

1 Magnuson-Stevens Fishery
2 Conservation and Management Act
3 Report to Congress:
4 Section 404 Fisheries Research

Vision

American people enjoying the riches and benefits of healthy and diverse marine ecosystems

Mission

Stewardship of living marine resources through science-based conservation and management, and the protection and restoration of healthy ecosystems

5 This report provides a five-year outlook on the science enterprise
6 and priorities of the National Marine Fisheries Service (NMFS)
7 National Oceanic and Atmospheric Administration (NOAA), under
8 the four key research areas prescribed by Section 404 (Fisheries
9 Research) of the Magnuson-Stevens Fishery Conservation and
10 Management Act (MSA). The areas are as follows.

- 11 • Research to support fishery conservation and management
- 12 • Conservation engineering research
- 13 • Research on the fisheries
- 14 • Information management research

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16 The MSA, as amended in 1996, directed the Agency to address
17 specific areas of research (e.g., abundance of stocks, new gear
18 technologies, socioeconomics of fisheries, and fishery information
19 management) that fall under these four broad topics.

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21 Fisheries research planning takes place within the context of
22 broader Agency plans including the NOAA Next Generation
23 Strategic Plan (NGSP),¹ the NOAA 5 Year Research and
24 Development Plan, the Climate Science Strategy,² the strategic plans
25 of the NMFS regional science centers, and the national overview
26 of those regional plans (Appendix A).³ Those plans guide annual
27 priorities from the broad goals encompassed in the NGSP to the
28 foci outlined in the region-specific plans and address other
29 mandates, many of which impact our understanding of fisheries.
30 These comprehensive strategic planning documents provide the
31 current context for the key research areas identified in MSA Section
32 404. Table 1 shows how these key research areas map to the current
33 strategic planning documents.
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Table 1. Key Research Areas of MSA Section 404 Mapped to NOAA/NMFS Strategic Plans

Magnuson Stevens Act Section 404 Research Areas				
Strategic planning documents	Fishery Conservation and Management	Conservation Engineering	Fisheries	Information Management
NOAA Next Generation Strategic Plan & NOAA 5-Year Research and Development Plan Goals				
Climate adaptation	x		x	x
Weather-Ready Nation	x		x	x
Healthy oceans	x	x	x	x
Resilient coastal communities and economies	x	x	x	x
NOAA science and technology enterprise	x		x	x
NOAA engagement enterprise			x	x
NOAA organization and administration enterprise				x
Climate Science Strategy Goal				
To increase the production, delivery, and use of the climate-related information required to fulfill NOAA Fisheries mandates	x		x	x
NMFS Regional Science Center Strategic Science Plan Themes				
Advancement of observations, modeling, and research necessary to understand climate change and its impacts	x			x
Long-term stability of marine fisheries and recovery of protected species and their habitats	x	x	x	x
Delivery of integrated data, information, products, and services needed to support resilient fishing, coastal communities and economies	x	x	x	x
Understanding ecosystems and phenomena – across missions and disciplines – with the goal of increasing the resilience of ecosystems, economies, and communities	x	x	x	x

Next Generation Stock Assessment Framework

Prioritization

- Determine stock assessment needs
- Customize assessment level and frequency
- Prioritize annual assessments
- Identify data and assessment gaps

Timeliness & Efficiency

- Streamline data management
- Standardize assessment process and products
- Establish efficient review processes

Expanded Scope

- Include more ecosystem linkages
- Develop harvest policies that consider ecosystem and socioeconomic dynamics
- Facilitate ecosystem-based fisheries management

Innovation

- Utilize advanced sampling technologies
- Sample more habitats
- Measure absolute abundance
- Improve analytical methods
- Research key processes

41 The planning documents described earlier provide detailed
42 information on future directions of NMFS fisheries research to
43 support the transition to a new era of ocean stewardship called
44 ecosystem-based fisheries management (EBFM).⁴ EBFM takes
45 ecosystem considerations into account to better safeguard marine
46 ecosystems, marine populations, and the resources human
47 communities depend on. This report describes the Agency's fisheries
48 research program under the four areas of research as required under
49 Section 404 of the MSA with a defined set of priorities that will be
50 addressed during the next five years.
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Research to Support Fishery Conservation and Management

52 The stock assessments conducted by NMFS provide much of the
53 scientific information that supports fishery conservation and
54 management. Stock assessments provide a scientific basis for
55 determining stock status, as well as estimates of sustainable harvest
56 levels. These assessments enable managers to set fishery quotas
57 to support a resilient fisheries economy while protecting key
58 resources now and for years to come. To ensure that scientific
59 advice is sound, stock assessments incorporate data from multiple
60 sources, including fishery catch monitoring, fishery-independent
61 surveys, species life histories, and other ecological information.
62 Thus, stock assessments represent a synthesis of many of NMFS'
63 scientific efforts. Fishery research and monitoring efforts are
64 broadening in scope to account for the numerous processes that
65 influence stock dynamics, and stock assessments must continue to
66 evolve to incorporate this new information.
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70 The MSA calls for fishery managers to use the best scientific
71 information available to manage U.S. commercial and recreational
72 fisheries under fishery management plans produced by the eight
73 regional fishery management councils. Additionally, coastal states
74 and international organizations rely on NMFS stock assessment
75 science to manage fish stocks. NMFS stock assessments help
76 managers make the best decisions to ensure a healthy balance
77 among sustainable fish stocks, ecosystem health, and vibrant
78 coastal communities.
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80 The demand for stock assessments is increasing, and, with a
81 continuing drive to balance fishery and ecosystem impacts,
82 fishery management questions need to be addressed more efficiently
83 and with greater precision and accuracy. To meet these challenges,
84 NMFS will transition to the Next Generation Stock Assessment
85 (NGSA) Framework⁵ (see sidebar) that will provide NMFS, fisheries
86 managers, and the public with more timely, accurate, and complete
87 information on sustainable catch levels and fish stock status.
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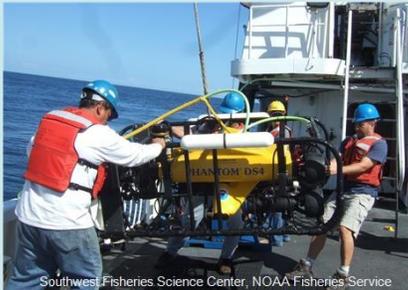


Advanced Sampling Technology



The new Southwest Fisheries Science Center (SWFSC) features an ocean technology development tank for testing advanced technologies.

Photo credit Vern Elmore © 2012.



Remotely operated vehicles can be used to survey inaccessible habitats.

Photo credit SWFSC.



The **SeaBED** Autonomous Underwater Vehicle (AUV) is unique because it "flies" a few meters above the sea floor, instead of remaining in the water column like many other AUVs. This AUV has a flexible payload and can be outfitted with an array of sensors, including multi-beam acoustics, cameras, and oxygen sensors. These sensors allow scientists to gather more information in rocky areas than ever before. Photo credit PIFSC.

89 The new NGS Framework will require operational changes to the
90 stock assessment program. It will include a national protocol to help
91 prioritize and tailor assessments to meet stock-specific needs. To
92 ensure that the right mix of assessments is being conducted each
93 year, the national prioritization protocol will be implemented in each
94 region to provide an objective approach to establishing targets for
95 assessment frequencies and the level of completeness appropriate
96 for each stock in each region.

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98 The NGS Framework will also include an increased use of
99 advanced technologies where possible to efficiently expand data
100 collection capabilities (see sidebar). These developments will support
101 21st century management measures, such as annual catch limits,
102 accountability measures and catch shares.
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Priorities for the next five years:

- Use a national process to expand fishery-dependent and – independent monitoring, including catch, abundance, and biological data collection to increase the number of stocks with adequate assessments;
- Use a national process to prioritize the frequency and analytical complexity of stock assessments based on objective criteria (e.g., fishery and ecosystem importance, stock status, biology and assessment history);
- Support the development and standardization, where possible, of stock assessment methods to deliver timely and efficient assessments;
- Incorporate ecosystem factors (e.g., climate, habitat and predator-prey dynamics) in key stock assessments;
- Employ advanced sampling technologies to facilitate sampling in inaccessible habitats, collecting multi-species data, and estimating the absolute abundance of certain stocks;
- Expand surveys of stocks experiencing climate-related distributional shifts. These efforts will support climate-ready fisheries management and ensure long-term sustainability of commercial and recreational fisheries, protected species, and the communities that depend on them; and
- Support enhanced decision analysis tools (e.g., management strategy evaluations⁶) to establish appropriate management decisions that consider and respond to socioeconomic and ecosystem-level dynamics.

Research on Conservation Engineering

Conservation engineering is the development of technological solutions and changes in fishing practices designed to minimize bycatch. Bycatch occurs when fishing operations unintentionally catch and discard fish, cause unobserved injury and mortality, or interact with living marine resources such as marine mammals, sea turtles, seabirds, protected fish, corals, and sponges. Bycatch can have significant biological, economic and social impacts on fisheries.⁷ Reducing bycatch through conservation engineering can help rebuild overfished fish stocks and help recover populations of endangered marine mammals, sea turtles, seabirds, and fish. Reducing bycatch can also increase the economic efficiency of fishing operations by reducing the time required to sort catches (refer to sidebar, next page).

NMFS is required to address bycatch reduction under several federal laws, including the MSA, the Endangered Species Act (ESA), and the Marine Mammal Protection Act (MMPA). NMFS works with the fishing industry to monitor and estimate bycatch through observer programs,⁸ electronic monitoring systems, self-reporting, and other methods. NMFS regularly reports fishery-specific and species-specific bycatch rates through its National Bycatch Report.⁹ After NMFS identifies bycatch problems, it works with the fishing industry and fishery management councils to develop solutions. NMFS established the Bycatch Reduction Engineering Program¹⁰ (BREP) in 2008 to help meet its various bycatch reduction requirements,¹¹ including the development of innovative technological solutions to bycatch problems in our Nation's fisheries.



Bycatch Reduction Engineering Program

2014 Annual Report to Congress

In support of our mission to sustainably manage the nation's fisheries, NOAA's National Marine Fisheries Service (NMFS) has been investing in technological and engineering solutions to reduce bycatch. Bycatch occurs when fishing operations discard fish or interact with marine mammals, seabirds, or sea turtles. Reducing bycatch in fisheries can have significant positive biological, economic, and social impacts. Reducing bycatch of protected species can improve the recovery of marine mammals, sea turtles, seabirds and fish. In 2012 NOAA Fisheries began funding external partners from state governments, academics, and the fishing industry.



Highlights from FY2013

The mission of the Bycatch Reduction Engineering Program (BREP) is to develop technological solutions and change fishing practices to minimize bycatch and reduce post-release injury and mortality of non-target species in our nation's fisheries. BREP projects strengthen cooperation and collaboration between NOAA Fisheries and the fishing industry by engaging partners in critical research projects and prioritizing research projects that have a strong management application.

This report highlights outcomes and management applications of projects funded with \$2.39 million in FY 2013. They represent four priority areas:

Reducing Protected Species Bycatch	Innovative Technologies
Improving Fishing Practices	Reducing Post-Release Mortality

FY2013 project highlights:

- In the Northeast, researchers used an enhanced communication network and real-time maps to allow longfin squid fishermen to avoid butterflyfish "hot spots" and reduce bycatch by 54 percent.
- Researchers on the West Coast have found that using LED lights can reduce bycatch of the endangered eulachon in the ocean shrimp trawl fishery by up to 91 percent.
- In the mid-Atlantic, scientists developed a modified gillnet that reduced sturgeon interactions by more than 60 percent in Virginia and North Carolina.

The report also identifies projects funded in FY 2014, although results from these projects will not be available until next year.

Each year, NMFS produces a National Report to Congress on the Bycatch Engineering Program.¹²



Circle hooks reduce bycatch. Photo credit NOAA.

Bycatch Reduction

Innovations that reduce bycatch include the following devices and technologies:

- Turtle Excluder Devices that allow sea turtles to swim free of fishing trawls
- Circle hooks or “weak hooks” used in pelagic longline fisheries that promote release of larger non-target species
- Use of Light-Emitting Diodes (LEDs) to illuminate fishing nets, allowing non-target fish to escape towed nets or avoid gillnets
- Expanded use of bright streamers that reduce seabird bycatch in longline fisheries



The Council for the Conservation of Migratory Birds presented NMFS and many partners with the 2015 Presidential Migratory Bird Federal Stewardship Award for developing streamers to reduce seabird bycatch. Photo credit NOAA.

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Priorities for the next five years:

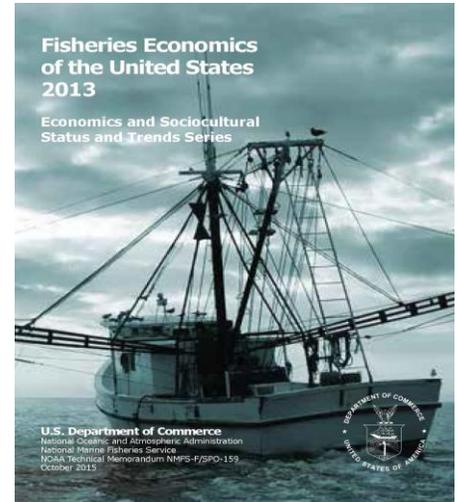
- Update the NMFS National Bycatch Strategy so that it reflects national priorities to minimize the impact of fishing activities on fish and protected species;
- Implement a Fish Release Mortality Science Action Plan¹³ to improve the understanding of release mortality, support improved estimates of release mortality rates, and develop additional best practices to reduce discard and release mortality;
- Provide guidance on collecting, recording, and reporting bycatch data;
- Increase the number of fishery and species bycatch estimates included in future editions of the National Bycatch Report;
- Enhance bycatch monitoring through the development and implementation of electronic monitoring technology where appropriate;
- Develop innovative and effective technologies, gear modifications, or improved practices in commercial and recreational fisheries to reduce bycatch impacts, especially for protected species, highly migratory species, or fish stocks that are overfished or experiencing overfishing; and
- Determine and develop techniques to reduce the degree and nature of interactions between fishing gears and corals, sponges, and other structure-forming invertebrates.

28 Research on the Fisheries

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30 The goal of the NMFS economic and sociocultural research
31 program is to identify management options that maximize
32 benefits to society while still achieving conservation goals. This
33 effort will result in a resource management strategy that is
34 consistent with the long-term sustainability of the Nation's
35 fisheries and the fishing communities that depend upon fishery
36 resources for a livelihood and a way of life. To meet this goal,
37 NMFS assesses the economic and sociocultural benefits of
38 commercial and recreational fisheries and other marine
39 ecosystem services at local, regional and national scales.
40 Sophisticated quantitative methods are used to assess and
41 predict the trade-offs associated with proposed management
42 options. These methods also assess the changes in values and
43 trade-offs induced by natural hazards (e.g., hurricanes and
44 drought); manmade hazards (e.g., oil spills and polluted runoff);
45 and a broad range of other phenomena. These phenomena
46 include population growth, land use change, climate fluctuations, ocean acidification, and
47 competing marine uses (e.g., ocean energy and marine transportation).

48 Research on the Fisheries: Economics

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51 The NMFS Economic Program provides the information base for meeting statutory mandates for
52 cost-benefit analysis of regulatory actions,¹⁴ small-business impacts,¹⁵ and social impact
53 assessments,¹⁶ among others. These assessments inform managers of the economic trade-offs of
54 fisheries management actions. To meet these mandates, NMFS must collect economic data from
55 commercial fishermen, for-hire operations, anglers, fishing communities, and fishing-related shore-
56 side businesses (e.g., seafood processors, dealers, and bait and tackle shops). Assessments
57 include, monitoring the economic performance of catch
58 share and non-catch share fisheries; evaluating quota
59 allocation strategies; analyzing the costs, benefits and
60 distributional effects of rebuilding plans; predicting catch
61 and effort, including bycatch; assessing the short- and long-
62 term economic effects of marine protected areas; analyzing
63 seafood markets, including ecolabeling; estimating the
64 economic contribution of fishing to the local, state, and
65 national economies; and assessing the economic impacts of
66 regulations on shore-side industry and fishing-dependent
67 communities.



Fisheries Economics of the United States is an annual report that provides economic information on the Nation's commercial and recreational



Working waterfronts sustain communities. Photo credit NOAA.

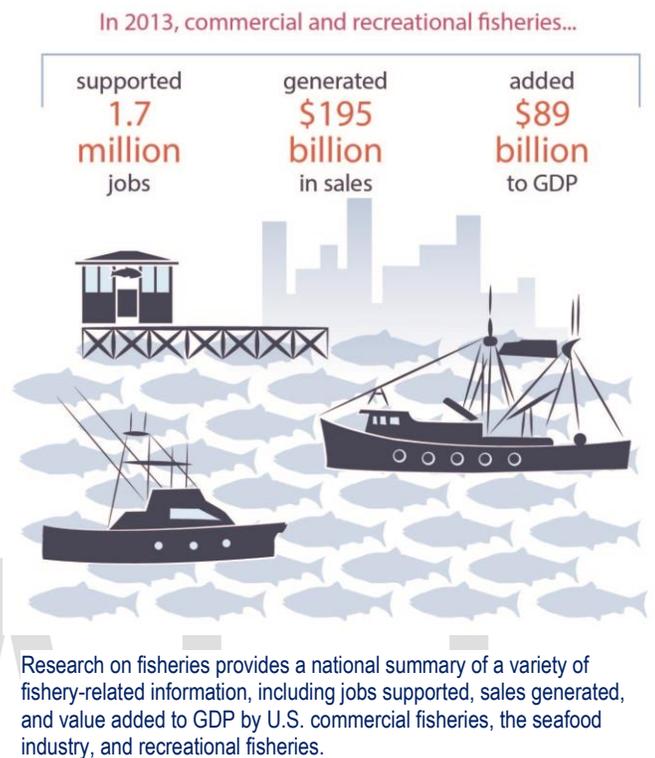
68 Agency economists often use rigorous quantitative
 69 models and available data to estimate these
 70 impacts. In addition, agency economists are
 71 developing and implementing decision support
 72 tools that will improve their economic analyses of
 73 fishery management options and other spatial
 74 management measures. Two examples are:
 75 Spatial Fisheries Economics Toolbox (FishSET)
 76 and Bioeconomic Length-Structured Angler
 77 Simulation Tool (BLAST). FishSET is an
 78 integrated spatial modeling tool for assessing the
 79 trade-offs of fishing ground closures and other
 80 management strategies in a risk framework.
 81 BLAST is a fully integrated, dynamic modeling tool
 82 for assessing the costs and benefits of recreational
 83 fishing regulations. Both tools allow timely and
 84 more accurate economic information to be
 85 provided to fishery managers, helping to ensure
 86 that fishery management is conducted at the least
 87 cost and greatest benefit to the nation.

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Priorities for the next five years:

- 92• Identify and address gaps in economic data collections and assessment capabilities for commercial and recreational fisheries;
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- 94• Implement FishSET, a spatial modeling toolbox for assessing costs and benefits of fishing ground closures and other restrictions;
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- 96• Expand BLAST, an integrated bioeconomic toolbox to all NMFS regions for assessing the costs and benefits of recreational fishing management options; and
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- 98• Implement standardized indicators for assessing the economic performance of catch share and non-catch share fisheries.
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Research on the Fisheries: Sociocultural Research

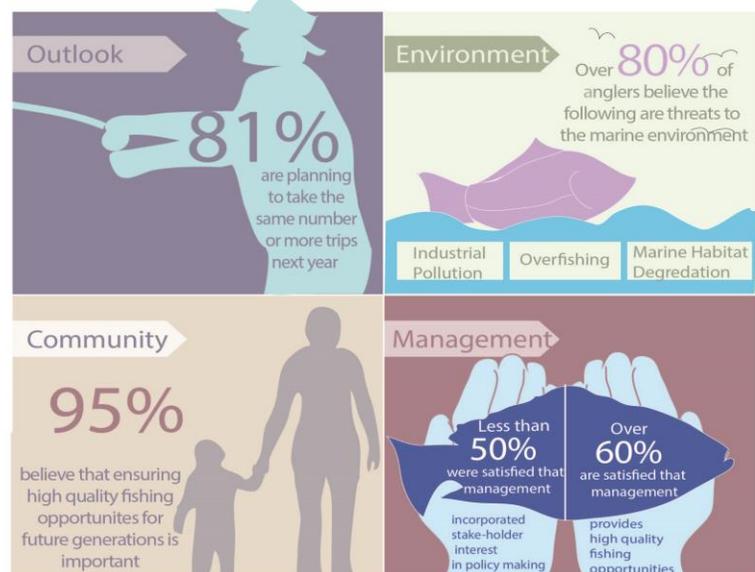
Fisheries have played an important role in coastal and state economies for generations, providing jobs, recreation and subsistence opportunities for fishermen as well as supporting employment in a diverse array of shoreside businesses that support both commercial and recreational fishing. The resilience of these communities is intrinsically tied to the sustainability of the fisheries and fishery management tools enacted to maintain these resources. Various federal statutes, including the MSA, National Environmental Policy Act and Executive Order 12898,¹⁷ among others, require agencies to examine the social and economic impacts of policies and regulations at the community level. To meet these mandates, NMFS initiated a national effort to create and maintain a series of regional fishing community profiles. These profiles portray past and current engagement in fisheries and contain basic information on the social and economic characteristics of these communities.

NMFS is expanding the information available on fishing communities to include social indicators of community vulnerability and resilience, particularly with respect to climate-related changes to stock distribution and abundance, sea level rise and increased vulnerability to / risk of coastal storms. Conceptually, this effort includes a suite of indicators that assess a community's vulnerability or susceptibility to harm from changes in fishery management or ecological conditions, or from a coastal hazard (e.g., storms, flooding or sea level rise). These metrics can add to social impact assessments and increase our understanding of long-term changes to coastal economies. Further, these indicators may augment the development of an ecosystem-based fishery management plan or, when linked to other indicators, provide the basis for evaluating the long-term economic and social sustainability of fishing communities.

Priorities for the next five years:

- Maintain and update fishing community profiles;
- Develop social indicators for tracking community vulnerability and resilience, particularly with respect to climate-related changes;
- Expand our understanding of stakeholder preferences and attitudes related to fishery management objectives; and
- Develop standardized indicators for assessing the social performance of catch share and non-catch share fisheries.

What matters most to saltwater recreational anglers?
2013 National Saltwater Angler Survey Highlights



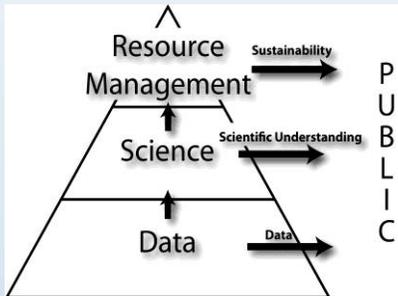
Understanding stakeholder preferences is important for fishery management.

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Research on Information Management and Dissemination



Best practices for data management are being established to increase the effectiveness of translating data into science that informs resource management.

As a data-driven organization, NMFS is improving its services by adopting best data-management practices. The Agency's science products depend on accurate analyses based on sound scientific methods that use data that are accurate, timely, accessible, and integrated. Data collection and analyses will be executed faster because of advanced data management practices. Such efficiency is especially important during periods of increasing budget constraints and demands for more timely results.

Data accessibility requirements are driven by the White House memorandum Providing Access to Research Results (PARR).¹⁸ We are actively making our data more discoverable and machine accessible as required by PARR.

NMFS is implementing modern data management practices through an approach called enterprise data management (EDM). Through EDM, the Agency is developing the ability to precisely define, easily integrate, and effectively retrieve data. EDM also enables NMFS to maximize the benefits of investments in innovation and to better collaborate with partners.



NMFS Enterprise Data Management (EDM) Program is an agency-wide program designed to improve NMFS data management

Priorities for the next five years:

- Increase data access and retrieval capability in accordance with PARR executive guidance;¹⁹
- Implement the NMFS Data Management Planning Procedural Directive;²⁰
- Establish opportunities for cloud computing, while ensuring the security of NMFS data; and
- Increase data storage at NOAA data centers to ensure data archiving and enhance access.

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The Science Enterprise

The purpose of the NMFS scientific enterprise is to ensure that the science products developed and disseminated by the Agency address the highest priority science needs and are of the highest possible quality.

The science enterprise has three primary components: science laboratories, people, and fisheries survey vessels. The six NMFS regional science centers, augmented by the headquarters Office of Science and Technology (OST), encompass 25 principal laboratories and employ more than 1,600 scientific and support personnel who conduct a comprehensive, interdisciplinary science program. The science centers provide the scientific knowledge base on which NMFS formulates stewardship policies in concert with its five regional offices. Research at NMFS laboratories supports resource management by NOAA, interstate fishery commissions, and other agencies; informs recommendations of the fishery management councils; and facilitates NOAA science-based decision making about marine resource management for sustainable fisheries, protected resources, habitat and aquaculture.



The NOAA Ship Reuben Lasker is the newest NMFS Fishery Survey Vessel. Photo credit NOAA.



Hexacopters (left) are used to capture aerial photographs of Stellar sea lions (right) in rugged areas that are difficult to access. Inset: Juvenile with identifying band. Photo credit NOAA.

206 The eight fisheries survey vessels in the NOAA fleet²¹ provide critical at-sea research and
207 monitoring and are purpose-built, dedicated research vessels. They support a full scientific
208 complement, contain laboratories and computers, and deploy multiple gear types (e.g., trawls,
209 longlines and oceanographic sensors). In addition, the Agency's science centers charter vessels
210 from academic and private industry fleets to supplement at-sea operations. Beyond ships, other
211 tools and methods that are used to amplify and leverage Agency efforts include a full array of
212 sampling equipment, observing systems, software and analytical systems, small boats, airplanes,
213 and unmanned aircraft systems.

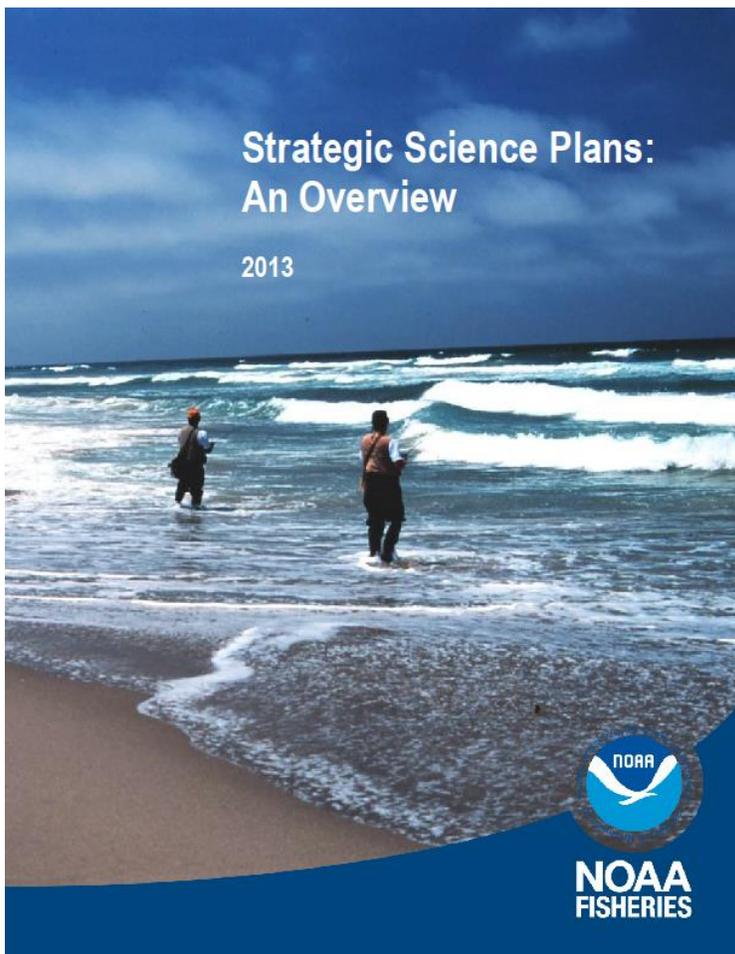
214
215 The NMFS science program collaborates extensively with academia, often through cooperative
216 agreements and grants. The science centers work in cooperation with other federal and state
217 agencies, international entities and nongovernmental organizations. NMFS research often involves
218 the participation of commercial and recreational fishing industries. The Agency will continue to
219 focus on cooperative research with these and other stakeholders, providing logistical support and
220 expertise to increase the Agency's fisheries research capacity needed to manage marine fisheries
221 sustainably.

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223 To ensure high-quality science is delivered to our managers and stakeholders, science centers and
224 the OST have developed strategic plans²² and a systematic science program review²³ process.
225 Science program reviews cover NMFS core program areas on a rotating annual basis. These
226 program areas include stock assessments; protected species science; ecosystem science
227 (including climate and habitat); social science; and economics.

228
229 Finally, outreach and education efforts are a critical part of the science enterprise. Clearly
230 communicating NMFS science policies, priorities and results is essential for developing the
231 relationships needed for collaborative work and for ensuring that NMFS science priorities
232 accurately reflect the concerns of our constituents.

Appendix A. National Overview of NOAA Fisheries Regional Science Center Strategic Plans

Select the image to see the document



Endnotes

1. National Oceanic and Atmospheric Administration Next Generation Strategic Plan (http://www.ppi.noaa.gov/wp-content/uploads/NOAA_NGSP.pdf)
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15. Regulatory Flexibility Act—5 U.S.C. 601 et seq.; Public Law 96-354, approved September 19, 1980; 94 Stat. 1164. (<http://www.sba.gov/advocacy/823>)
16. National Environmental Policy Act—42 U.S.C. 4321 et seq.; Public Law 91-190, approved January 1, 1970; 83 Stat. 852. (<http://www.epa.gov/compliance/bascis/nepa.html>)
17. Executive Order 12898, Federal actions to address environmental justice in minority populations and low- income populations, 3 C.F.R 859 (1995), reprinted as amended in 42 U.S.C. 4321. (<http://www.gpo.gov/fdsys/pkg/USCODE-2013-title42/pdf/USCODE-2013-title42-chap55-sec4321.pdf>)

18. http://docs.lib.noaa.gov/noaa_documents/NOAA_Research_Council/NOAA_PARR_Plan_v5.04.pdf
19. https://www.whitehouse.gov/sites/default/files/microsites/ostp/ostp_public_access_memo_2013.pdf
20. <http://www.nmfs.noaa.gov/op/pds/documents/04/111/04-111-02.pdf>
21. NOAA ships and airplanes are owned and operated by NOAA's Office of Marine and Aviation Operations.
22. <http://www.st.nmfs.noaa.gov/strategic-plan/index>
23. <http://www.st.nmfs.noaa.gov/science-program-review/>