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NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION  
U.S. DEPARTMENT OF COMMERCE**

**ON  
IMPROVEMENTS AND INNOVATION IN FISHERIES DATA COLLECTION**

**BEFORE THE  
COMMITTEE ON COMMERCE, SCIENCE, AND TRANSPORTATION  
SUBCOMMITTEE ON OCEANS, ATMOSPHERE, FISHERIES, AND COAST GUARD  
U.S. SENATE**

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Good afternoon, Chairman Rubio, Ranking Member Booker, and Members of the Subcommittee. Thank you for the opportunity to testify before you today on improvements and innovation in fisheries data collection. My name is Dr. Kathryn Sullivan, and I am the Under Secretary of Commerce for Oceans and Atmosphere and Administrator of the National Oceanic and Atmospheric Administration (NOAA). NOAA is dedicated to the stewardship of living marine resources through science-based conservation and management, and the promotion of healthy ecosystems. As a steward, NOAA conserves, protects, and manages living marine resources to ensure functioning marine ecosystems and recreational and economic opportunities for the American public.

NOAA is an acknowledged international leader in fishery science, rebuilding overfished stocks, and preventing overfishing. Our domestic fisheries are more sustainably managed than ever before, and this is directly because of the world class science that informs our decision-making. Our recent report to congress on the Status of US Fisheries outlines our progress showing that overfished stocks and overfishing are at all-time lows. It is vital that our science not regress, as this would inevitably lead to declines in our stocks and a loss in the economic and social values they provide.

Our progress in making fisheries management more effective is based on the principle that management is based on sound science. National Standard 2 of the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) mandates that all fisheries conservation and management measures must be based upon “the best scientific information available” (16 U.S.C. 1851(a)(2)). While we face challenges to securing accurate, precise, and

timely data for stock assessments, on balance, our science-based management has consistently proven to provide better resource management than without this advice. This has, in turn, led to improved productivity and sustainability of fisheries and fishery-dependent businesses. In some fisheries, particularly the Northeast, the science has indicated the need to rebuild stocks but uncertainty in the science has confounded finding exactly the level of fishery restrictions needed to accomplish that rebuilding. In other fisheries, particularly in the Southeast, the large numbers of stocks exceed our current capacity to deploy surveys and conduct assessments of the status of these stocks. The quality and extent of our stock assessment enterprise has room for growth.

Sustainability of our Nation's fisheries is based on continual monitoring of fish catch and fish stock abundance. Because this data-intensive endeavor is costly, NOAA and our partners have always focused on getting the most of the highest-priority and highest-quality data by fully using the funding Congress has provided for this vital work. This funding and the work it supports enables us to sustain and enhance our fisheries. NOAA continues to make substantial progress toward improving the quality of the science available to effectively manage commercial and recreational fisheries, benefiting coastal communities and the United States (U.S.) economy both today and for generations to come. We greatly appreciate the increased funding that Congress has provided to make U.S. fishery management, and its preeminence worldwide, possible.

Today, I will discuss how our fisheries science is conducted and how this science underpins and provides for good management. In particular, I will focus on methods we use to collect the data, what types of data are collected, how these data are used in fishery management, and the importance of our partners in our collection of data. I will also describe some of the recent advances we have made in our science.

***How fishery surveys are conducted—including through the use of Federal vessels, charter vessels, or through other cooperative arrangements***

Long-term monitoring of fish abundance provides an indicator of the abundance of stocks over time, and as such are invaluable inputs to stock assessments. Abundance data tell us the number or weight of a particular stock of fish in the ocean. Information on fish abundance is best obtained from standardized, fishery-independent surveys covering the extensive geographic range of the fish stocks. The average catch rate of fish typically is measured using standardized methods at hundreds of sampling locations over the range of a suite of fish stocks. A diversity of conventional survey methods is employed, including bottom, mid-water, and surface trawls; longlines; gillnets; and traps, as appropriate for the particular target, habitat, and region. In addition, our surveys incorporate state-of-art technology, including various sonars and optical systems to survey reef fish in the Southeast and Atlantic sea scallops in the Northeast. These surveys are repeated, typically annually, to measure the change in catch rate over time, which is the cornerstone information of the fishery assessment models. In some cases, fishery-dependent

data from fishermen's logbooks can be statistically processed to provide additional indicators of trends in fish abundance.

NOAA surveys in support of fish stock assessments are conducted in every region. In this fiscal year, 48 directed fish surveys and 19 supporting surveys will be conducted in support of fish stock assessments. These surveys are conducted on NOAA fishery survey vessels and on NOAA-owned small boats, as well as on chartered commercial fishing vessels, state-owned boats, and UNOLS (university-owned) ships.

NOAA fishery survey vessels are a key source of fisheries-independent data. Seven ships in the NOAA fleet conduct many of the cruises to survey fish abundance. The fleet includes four new Dyson-class vessels with state-of-the-art technological capabilities, with a fifth vessel in this class becoming available in 2015. The timing of these cruises, survey designs, and sampling methodologies are adapted to the specific region and stocks.

We augment NOAA vessel surveys with cooperative surveys involving industry, academic, and state government partners. These surveys commonly use chartered commercial vessels and employ local fishermen, who provide critical local knowledge of the region's stocks and fisheries. The surveys conducted using chartered vessels provide important data streams from regions and time periods when NOAA ships are not available. For example, since the 1970s, the National Marine Fisheries Service (NMFS) line office of NOAA has conducted its primary groundfish surveys in the Bering Sea, Gulf of Alaska, and the Pacific coast by chartering local fishing vessels of suitable characteristics to work with NMFS scientists on board, using standardized sampling gear and strict statistical protocols to collect the data to support some of our most valuable fisheries. In the Northeast, NMFS charters a commercial vessel from the region for the annual surf clam and quahog survey. In some surveys, the chartered fishing vessels may be partially funded through research set-asides or other forms of cooperative research. These collaborative surveys provide valuable data and enhance communication between assessment scientists and fishermen. Other surveys are conducted on commercial fishing vessels with universities (e.g., the NEAMAP or Northeast Area Marine Assessment Program with the Virginia Institute of Marine Science), and state agencies (e.g., the Maine-New Hampshire Surveys Inshore Groundfish Trawl Survey with the Maine Department of Marine Resources and New Hampshire Fish and Game Department).

NOAA also charters state vessels for some surveys. State vessels are generally smaller than the NOAA vessels, and can operate in shallower near-shore and estuarine areas. This is particularly important for providing data on stocks that occur in these habitats. For example, the Southeast Area Monitoring and Assessment Program (SEAMAP), is a collaboration dating back to 1977 involving NMFS, the Gulf States Marine Fisheries Commission, and the states bordering the Gulf of Mexico. Through funds transferred to the Commission and individual states via grants

and cooperative agreements to conduct the surveys, SEAMAP provides much of the fisheries-independent data used in Gulf of Mexico stock assessments.

### ***How landings and other harvest-related data are gathered and used***

The catch monitoring programs strive to measure total catch, or the amount of fish removed through fishing. Rarely are fishery catch monitoring programs focused on single species or fisheries; instead, they are generally designed to monitor multiple species and fisheries over large geographic areas. One component—landed catch information—is obtained by monitoring commercial landings, largely in partnership with the states and the marine fisheries commissions. In some Alaskan fisheries, where the catch is processed at sea, fishery observers provide catch data. Observers also conduct at-sea monitoring of bycatch and collect information on discards in numerous fisheries in all regions.

NMFS has a strong partnership with the states and the interstate marine fisheries commissions to conduct efficient and cost-effective monitoring of commercial landings and recreational catches. The federally funded Fisheries Information Networks have provided a means through which NMFS has been able to work collaboratively with its partners to design and implement well-integrated data collection programs that meet the management needs of both state-managed and federally managed fisheries. Cooperative regional programs—such as the Atlantic Coastal Cooperative Statistics Program, the Gulf Fisheries Information Network, the Pacific Fisheries Information Network, the Pacific Recreational Fisheries Information Network, the Western Pacific Information Network, and the Alaska Fisheries Information Network—have worked effectively to eliminate unnecessary overlaps, standardize data elements and collection methods, and improve the timeliness of data processing, statistical analysis, and dissemination of catch statistics to all partners. Much of the commercial landings and recreational catch data is actually collected, processed, and managed by state agency personnel in accordance with procedures developed in collaboration with NMFS. Continued funding of the Fisheries Information Networks will be crucial for maintaining our current capabilities for monitoring commercial and recreational catches.

NMFS' National Fisheries Information System Program has provided a mechanism for cross-regional collaboration and sharing of ideas on how best to improve the timeliness, quality, and accessibility of commercial and recreational fishery catch information. The Fisheries Information System Program has been working to continue to develop electronic dealer reporting programs and electronic logbook reporting programs to provide more timely and accurate updates on commercial landings. The Fisheries Information System Program and the Fisheries Information Networks have also been working together to develop and implement information management architectures that will enable comprehensive access to commercial and recreational landings data at the national level. Cooperative efforts are now also focused on improving quality management

of catch data collection programs through enhanced reviews and evaluations of the current procedures for quality assurance and quality control. Improving the timeliness, accessibility, and quality of catch information is extremely important to facilitate the work of fishery managers in monitoring the success of implemented fishery management regulations.

Fisheries observers are trained biologists placed on board commercial fishing and processing vessels, and catch monitors/observers also collect data at some shoreside processing plants. They are a reliable and unbiased source of data on the actual at-sea performance of commercial fisheries. They collect data on bycatch, enabling accurate estimations of total mortality, a key component of stock assessment modeling. In some fisheries, they provide data on catches. They also provide high-quality data on interactions with protected species. This information is important to ensure that protected species stocks remain healthy and their interactions with fisheries are minimized, so that harvest opportunities are affected as little as possible. In FY 2013, NMFS logged nearly 81,000 observer days in 48 fisheries and employed 917 contracted observers. The observer programs were supported by a combination of government funds and industry funds.

Recreational fisheries are a significant, and sometimes the dominant, component of the total catch, particularly in the Gulf of Mexico and South Atlantic regions. NMFS has made a substantial effort to monitor those fisheries and incorporate data from recreational fisheries into fish stock assessments, and is applying new and improved methods for estimating total catch by the millions of recreational saltwater anglers nationwide. These new methods are being used to collect data as part of NMFS' Marine Recreational Information Program.

### ***Types of biological data collected and how the data are used for management purposes***

Data on fish biology are collected to learn about fish longevity, growth, reproduction, movement, and other factors. The biological information we collect includes age data for many of our most important stocks. With the addition of fish age data, we are able to apply more complex and sophisticated stock-assessment models that provide better information on changes in fish abundance over time, more direct information on fish mortality rates caused by fishing, and more precise forecasts of future changes in fish abundance and potential annual catch limits. This provides important information about fluctuations in productivity and recruitment of new fish into the stock.

The sources of fish biology information are diverse, with important information coming from NMFS monitoring programs, academic studies, cooperative research, and other programs. Some important sources are fisheries-dependent, which provide key demographic information about the fish that are removed from the populations by fishing. For example, fisheries observers and dockside monitors take observations (e.g., length, weight, sex, and maturity) and collect otoliths

(ear bones) from fish. The otoliths and their growth rings (similar to the annual growth rings in trees) are analyzed in on-shore laboratories. This suite of information provides important data for stock assessment models, and is vital for tracking changes in stock dynamics. Biological data are also collected on NMFS fishery-independent surveys where it can be matched to environmental data collected on those surveys. Other sources of data on fish biology include cooperative research and academic studies. Waiting to get these age data is one of the factors that adds time between conducting a survey and updating the assessment using the whole, longer time series of catch, abundance, and biological data.

### ***How stock assessments are conducted***

All of the data discussed here provide the inputs for stock assessments. Passage of the Magnuson-Stevens Fishery Reauthorization Act in 2006 resulted in the need for more timely stock assessments to ensure overfishing has ended, to set Annual Catch Limits that prevent overfishing, and to track progress toward rebuilding overfished stocks.

NMFS manages over 450 stocks, 199 of which have been identified for inclusion in the Fish Stock Sustainability Index (FSSI). These Fish Stock Sustainability Index stocks include those of high economic value, high profile, and/or significant social value (e.g., recreationally important). NOAA Fisheries conducts approximately 185 stock assessments each year, including annual and biennial updates for important stocks and periodic or first time assessments for other stocks. Approximately 80 assessments are conducted on Fish Stock Sustainability Index stocks annually. For the purpose of tracking performance, an assessment is considered to be adequate if it meets a specified level of rigor and if it is no more than 5 years old. Stocks without quantitative assessments have Annual Catch Limits set through alternative methods (e.g., averages of recent catches). The overall Fish Stock Sustainability Index score—which tracks our knowledge about the stocks and our progress in ending overfishing and rebuilding overfished stocks—has increased by 96 percent since 2000. That substantial increase shows that investment in both science and management improves the sustainability of fisheries.

*Assessment Process* - Typically a major “benchmark” stock assessment involves two sets of workshops culminating in a peer-reviewed assessment. These workshops are open to the public, and constituents are encouraged to participate. The first workshop typically focuses on data—specifically the catch, abundance, and biology data used to calibrate the assessment models. Agency and university researchers, fisheries management council representatives, and partners get together to summarize and evaluate data sources, collection methods, reliability, approaches to data processing, and applicability of data for population modeling. Through a collaborative process, the workshop participants develop recommendations on which data inputs to include in assessments. Participation by fishermen is extraordinarily important, because their fishing

practices and on-the-water observations of fish behavior help scientists correctly interpret factors such as patterns in fishery catch and effort.

The second workshop is held to calibrate the mathematical computer model, which analyzes input data to estimate changes in the stock over time, as well as the influence of fishery harvests on the stock. NOAA has several standardized models available that it maintains. These models use sophisticated statistical approaches for dealing with data gaps and uncertainties, blending available data, and forecasting results with appropriate confidence intervals. Conceptually, this is similar to NOAA's National Weather Service dynamic models, which use multiple observations to calibrate complex atmospheric models that predict the weather. Even though fish stock assessments operate on much longer time scales than weather models—months and years rather than hours and days—they similarly combine and incorporate many different complex observations into a holistic picture of the situation. NOAA scientists run assessment models with inputted abundance, biological, and catch data, which gives us the information to develop a stock assessment report that forms the basis for a catch limit.

Independent external scientists review the stock assessment report and evaluate the quality of the assessment. They may conclude that the science is sound, recommend changes to improve the stock assessment, or, in some cases, reject some or all of the attempted analyses in the assessment. The peer-review process provides fishery managers and constituents with confidence in the integrity of assessments and assurance that they represent the best scientific information available. The Magnuson-Stevens Act affirms that such peer reviews are a valuable part of the management process. The Regional Fishery Management Councils' Scientific and Statistical Committees use the peer-reviewed stock assessment results as the basis for providing fishing level recommendations to their respective Councils. NMFS is collaborating with the Councils and their Scientific and Statistical Committees as each Council works to implement regionally relevant protocols for peer reviews and to strengthen the role of Scientific and Statistical Committees in providing fishing level recommendations.

*Stock Assessment Quality* – In addition to the peer review of assessments, NMFS is working to improve the quality of the data and analyses used in stock assessments. This is vital for maintaining and enhancing the accuracy and precision of our stock assessments and the credibility of the management actions that depend on them.

The Agency complies with the requirements of the Information Quality Act, including OMB's guidance on transparency and balanced review of the influential science that is conducted. The Agency has also updated its Magnuson-Stevens Act National Standard 2 Guidelines, which provide guidance on the scientific integrity of information used for the conservation and management of living marine resources.<sup>1 2</sup>

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<sup>1</sup> As published in the Federal Register Vol 78, No 139 on July 19, 2013

NMFS has also embarked on a systematic process of science program reviews to identify strengths, weaknesses, and opportunities for improvement. These reviews will be repeated on a five-year cycle. The process began in FY 2012, with every NMFS Science Center and the Office of Science and Technology conducting a comprehensive strategic review of their programs. Now in our fourth year of reviews, the Agency has successfully completed reviews of the data collection and fish stock assessment programs in the Science Centers and the Office of Science and Technology. NMFS is now conducting reviews of its protected species science programs in FY2015.

### ***How federal fishery surveys and assessments are prioritized***

Surveys are prioritized and scheduled to ensure data are available on a timely basis to support scheduled assessments. However, most surveys are repeated either annually or biennially to ensure a time-series is available for stock assessments. A short time series is difficult to use in assessment models unless the survey is capable of providing estimates of absolute abundance, rather than relative changes in abundance which is most common. Note also that most surveys collect data on multiple species. For example, bottom trawl surveys in the Northeast simultaneously collect data on all 20 stocks in the Multispecies Groundfish assemblage, as well as numerous other species. Even highly specialized surveys provide information on stocks other than the target stock. For example, the annual scallop dredge surveys are used to provide abundance data needed for scallop stock assessments, and they also provide data on yellowtail flounder that is used in the latter's assessment.

Stock assessments are prioritized and scheduled regionally through discussions between the Councils and NMFS Regional Office and Science Center staffs. Priorities are established by evaluating the commercial importance of a stock, the age and quality of the existing stock assessment, and biological characteristics of the stock. Schedules are usually set annually on a three-year rolling basis, and are posted online.<sup>3</sup> NMFS is in the process of implementing a prioritization scheme nationally, which will provide a transparent, need-based approach to assessment prioritization. NMFS released a draft in 2014, and expects this system to go operational during FY16.

The amount and quality of data has a direct effect on the accuracy and precision of the stock assessment result. For example, an economic study in Alaska showed that maintaining annual frequency of surveys, rather than slowing to biennial surveys, allowed for rapid detection of increases in stock abundance and tens of millions of dollars in added value of the catch. As the

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<sup>2</sup> Further information on the National Standard 2 is available at [https://www.st.nmfs.noaa.gov/science-quality-assurance/national-standards/ns2\\_revisions](https://www.st.nmfs.noaa.gov/science-quality-assurance/national-standards/ns2_revisions)

<sup>3</sup> See <http://sedarweb.org/> for an example in the southeast region.



Agency moves towards implementing the new fish stock assessment prioritization protocol, NOAA Fisheries will be able to improve assessments for fishery management.

### ***How socio-economic data are collected and used***

NMFS' socio-economic data collection program directly supports Agency efforts to identify management options that achieve conservation objectives while minimizing impacts to fishery participants. These efforts result in a management strategy that is consistent with the long-term sustainability of the resource as well as the fishery and fishing communities. Underpinning this capability are the economic and sociocultural data collection programs and surveys that provide the information base for meeting statutory mandates for cost-benefit analysis and social impact assessments of regulatory actions (e.g., fishing ground closures, gear prohibitions, effort reductions, catch quotas, etc.). On the commercial side, economic questions are added to logbook programs, observer programs, and permit programs to provide cost-effective survey vehicles in a number of fisheries. This information is used to help estimate the economic value of those fisheries. In other commercial fisheries, NMFS relies upon one-time surveys that are updated periodically but, ideally, within three to five years depending upon survey type. In terms of recreational fisheries, NMFS routinely collects expenditure data from saltwater anglers every five years and conducts occasional surveys of for-hire operations, as well as other angler surveys deemed essential for assessing the economic effects of regulations on this group of stakeholders.

In addition to supporting the required management assessments for implementing stewardship regulations, the socio-economic data are increasingly used to support integrated analyses. For example, BLAST (Bioeconomic Length-structured Angler Simulation Tool) is a fully integrated and dynamic decision support tool for assessing the benefits associated with recreational fishing management options, including changes in bag limits, season length, and rebuilding plans. A key feature of the model is that it integrates recreational fishing behavior with age-structured stock assessment models, enabling NMFS to realistically project future economic and biological conditions. This ecosystem approach to fisheries management provides insight into the short- and long-run effects of alternative fisheries policy on both the economic and biological health of important recreational fisheries.

Socio-economic analyses are then used to evaluate the societal impacts of management options, which enables fishing regulations to be developed that meet requirements to sustain fish stocks while minimizing impacts to employment and economic benefits. The Agency is also working to develop improved methods for balancing the prevention of overfishing while providing for fishing opportunities.

***Has the new recreational statistics data program been fully developed and implemented, and does the program meet the goals envisioned by Congress?***

Under the Marine Recreational Information Program, revised methods were developed that are being incorporated to substantially reduce sources of error and improve the accuracy of effort and catch estimates based on a combination of telephone, mail, and access point surveys. An improved estimation method was developed and implemented in 2012 to provide more accurate 2004–2011 recreational catch statistics for the Atlantic coast and Gulf of Mexico. In addition, a new sampling design for the Atlantic and Gulf on-site surveys of angler catch was implemented in 2013. These revised recreational data sets have already been incorporated into stock assessments.

The Marine Recreational Information Program has also been working with Regional Fishery Management Councils, Interstate Marine Fisheries Commissions, and our state partners—including Florida, North Carolina, New York, Massachusetts, and Louisiana—to develop and test new methods that use angler registries to survey anglers for production of trip estimates. Following completion of major pilot efforts in calendar years 2012 and 2013, a new, more targeted mail-based Fishing Effort Survey design that will replace the coastal household telephone survey has been implemented as a benchmarking effort alongside the telephone survey. The new mail survey was initiated in early March 2015, and will provide estimates of shore and private boat recreational fishing trips for the Atlantic and Gulf coasts. A transition plan has been developed that outlines the most appropriate way to shift to the new mail survey in a way that ensures the sustainability of our living marine resources while minimizing impacts on management and assessment activities. The transition plan lays out a detailed 3-year approach that outlines the necessary steps and activities needed to align the trip estimates produced with the new mail survey with the legacy estimates from the telephone survey in a common currency. This alignment, or calibration, will ensure a smooth transition to the new survey method, while taking the necessary time and effort to properly incorporate new estimates into the science and management processes. During the transition period, fishery management agencies will continue to use effort and catch estimates based on the current phone survey data as the best available science to effectively manage the health of fish stocks and marine ecosystems.

The Marine Recreational Information Program and our partners are also developing and testing a number of other possible improvements to the current suite of surveys, including:

- Implementing electronic reporting and conducting pilot projects to improve sampling for validation in the Southeast Headboat Survey.
- Pilot testing of electronic logbook reporting with dockside validation for the Alaska, North Carolina, and South Carolina Charterboat fisheries.
- Completing pilot projects to test improved survey designs that reduce sources of potential error and improve survey coverage in Washington, Oregon, and California, and Atlantic

highly migratory species, and working to implement the survey design improvements based on the pilot results.

- Development and testing of new survey methods and improved designs that will enhance data collection and catch statistics in Hawaii, Puerto Rico, and the Virgin Islands.
- Working with the States and the Councils in the Southeast to develop and test supplemental survey designs that will provide more precise and timely estimates of catch for rare event and pulse fisheries such as Gulf red snapper and South Atlantic snapper-grouper complex species.
- Working with the fishery information networks in 2015 and 2016 to develop Regional Implementation Plans that will identify regional partners' preferred survey designs and priorities for investment is additional sampling to improve precision, timeliness, and coverage and supplemental specialized fishery needs.

Recently, NOAA announced that the Agency is committed to working with the National Research Council to conduct an independent review of the Marine Recreational Information Program. The new assessment will provide an objective, independent analysis of our work in responding to the recommendations from the National Research Council's 2006 Review of Recreational Fisheries Survey Methods, which were incorporated into federal law as part of the Magnuson-Stevens Reauthorization Act. It will also detail our progress in meeting our commitments to Congress and the recreational fishing community to address these issues through a process that is scientifically sound, statistically robust, collaborative and transparent. We expect the National Research Council review to commence in late 2015 and to take approximately a year to complete.

***How can new technologies help fishery managers achieve better and more timely information for management purposes?***

NMFS is continually striving to improve and augment its processes, methods, and programs for commercial fishery data collection and analysis. We recently completed Electronic Technology Implementation Plans for all regions which identify where technologies can best support fisheries management in each region. For FY 2016, the President's Budget Request includes an additional \$7 million for Electronic Monitoring and Reporting. We are making progress in assessing and implementing electronic technologies that can result in greater efficiency and reduce fishermen's burden and costs – while still providing the fishery data we need to manage. Progress has been slow due to limited funds – this request will speed work in partnership with industry towards these shared goals.

While electronic monitoring will not replace observers, it is possible that electronic monitoring can provide more flexibility for some fishermen where use of this technology makes sense (e.g., relatively low bycatch/single species fisheries). We are assessing all options, including vessel

monitoring systems, electronic logbooks, and video cameras. Electronic technologies have the potential to increase the quantity of data; lower costs and reduce the time for data entry; improve the quality of data analysis; and lower the economic and time burden on fishermen for compliance with recordkeeping and reporting regulations.

Electronic reporting may be the most ripe for improving efficiency and timeliness in the short term. Paper forms, manual data entry, and other legacy processes still exist. For example, in the Gulf of Mexico, commercial landings data are collected in cooperation with the five Gulf States and the Gulf States Marine Fisheries Commission, and are used to track progress toward reaching the Annual Catch Limits of managed stocks. By shifting from paper dealer reports, submitted semi-monthly, to electronic dealer reporting, submitted weekly, timelier data are generated to more accurately project when a fishery will reach the Annual Catch Limit. This will enable commercial fishermen to more efficiently plan their fishing activities, and reduce the risks of exceeding an Annual Catch Limit.

Two fisheries in the Bering Sea-Aleutian Islands Groundfish Fishery Management Plan in Alaska currently employ video compliance monitoring. The technical requirements for these applications are relatively simple; for example, they do not involve complex requirements for species identification or measurements. Under Amendment 80, video monitoring is used by about half of the vessels in the Alaska head and gut catch processor and pollock catcher processor fleets to meet the regulations that ensure that no pre-sorting activities occur prior to observer sampling. The regulations for Amendment 91 to this Fishery Management Plan contain the second electronic monitoring requirement that NMFS has implemented in Alaska. Amendment 91 created Chinook salmon prohibited species catch limits on the Bering Sea pollock fishery for the first time. To monitor the Chinook salmon limits, NMFS is striving for a census, or a full count, of Chinook salmon bycatch in each haul by a catcher/processor and each delivery by a catcher vessel. A camera located in the observer sampling station provides views of all areas where salmon could be sorted from the catch as well as the secure location where salmon are stored, thus allowing observers to comprehensively monitor the salmon bycatch while still performing their other required duties.

Other means of electronic monitoring, including the use of digital video cameras, are currently being transitioned to operations in Alaska, the West coast and New England. For example, NMFS—in cooperation with the Pacific States Marine Fisheries Commission and the Pacific Fishery Management Council—will implement video monitoring in the West Coast Groundfish Trawl fishery. The Agency is in the process of implementing region-specific video monitoring programs cooperatively with industry partners. Cooperatively developing electronic monitoring systems with local fishermen who work in the affected fisheries is key to ensuring that the systems being developed are practical and will reliably and efficiently provide the needed data. The program's goal is to implement a blended mix of electronic and fishery observer monitoring

to provide more cost-effective and timely reporting of fish catches. Electronic monitoring is also being tested in the New England groundfish fishery and Alaska small boat/fixed gear sector for implementation in 2016 and 2018, respectively.

NMFS is also striving to conduct more surveys using a number of advanced sampling technologies that can achieve higher standardization and, in some cases, can directly measure fish abundance at each survey location, not just a standardized catch rate. With such information, NMFS will be able to provide more precise and accurate assessments sooner. At present, these technologies are still in the developmental phase, and collecting the data is only the first step toward an assessment. Optical and sonar sensors produce huge volumes of data, and NMFS is just beginning to work on methods to process these data types and bring the results into our assessments. In the future, these technologies will enable greater efficiency and increased accuracy and precision for our assessments, but these benefits will take some years to be realized. The FY16 President's Budget requests a \$2.8 million increase for our Next Generation Stock Assessments. Next Generation Stock Assessments incorporate ecosystem information (e.g., climate, predator-prey dynamics) and use advanced sampling technologies (e.g., remote sensing, digital imaging) – to give us a better view of what is happening in the ocean as well as to the stock.

NMFS also expects to develop new and innovative approaches to surveying fish stocks in hard-to-survey areas. For example, we are funding a multi-year research project with an academic partner to explore the use of towed camera arrays for use in surveying reef fishes in the Gulf of Mexico and Pacific Islands. If feasible, shifting to this approach would dramatically increase the effectiveness and efficiency of our reef fish surveys – meaning more science for the dollar. In another example, NMFS scientists are engaged with academic partners to develop improved methods for surveying Atlantic sea scallops. This includes the Woods Hole Oceanographic Institution's towed camera technology and the University of Massachusetts' dropped camera system that uses video stills on scallop beds for analysis.

***What are the challenges to ensuring NMFS ability to collect abundance data for stock assessments?***

There are a number of challenges to collecting abundance data for stock assessments. First is the ability to understand the relationship between fish stocks and the environment and determining how that will impact future stock distribution and abundance. Given the impacts of climate change on ocean and coastal conditions, it is becoming more challenging to predict future stock distribution and productivity using historical datasets. This makes ocean “process” studies increasingly important. We are conducting climate vulnerability assessments for major fish stocks in each region, launching focused research to better understand and respond to climate impacts on fisheries in the Northeast region, and finalizing the NOAA Fisheries Climate Science

Strategy to provide the blueprint for providing the climate-related information needed for effective Agency decisions regarding fisheries and protected species in a changing world. Expanded funding requested in a variety of budget lines in NOAA's FY 2016 budget is a start toward filling key information needs and responding to growing climate-related impacts on living marine resources and the people, businesses and communities that depend on them. The second challenge is finding ways to sample hard-to-survey bottom types such as coral reefs. The Agency continues to dedicate funding and expand its partnerships to conduct research on advanced sampling technologies, such as acoustic and video surveys, which can help collect data in these areas.

In conclusion, the quality of scientific advice provided to management has been a major reason the United States has become a model of responsible fisheries management. Direction provided by the Magnuson-Stevens Act has been crucial to NOAA's scientific program. However, this is not to say that we cannot continue to improve the scientific guidance we provide and we are continuing to invest significant energy and resources and work with our partners to modernizing our data collection.

Thank you again for the opportunity to discuss fisheries data collection programs. I appreciate both your own, and the Committee's, interest in exploring innovative approaches to data collection, and I look forward to continuing to work with all of you to further improve the vitality of our Nation's fisheries. I am available to answer any questions you may have.