

Charge to Reviewers

NOAA Ocean Acidification Program Review

28-30 September 2020 in Silver Spring, MD

Purpose of the Review The National Oceanic and Atmospheric Administration (NOAA) Office of Oceanic and Atmospheric Research (OAR) conducts Program reviews every five years to evaluate the *quality, relevance, and performance* of the activities its Programs fund and how the Programs decide on what types of scientific research to support. The purpose of this Ocean Acidification Program (OAP) review is to provide an external assessment of the program including its management structures and to convey program direction and priorities to external partners. This review is useful for NOAA/OAR planning and in helping the Program progress towards its research objectives. These reviews also ensure that OAR Programs are in alignment with strategic documents, are responsive to congressional mandates, and are producing high quality and high performance outputs.

Scope of the Review This external review will cover the past five years of OAP activity and management. This is the first such review that the OAP has undergone since becoming an OAR Program. The thematic areas for the OAP review include: 1) Program Scientific Priority Setting; 2) Research to Understand OA Vulnerability; 3) OA Data Management and Product Development; and 4) OA Education and Outreach. Reviewers are asked to provide perspective and advice on how OAP and NOAA can most effectively position themselves over the next five years to tackle new challenges while leveraging existing research initiatives, partnerships, technologies, data science, and products.

Background NOAA's research aims are to improve the ability to understand, protect, manage, and restore ecosystems that support healthy fisheries, increase opportunities for aquaculture, and balance conservation with tourism and recreation. OAR's mission is to conduct research to understand and predict the Earth system; develop technology to improve NOAA science, service, and stewardship; and transition the results so they are useful to society (OAR Strategy 2020-2026). OAR accomplishes its mission through laboratories and programs positioned at the intersection of NOAA's science, service, and stewardship missions and the broader academic, interagency and non-governmental organization (NGO) research community. This interface enables OAR to build partnerships and to take an integrated research approach that can enhance society's ability to make effective science-dependent decisions.

The primary components of OAR are:

Laboratories conduct an integrated program of research, development, and services to improve the understanding of the Earth system and describe and predict changes occurring in them. The laboratories and their field stations are located across the country and around the world.

Program offices select, fund, and manage high-priority, competitive research that includes assessments, decision support, outreach, education, and capacity building activities. Program offices support and foster collaboration within NOAA's labs and across the environmental science community to advance understanding of the Earth system and foster the application of this knowledge in risk management and resilience efforts.

External partnerships are essential for achieving NOAA's mission and support the delivery of world-class science. Partnerships include, but are not limited to, NOAA Cooperative Institutes, National Sea Grant College Program, state and local governments, academia, and the private sector.

In supporting Ocean Acidification (OA) science, OAR conducts foundational research to detect changes in ocean conditions that can be used to inform decisions on sustainable use and stewardship of ocean and coastal resources. OA research at NOAA responds to numerous legislative mandates and policy drivers. The primary OA-related legislation is the Federal Ocean Acidification Research and Monitoring Act of 2009 (FOARAM Act) that led to the formation of OAR's OAP in 2012. Under the FOARAM Act, the OAP supports foundational research that studies the marine environment, detects changes in the ocean, improves forecast capability and drives innovative science and technological development (2010 NOAA Ocean and Great Lakes Research Plan). The FOARAM legislation and the 2010 NOAA Ocean and Great Lakes Research Plan specify that the OAP conduct research that informs sustainable use and stewardship of ocean and coastal resources as OA and other environmental changes challenge the resilience of coastal communities posing threats to vulnerable marine species.

Overview of OAP Activity Areas OAP's primary activities fall into four major areas, which are the core focal areas for this review. As a funding entity that facilitates and promotes research versus executing it, Activity Area 1 reflects the program's focus on developing a framework to strategically identify and balance scientific priorities. The remaining OAP Activity Areas map to the six research themes laid out in the 2010 NOAA Ocean and Great Lakes Acidification Research Plan, which include research to (Theme 1) develop the monitoring capacity to quantify and track OA and its impacts in open-ocean, coastal, and Great Lakes systems; (Theme 2) assess the response of organisms to ocean and lake acidification; (Theme 3) forecast biogeochemical and ecological responses to acidification; (Theme 4) develop management strategies for responding and adapting to the consequences of OA from a human dimensions

perspective; (Theme 5) to provide a synthesis of ocean and Great Lakes acidification data and information; and (Theme 6) develop an engagement strategy for educational and public outreach.

Activity Area #1: Scientific Priority Setting

The OAP has constructed an approach to scientific priority setting which includes transparency and inclusion of scientific input from inside and outside of OAR. The OAP has adopted a three-year program-level research prospectus approach in which the program identifies and balances scientific priorities that span thematic research areas and integrate NOAA partners. OAP's fostering of partnerships across NOAA has resulted in both additional funding and in-kind services towards the NOAA OA mission. Reviewers should consider the success of the OAP priority decision making process in terms of responsiveness to scientific needs and mandates.

Activity Area #2: Research to Understand Vulnerability

Under the 2010 NOAA Ocean and Great Lakes Acidification Research Plan, the OAP has supported the development of an OA monitoring network (Theme 1), research to understand species, community and ecosystem response to OA (Theme 2), the development of biogeochemical and ecosystem models (Theme 3) and research to understand the human dimensions of OA impacts (Theme 4). The OAP has more recently re-framed these themes into what is called the OA-trifecta, which is the program's approach to integrating three spheres of research, *environmental monitoring*, *biological sensitivity* and *human dimensions*, to more closely evaluate the intersections of these research areas in an effort to determine the vulnerability of ecosystems and human communities to OA. *Environmental monitoring* research supports efforts that document and detect the progression of OA in the environment, *biological sensitivity* research characterizes and enhances our understanding of species, community, and ecosystem response, and *human dimensions* research investigates the impacts OA has on human communities.

Reviewers should consider the OAP's role in fostering the development of the US and global OA observing network, supporting science to understand species, community and ecosystem response, and providing research opportunities to understand the human dimensions related to the range of stakeholder impacts to OA. Program reviewers should consider the success of OAP's research approach, contribution to the foundational understanding of OA science, and the impact research results have had on other NOAA Programs and the nation.

Activity Area #3: Data Management and Product Development

In response to Theme 5 of the 2010 NOAA Ocean and Great Lakes Research Plan, the OAP has invested resources into developing data management plans and tools as well as data synthesis product development. OAP research investments have returned a tremendous amount of biogeochemical, biological and model data sets that has required the OAP to identify data management plans to ensure information is findable, accessible, interoperable, and reusable (FAIR). OAP investments have also been made to support data synthesis to provide useful products that can be used by a range of OA stakeholders. The Program should be evaluated on its ability to make data accessible—that is, easy to locate, relate to similar data, and obtain. As data management and information is a customer service function, the Program should be evaluated on whether it discharges its responsibilities in a way that meets the needs of the scientific and management communities, engages partners in the sharing and dissemination of data, and develops products to share information about OA research results to broad audiences.

Activity Area #4: Education and Communication

In response to Theme 6 of the 2010 NOAA Ocean and Great Lakes Research Plan, the OAP has invested resources and personnel in developing and strengthening OA communication and education products. In coordination with other NOAA programs and collaborators, the OAP has worked to understand and fill the needs of the OA education and communication community by working to engage local, regional, national and international audiences through innovative education and outreach programs to communicate the complex issues arising from OA and inspire action. Reviewers should consider OAP’s ability to reach its target audiences and make data and information about basic OA research and results easily accessible and understandable. Reviewers should also consider how OAP has built awareness of OA, inspired educators and learners, and expanded the Program through its partnerships and outreach activities.

Information for Reviewers

Reviewers will be subject matter experts from not-for-profit organizations, academic institutions, the private sector, and other federal agencies. Each reviewer will independently prepare her/his written evaluations of at least one activity area. These evaluations will be compiled, but not analyzed, by the review chair in a summary report highlighting findings and recommendations for each activity area and program-wide findings and recommendations.

General Guidance

- Reviewers should refer to the following documents and legislative mandates to assess Program success over the last five years:
 - Federal Ocean Acidification Research and Monitoring Act

- 2010 NOAA Ocean and Great Lakes Acidification Research Plan
- NOAA Ocean Acidification Education Implementation Plan
 - *Supplemental Reading Resources*
 - Interagency Working Group on OA Strategic Plan for Federal Research and Monitoring of Ocean Acidification
 - Interagency Working Group on OA Implementation of the Strategic Plan for Federal Research and Monitoring of Ocean Acidification
- Reviewers will be supplied with relevant presentations and recordings from the recent 2019-2020 NOAA Lab Reviews whose researchers are jointly supported by the OAP.
- Reviewers should refer to the following documents to provide advice and input on Program operation over the next five years:
 - 2020-2029 NOAA Ocean and Great Lakes Acidification Research Plan
 - *Supplemental Reading Resources*
 - OAR Strategy 2020-2026
 - NOAA Research and Development Research Areas
- The Program's general engagement of, and responsiveness to, stakeholders should be considered as follows:
 - Determine how well the Program is performing in terms of engaging researchers, industry, citizen scientists, NGOs and coastal community stakeholders.
 - Review how well the Program has performed over the past five years in reaching both national and international partners to encourage collaborative activities.
 - Consider how the Program has designed, along with stakeholders, strategic research plans, assessments and products that respond to needs.

Evaluation Guidelines

NOAA guidance asks reviewers to consider the quality, relevance, and performance of the OAP, and to provide an overall rating for *each* activity area reviewed. For each activity area reviewed, individual reviewers will provide one of the following overall ratings:

- *Highest Performance*: Program greatly exceeds the satisfactory level and is outstanding in almost all areas.
- *Exceeds Expectations*: Program goes well beyond the satisfactory level and is outstanding in many areas.
- *Satisfactory*: Program meets expectations and the criteria for a satisfactory rating.
- *Needs Improvement*: Program does not reach expectations and does not meet the criteria for a satisfactory rating.

Reviewers will also be asked to assign a rating for each of the subcategories (*quality, relevance, and performance*) within the activity area reviewed. Activity Area #1 should be assessed according to whether the OAP scientific priority setting process is leading to high quality, relevant science in an efficient way (performance).

As a part of her/his review, the reviewer will identify specific problem areas that need to be addressed in order to meet/exceed satisfactory performance.

1. Quality: This metric is a measurement of the quality of the science conducted with program funds. Evaluate the progress toward meeting OAR's goal for programs to support or further preeminent research based on OA scientific results to advance NOAA or national priorities as listed in the "Indicators of Preeminence" (e.g., publications, awards, scientific leadership). Preeminence is tied to the frequency and level of peer review publications that cite data collected by the OAP or partners the Program funds (both as represented by bibliographic citation analyses and general search); the degree to which Program approaches are adopted in the community; and similar indicators of preeminence and leadership as this information serves as a benchmark with which to assess the Program's influence.

Quality Rating Criteria: *Satisfactory* rating – Program staff and scientists they fund are often recognized for excellence through collaborations, results, and national and international leadership positions. While good work is done, OAP staff and scientists funded by the program are not consistently recognized for leadership in their fields.

Evaluation Questions to consider:

- Does the Program support/fund preeminent research?
- Are the scientific products and/or technological advancements meritorious and do they significantly contribute to the scientific community?
- Do Program-supported researchers (including OAP, OAR, NOAA federal or contractual staff and funded academic partners) demonstrate scientific leadership and excellence in their respective fields (e.g., through collaborations and research accomplishments)?
- How does the quality of the Program's supported research rank among Research and Development (R&D) programs in other U.S. federal agencies? Other science agencies/institutions?
- Are appropriate approaches in place to ensure that high-quality work will be done in the future?
- Activity #1 only: Is the OAP priority setting process leading to the highest quality science?

Indicators of Quality: Indicators can include, but are not limited to the following:

- Program and funded researcher representation in national and international leadership positions.
- Evidence of collaboration with national and international research groups, both inside and outside of NOAA.
- A measure (often in the form of an index) that represents the value of OAP funded researcher refereed publications to the advancement of knowledge (e.g., Hirsch Index).
- Other forms of recognition from NOAA information customers such as decision- makers, private industry, the media, education communities, and the public.
- Contributions of datastreams and involvement in developing databases that are quality-controlled to ensure accuracy, precision, inter-comparability, and accessibility of global datasets.

2. Relevance: This metric refers to the value of the OAP’s activities to users beyond the scientific community, both in terms of hypothetical value and actual impact. Evaluate the degree to which the Program’s research and development is relevant to NOAA’s and OAR’s missions and of value to the Nation. Reviewers are asked to assess whether the Program identifies national and NOAA priorities in setting its own and whether its activities address its goals and objectives identified above, the goals of relevant inter-agency working groups, relevant legislative requirements, and impacts to society at large. Relevance of Program activities is measured by how well the specific research or activity supports OAR’s and NOAA’s missions, which are laid out in strategic and priority guide documents, and broader needs of states and broader society.

The Interagency Working Group on Ocean Acidification (IWG-OA) Research and Implementation Plan (Strategic Plan for Federal Research and Monitoring of Ocean Acidification/Implementation of the Strategic Plan for Federal Research and Monitoring of Ocean Acidification) and a 10-year NOAA-wide OA Research Plan (2010 NOAA Ocean and Great Lakes Acidification Research Plan) that are both framed by and responsive to the FOARAM legislation guide the program. The legislation, interagency research and implementation plans and NOAA research plan will be used to evaluate Program activity relevance and past progress of the program. The 2020-2029 NOAA Ocean and Great Lakes Research Plan will be used to make recommendations about future endeavors. The NOAA 5-year Research and Development Plan objectives (FY13-FY18), the NOAA Strategic Plan objectives (FY14-FY16) will be used for evaluation to broader NOAA and OAR goals.

Relevance Rating Criteria:

Satisfactory rating -- The activities of the Program show linkages to its guiding strategic research plans, NOAA’s and OAR’s missions (e.g., through implementation of the NOAA

Strategic Plan, NOAA Priorities, OAR corporate priorities, and 5-Year Research and Development Plan) and is of value to the Nation. There are some efforts to work with customer needs but these are not consistent throughout the activity area.

Evaluation Questions to consider:

- Do activities address existing (or future) socially relevant needs (national and international)?
- How well do activities address issues identified in the NOAA strategic plan, NOAA priorities and research plans, or other policy or guiding documents, including inter-agency working group goals, relevant legislative requirements and state and tribal priorities?
- Are stakeholders and customers engaged to ensure relevance of activities?
- What is the quality of outreach products? Does the Program have identified plans, processes, and systems so that information about research results and data and information products are provided to the relevant stakeholders?
- Are the activities conducted or funded by the Program relevant to stakeholder needs, including the needs of other Line Offices?
- Are there activities within the Program's mission relevant to national needs that the Program should be pursuing but is not? Are there activities within NOAA and OAR plans that the Program should be pursuing but is not?
- Activity #1 only: Is the OAP priority setting process leading to the most relevant science for the nation?

Indicators of Relevance: Indicators can include, but should not be limited to the following:

- Evidence of linkages to objectives in the NOAA strategic plan and NOAA priorities (e.g., milestones completed in the Annual Operating Plan) and responsiveness to the FOARAM Legislation.
- A list of established partnerships and collaborations that connect the Program with a diverse range of stakeholders.
- Evidence of public outreach, such as participation in Program events, product demonstrations, or local education efforts conducted by Program personnel.
- A list of products, information, and services supported by the Program and an indication of value to the OA community.
- Access to Program products, as demonstrated by usage of and downloads from Program websites.

3. Performance: This metric is used to assess effectiveness (ability to achieve useful results) and efficiency (ability to achieve quality, relevance, and effectiveness in a timely fashion with minimal waste). It refers not only to how well tasks are executed, but also to the adequacy of the leadership, workforce, and infrastructure in place to meet the Program's goals. One of the key criteria of performance is whether we are meeting the OA information needs (as reviewed in the relevance section) of the country. Programs are judged on how well they plan and conduct their activities. The Panel is asked to evaluate the overall effectiveness with which the Program executes its mission, meets NOAA OA Strategic Research Plan priorities, and the needs of the Nation, given its resources.

The evaluation will be conducted within the context of two sub-categories: *a) Research Leadership and Planning* and *b) Efficiency and Effectiveness*.

Performance Rating Criteria:

Satisfactory rating -- The Program generally has documented programmatic objectives and strategies through strategic and implementation plans (e.g., OAP Prospectus) and a process for evaluating and prioritizing activities. The Program usually demonstrates effectiveness in completing its established objectives, milestones, and products and is generally effective and efficient in delivering most of its products/outputs to applications, operations, or users. The Program often works to increase efficiency (e.g., through leveraging partnerships) and program staff generally function as a team and work to improve operations.

A. Research Leadership and Planning: Assess whether the Program has clearly defined objectives, scope, and methodologies for its key activities and projects.

Evaluation Questions to consider:

- Does the Program have the leadership and flexibility (i.e., time and resources) to respond to unanticipated events or opportunities that require new activities or changes in direction?
- Does the Program provide effective leadership within NOAA and its external community on OA?
- Are the Program-funded researchers making OA-relevant information available to those who need it and is the information being used?
- Activity #1 only: Does the Program have clearly defined and documented management, scientific, technological, and/or policy objectives, and rationale a for funding key activities/projects?

- Activity #1 only: Does the Program have an evaluation process for its activities: selecting/continuing those activities or projects with consistently high marks for merit, application, and priority fit; ending projects; or transitioning projects? If so, how well does it adhere to that process?
- Activity #1 only: How does the Program identify its priorities? How are NOAA and national priorities considered? What is the role of the science community?
- Activity #1 only: Does Program management strive to improve processes? Are there institutional, managerial, resource, or other barriers to the team working effectively?

Indicators of Leadership and Planning: Indicators can include, but should not be limited to, the following:

- Progress towards performance measures and milestones outlined in the IWG-OA and NOAA OA Research Plans
- Engagement in developing strategic research plans at the Program, Agency and Interagency levels
- Active engagement with the Interagency Working Group on Ocean Acidification, NOAA leadership, the OAP Executive Oversight Board, other NOAA programs and the broader OA community beyond NOAA
- Active involvement in NOAA and OAR planning and budgeting processes
- Sustained engagement with internal and external stakeholders through a number of channels including but not limited to the OA Information Exchange

B. Efficiency and Effectiveness: Assess the efficiency and effectiveness of the Program's activities, given its goals, resources, and constraints and how effective it is in obtaining needed resources through NOAA and other sources.

Evaluation Questions to consider:

- Do Program funded researchers execute the scientific activities in an efficient and effective manner given the goals, resources, and constraints?
- How well integrated is the Program funded research with NOAA's, OAR's and other relevant LO's planning and execution activities?
- Are program funded researchers leveraging relationships with internal and external collaborators and stakeholders to maximize results?
- Is laboratory staffing, funded by the program, sufficient to support high-quality results?
- Activity #1 only: Is the Program organized and managed to optimize the planning and execution of its activities, including the support of creativity?

- Activity #1 only: Are human resources adequate to meet current and future needs? Is the Program organized and managed to ensure diversity and inclusion in its workforce? Does it provide professional development opportunities for staff?

Indicators of Efficiency and Effectiveness: Indicators can include, but should not be limited to, the following:

- Number and nature of partnerships (indicates how well the Program and program funded researchers leverage relationships with collaborators to maximize results)
- Ability to meet required deadlines (e.g., reports to Congress, grants deadlines, scientific assessments)
- Staff to funding ratio in the laboratories where research is conducted
- Amount of leveraged funding and in-kind investments made by other NOAA programs and/or labs towards OA research
- Quality of research outcomes and availability of data from observing system

Proposed Schedule and Time Commitment for Reviewers:

The review will be conducted 28-30 September 2020 in Silver Spring, MD. Two teleconferences before the review are planned with the OAR Deputy Assistant Administrator for Programs and Administration Ko Barrett, who will serve as the OAR Senior Executive liaison with the review team and for the completion of the report. All relevant information requested by the review team will be provided on the review website at least two weeks before the review.

Each reviewer is asked to independently prepare her/his written evaluations on at least one identified activity area, including an overall rating for the activity area based on the evaluation guidelines provided to reviewers. These evaluations will be provided to the review panel chair with a copy to Evaluation Team Lead Emily Larkin in OAR headquarters. The chair, Kimberly Yates (USGS), will create a report summarizing the individual evaluations. The chair will not analyze individual comments or seek a consensus of the reviewers.

OAR requests that within 45 days of the review, the review team provide the draft summary report to Ko Barrett. Once the report is received, OAR staff will review it to identify any factual errors and will send corrections to the review team. Once corrections are accepted by reviewers, OAR Evaluations staff will submit the final individual evaluations and the summary report to OAR Assistant Administrator Craig McLean.

Review Team Resources: OAR will provide the resources necessary for the review team to complete its work, including:

- Information to address each of the Program's activity areas to be reviewed will be prepared and posted on a public review website. A copy of all the information on the website will also be provided to reviewers at the review.
- Travel arrangements for the onsite review will be made and paid for by OAR.
- On-site review team support to acquire and deliver to the team any additional, relevant documents requested during the review to aid in assessing the Program.