and reporting initiatives to improve catch data monitoring and timeliness.

In some cases, additional data are used in stock assessments, including physical ocean properties, ecosystem interactions, and social and economic information.

2. Stock Assessment Modeling

Stock assessment models are mathematical representations of fish stocks. They incorporate the types of data described in section 1 to calculate historical levels of fish stock abundance and fishing intensity, and project future population trends. The available data primarily determine the type of model used to assess a stock. Stocks with more complete abundance, biology, and catch data support models that provide a detailed analysis of abundance and fishing effects by age or size. Assessments of stocks with fewer data available employ simpler methods with more uncertainty around the results. Once calibrated, a model can be used to determine stock status and to make short-term forecasts that inform managers' annual catch limits.

3. Developing and Communicating Advice

Stock assessments produce scientific advice that is scrutinized by scientists, the fishing industry, anglers, conservationists, and fishery managers. Reviewers evaluate the appropriateness and quality of the methods and data used to ensure that management advice is consistent with the best scientific information available. Successful stock assessments facilitate consensus among stakeholders with respect to the condition of a stock. NOAA Fisheries' assessment process is transparent, well-documented, and open to public participation. Managers use this information to establish catch levels that appropriately limit the probability of overfishing.

Future of Stock Assessments

NOAA Fisheries' strategy for transitioning to a Next Generation Stock Assessment Enterprise[1] includes

Figure 3. *The four competing demands placed upon stock assessments.*

recommendations focused on conducting more holistic and ecosystem-linked assessments, utilizing innovative technologies, and establishing a more timely, efficient, and effective stock assessment process. Implementation of this strategy will facilitate stock assessments that better support and align with the principles of ecosystem-based fishery management.

Innovative and advanced technologies are key to augmenting traditional data collection and analysis and addressing data collection challenges caused by climate change. NOAA Fisheries is increasingly using technologies such as hydroacoustics, optical imaging, and electronic catch monitoring.

In 2020, NOAA Fisheries used optical methods, combined with Artificial Intelligence methods of analysis to collect critically needed data to support management of the Pacific Islands' bottom fish complex. To help fill in for ship-based surveys that were not possible due to the COVID-19 pandemic, and in collaboration with contracted fishers, MOUSS (Fig. 4) camera stations together with fishing effort data provided information later used successfully in stock assessments[2].

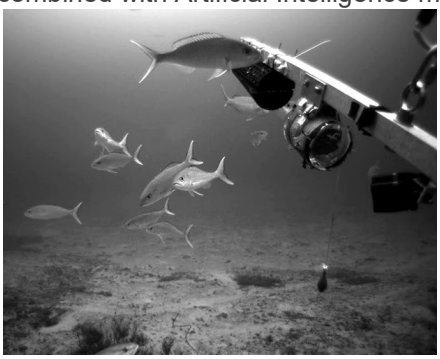

Figure 4. *The Modular Optical Underwater Survey System (MOUSS) is one of several technologies NOAA Fisheries is using to study Hawai'i's fish populations.*

Stock assessments are a constantly evolving field of science. For the most up to date information, please visit: https://www.fisheries.noaa.gov/topic/population-assessments

[1] https://www.fisheries.noaa.gov/feature-story/updated-stock-assessment-improvement-plan-builds-past-success

[2] https://www.fisheries.noaa.gov/feature-story/cooperative-research-key-successful-start-annual-bottomfish-survey-hawaii