NOAA Fisheries National Science Activities and Updates on SSC-Relevant Topics

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NOAA Fisheries is actively engaged in a range of science and management activities relevant to work by the Councils' Scientific and Statistical Committees. In particular, ongoing work is occurring related to each of the SCS7 key themes of managing interacting species, assessing distributional changes, and incorporating ecosystem indicators into stock assessments. This report provides a brief overview of the most relevant activities and further resources, where available.

Stock Assessment Modeling

The Fishery Integrated Modeling System (FIMS) is envisioned as a next-generation stock assessment modeling framework. Planning for FIMS has been underway for several years, with active development beginning in 2022. The framework, when fully implemented, will comprise a system of tools developed collaboratively by scientists across NOAA Fisheries. FIMS is being developed using modern software development approaches and will enable users to leverage technological developments (e.g., high performance computing, cloud resources, parallel processing). Because FIMS is designed from the outset as modular and extensible, it will have greater longevity as a software platform for conducting fisheries assessments and allow multiple contributors to maintain, update, or enhance its features.

The NOAA Fisheries Integrated Toolbox (FIT) is an interdisciplinary collection of operational tools. FIT facilitates sharing and comparison of analytical tools for stock assessment, forecasting, data preparation, economic analysis, ecosystem modeling, and other applications. Hosted tools are developed by NOAA Fisheries scientists as well as external partners, and additional resources are provided (e.g., technical training). As development of FIMS progresses, it will provide NOAA Fisheries the opportunity to build linkages between existing analytical tools and the FIMS framework, providing scientists seamless access for conducting more holistic stock assessment investigations.

The Center for the Advancement of Population Assessment Methodology (CAPAM) will host a technical workshop in October 2022 on Stock Assessment Good Practices. NOAA Fisheries' stock assessment scientists will engage thoroughly in this workshop, including by leading several of the keynote presentations and drafting the associated research papers defining assessment good practices. These papers, after discussion and review by workshop participants, will be submitted for publication to the journal Fisheries Research. Engagement in

this workshop and similar efforts ensures that agency assessments remain cutting edge, and development of FIMS utilizes accepted good practice methodologies.

Spatial and Distribution Modeling

NOAA Fisheries launched the Distribution Mapping and Analysis Portal (DisMAP) in April 2022 to address decision-maker needs for information on changing species distributions. DisMAP is designed to provide users with an interactive website equipped with tools to visualize and analyze species distributions over time, facilitating improved data sharing and decision making. The portal provides access to distribution information for over 800 marine fish and invertebrate species caught in NOAA Fisheries bottom trawl surveys across five regions. Planned future enhancements to DisMAP will include additional data types as well as adding new functionalities identified as priorities by our partners. Continued buildout of this system will enhance the ability of NOAA Fisheries and our partners to identify, plan for, and respond to climate-driven changes now and in the future.

In 2023, NOAA Fisheries will resume its National Stock Assessment Workshop, which has been on hold due to the COVID-19 pandemic. These internal agency workshops provide an opportunity for NOAA Fisheries' stock assessment scientists from each of the six regional Science Centers to exchange ideas and discuss assessment approaches, identify issues and emerging priorities, and collaborate to establish good practices for stock assessment methods. The theme for the 2023 meeting will be spatial modeling, with a focus on species distribution modeling and parameterizing spatial stock assessments. The meeting will also be held jointly with NOAA Fisheries' MARVLS (Maturity Assessment Reproductive Variability and Life Strategies) Workshop, including a joint session.

National Standard 1 Technical Guidance

NOAA Fisheries has been working to update the 1998 National Standard 1 (NS1) technical guidance to incorporate some of the significant changes to NS1 and provide the implementation guidance needed to meet today's management challenges. Development of guidance was divided into three main topics: 1) Status Determination Criteria (SDC); 2) carry-over and phase-in provisions; and 3) data-limited stocks and alternative approaches for setting ACLs. Development of technical guidance for each topic has moved forward at different paces. Technical guidance for harvest policies related to carry-over and phase-in provisions was completed and published in 2020. Technical guidance on data-limited approaches is currently undergoing final review and clearance within NOAA Fisheries and is anticipated to be published later this year. An initial draft of the technical guidance for SDC is currently undergoing internal review; it is anticipated that Council partners will be briefed on this portion at the October Council Coordination Committee meeting, with the opportunity to provide comment afterwards. This document covers a number of challenging topics related to SDC, including use of proxies, prevailing conditions, and additional considerations (e.g., spatial complexity, age truncation, etc.). Technical guidance for control rules, rebuilding plans, and related issues are beyond the scope of this document and are not included.

Climate Science

The NOAA Climate, Ecosystems and Fisheries Initiative (CEFI) is a cross-NOAA effort to provide climate-informed advice to reduce risks and increase resilience of marine resources and the people and businesses that depend on them. CEFI's goal is to leverage existing capabilities and make critical new investments to build the end-to-end, operational ocean modeling and decision support system needed under a changing climate. CEFI pilot projects are underway in four regions (Bering Sea, West Coast, Gulf of Alaska, and Northeast), and NOAA is updating build-out plans for FY23-26.

The NOAA Fisheries Climate Science Strategy 5-yr Progress Report lists recent accomplishments of the NOAA Fisheries Climate Science Strategy (NCSS), published in 2015 to increase the production, delivery, and use of climate-related information to support resilience and adaptation to changing climate. Highlights of recent accomplishments include:

- Development of tools and products to help decision makers track changes using ecosystem indicators, such as Ecosystem Status Reports and the Marine Ecosystem Indicators Portal
- Climate vulnerability assessments for fish stocks, marine mammals, sea turtles, habitats, and communities
- New forecasts of Marine Heat Waves that provide up to a year's advance notice to help managers and other stakeholders prepare and respond to these events

To customize and implement the NCSS, NOAA Fisheries has developed draft Climate Regional Action Plans (RAPs) for 2022-2024. Through coordinated cross-agency efforts, these plans focus on building regional capacity, partners, products and services to address key regional climate science needs and build on progress that has been made since the NCSS was published in 2015. NOAA Fisheries is seeking public comment on the draft RAPs until 7/29.

Ecosystem Modeling

The NOAA Fisheries Strategy for Ecosystem Modeling to Support Operational EBM/EBFM was recently published. The goal of this strategy is to accelerate the operational delivery of EBM/EBFM advice provided by ecosystem modeling and analysis. Implementation will help to ensure a more efficient use of overall agency analytical capacity and an increased, more strategic use of modeling capacity to serve multiple programmatic needs in different regions.

Exemplifying the forward progress NOAA Fisheries continues to make in ecosystem modeling, several agency authors contributed to a special issue of Frontiers in Marine Science titled "*Using Ecological Models to Support and Shape Environmental Policy Decisions*." The special issue was created following the 5th National Ecosystem Modeling Workshop (NeMOW) in 2019. Contributed papers discuss recent progress in applying ecosystem modeling for living marine resource management.

A Multispecies Modeling and Applications Workshop was held in June 2021 by NOAA Fisheries in partnership with UMass Dartmouth's School for Marine Science & Technology (SMAST). The main purpose of the workshop was to convene a global group of experts in multispecies

modeling to address the question, "*Why aren't multispecies models used more frequently in an operational fisheries context, and can we increase their use?*" A report from the workshop is available, and an additional manuscript resulting from the workshop tentatively titled "*Increasing the uptake of multispecies models in fisheries management*" is in prep.