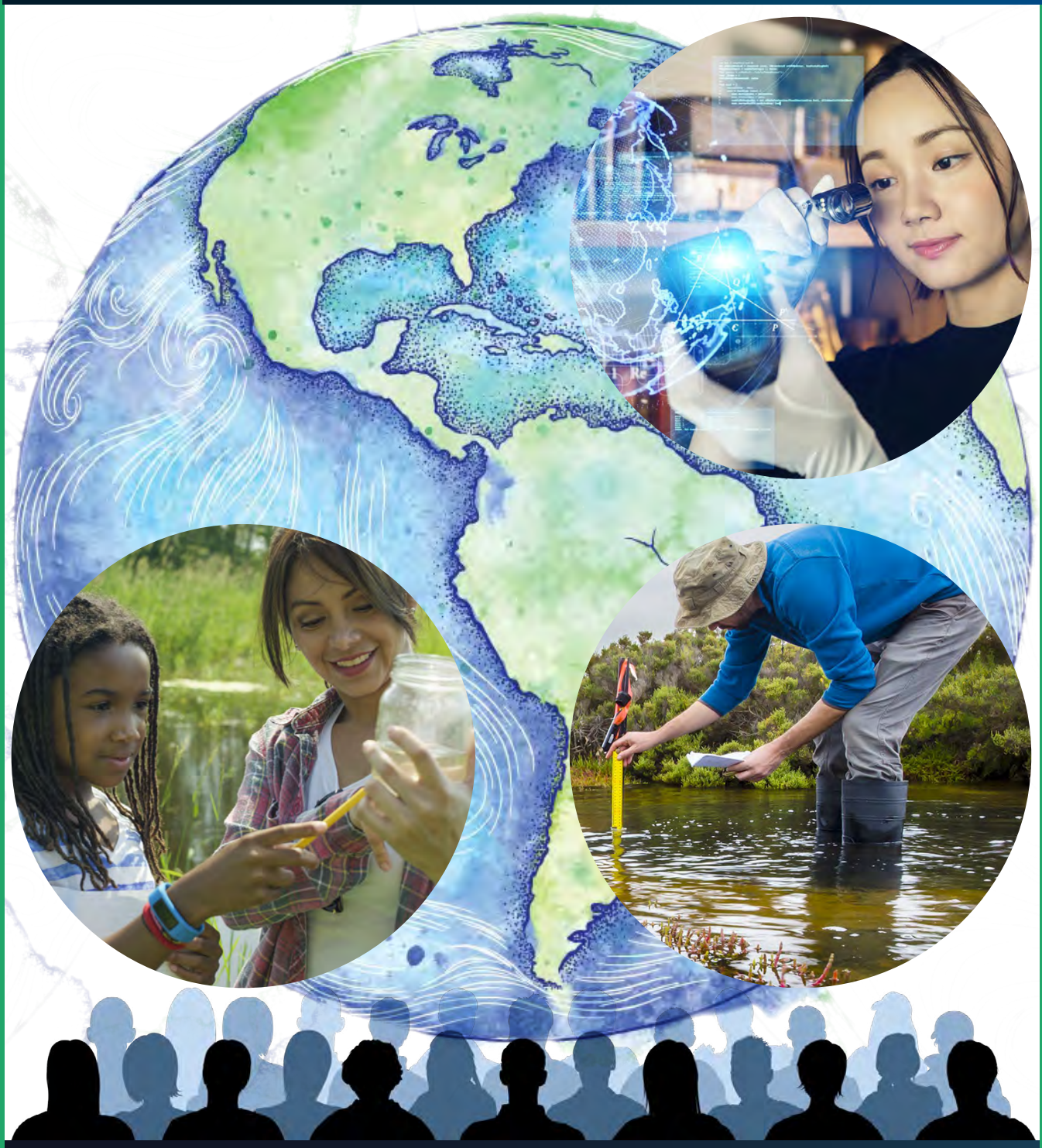
NOAA Citizen Science

Applying the Power of the Crowd

Action Plan 2023–2027



National Oceanic and Atmospheric Administration
U.S. Department of Commerce

NOAA Science & Technology Focus Areas:

Uncrewed Systems ▪ Artificial Intelligence ▪ 'Omics ▪ Cloud ▪ Citizen Science ▪ Data

April 2023

NOAA Citizen Science Action Plan

Applying the Power of the Crowd

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April 2023

Dedication to Dr. Kevin Wood

The NOAA Citizen Science Action Plan is dedicated to a pioneer in the field of citizen science, Dr. Kevin Wood, who passed away in February 2022. Kevin's Old Weather project brought together history and citizen science in a novel way to study climate change through the transcription of ship logs. The 2019 Reuters story *Icebound: the climate-change secrets of 19th century ship's logs* on Old Weather citizen scientists highlights the significant impacts of this project. In addition to being a citizen scientist, Kevin was a sailor and gifted writer. NOAA honors Kevin's accomplishments and is grateful for the legacy his citizen science contributions leave behind.

NOAA Citizen Science Action Plan

Applying the Power of the Crowd

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Introduction

The National Oceanic and Atmospheric Administration (NOAA) approved the NOAA Citizen Science Strategy in 2021. The Strategy provides an outline for the agency to engage the public in supporting key mission areas. This Action Plan identifies actions to carry out that strategy.

Since NOAA's inception in 1970, citizen science has been a vital part of the agency's research and monitoring efforts, and helped inform our Nation's prediction and management of weather, oceans, and coasts. The Crowdsourcing and Citizen Science Act details the array of benefits that result from engaging the public in the scientific process. As a result, this helps to "accelerate scientific research, increase cost-effectiveness—maximizing the return on taxpayer dollars—as well as address societal needs, provide hands-on learning in science, technology, engineering and mathematics (STEM), and connect members of the public directly to Federal science agency missions and to each other." As stated in the *Multi-Agency Research and Development Priorities for the FY 2023 Budget* memorandum from the Executive Office of the President: "Public participation in science is critical for the health of the nation and leads to more innovative research of all kinds...."

NOAA's Role in Citizen Science

NOAA's work to coordinate citizen science across the agency began with the establishment of a community of practice in 2013 to promote sharing among staff working on, or interested in, citizen science projects. As new technologies expand pathways for people to participate, NOAA's project offerings have likewise expanded. As of September 2022 there are over 60 projects supported by the agency listed in the Federal Crowdsourcing and Citizen Science Catalog. These projects received over 1.1 million volunteer hours in 2019 and the vast majority of these projects began in the past ten years. Almost all of NOAA's citizen science efforts are operated in partnership with other agencies or organizations.

NOAA is a founding member, and currently serves as a Co-Chair, of the Federal Crowdsourcing and Citizen Science Community of Practice. NOAA also contributes content on the CitizenScience.gov website and aided in the creation of the Federal Crowdsourcing and Citizen Science Toolkit, which provides resources for planning, designing, and carrying out a crowdsourcing or citizen science project.

Citizen science efforts, depending on their nature and scope, may go by other names, such as community science, crowdsourcing, monitoring, and public participation in scientific research. It should be noted that we use the term citizen to refer to participants as citizens of the world and not of a specific nation or nationality. We aim to ensure that education and training are considered in project design and implementation of NOAA citizen science efforts. Emphasizing community-based activities, where participants play a key role in project development, can help NOAA better serve and engage a wide range of communities.

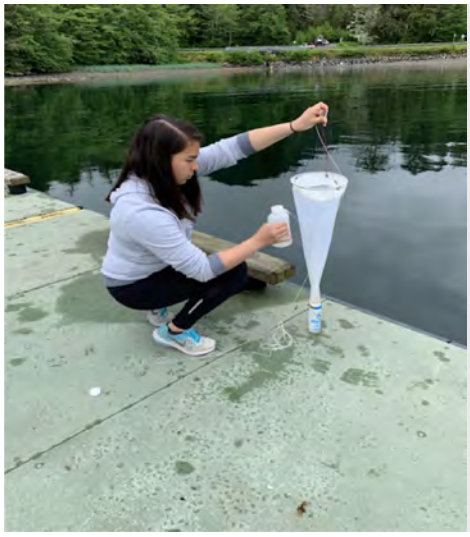
> ***Citizen science designers can make a special effort to welcome and respect the epistemologies, beliefs, practices, and skills that all people bring into citizen science.***
>
> ***Learning Through Citizen Science: Enhancing Opportunities by Design*** *Consensus Study Report from the National Academies of Sciences, Engineering, and Medicine (2018)*

Citizen Science, including crowdsourcing and challenge competitions, provides opportunities for the agency to engage the American public, address societal needs, as well as, accelerate science, technology, and innovation. Through coordination with NOAA's other Science & Technology Focus Areas, we are well-positioned to maximize contributions from public involvement in science.

Actions to Implement the Citizen Science Strategy

Below are actions that will help NOAA achieve the objectives and outcomes introduced in the NOAA Citizen Science Strategy. These actions are classified as:

A. Ongoing, meaning they are already being undertaken;
B. New Action, meaning they can be accomplished without additional funds; or
C. Aspirational, meaning they will require additional new funds or additional staff time to accomplish. Note: we do not include fiscal years in aspirational items.



Citizen Science and Tribal Communities

Tribal and indigenous communities are often disproportionately impacted by Harmful Algal Blooms (HABs), which threaten subsistence harvesting and culturally important coastal resources. NOAA supports Alaskan Tribal communities through the citizen science-driven Phytoplankton Monitoring Network, a national network of citizen HAB observers. Citizen scientists provide observations of blooms that are incorporated into monitoring and forecasting tools. NOAA facilitates phytoplankton identification training and workshops, expands and validates toxin detection methods, and communicates results to Tribal communities; all of which help build a network that works directly to reduce the impacts caused by HABs using phytoplankton observations, coupled with toxin analysis of subsistence harvested shellfish.

Image: Morgan Feldpausch, a Tribal student intern with SEATOR, sampling phytoplankton using a plankton net. Credit: Southeast Alaska Tribal Ocean Research (SEATOR)

Together, these actions will strengthen and expand citizen science projects in collaboration with NOAA's partners and the broader community invested in citizen science.

Goal 1: Coordinate and Support Citizen Science Efforts across NOAA

Objective A. Strengthen and expand an agency community of practice

Action 1.A.1. Host webinars for NOAA staff focused on model projects, project challenges, and best practices by NOAA staff and/or outside experts. (FY24, New Action)

Action 1.A.2. Develop an internal NOAA portal for resources and information on citizen science and connect insights into what other offices and agencies are doing; Include examples, templates, and best practices on topics including liability, environmental compliance, data ownership, and attribution. (Aspirational)

Objective B. Increase awareness, and capacity to use citizen science as a viable and increasingly capable tool to engage the public in helping NOAA meet its mission

Action 1.B.1. NOAA leadership sends a message to the agency about citizen science and its importance in advancing the nation's goals in order to help support and promote its use internally. (FY24, New Action)

Action 1.B.2. Increase awareness of NOAA's citizen science efforts through social media campaigns, web stories, and other communication strategies (e.g., Citizen Science Month countdown events). (FY23, Ongoing)

Action 1.B.3. Create a NOAA citizen science report that highlights the value of citizen science to NOAA and identifies exemplary projects from across the agency. Should the report prove useful, identify the most efficient means for producing it in future years. (Aspirational)

Action 1.B.4. Develop and maintain a NOAA-wide information collection request for citizen science projects. (FY24, Ongoing)

Action 1.B.5. Provide all agency staff with information on how to participate in NOAA citizen science opportunities. (Aspirational)

Objective C. Develop flexible and diverse metrics and processes to track projects and impacts

Action 1.C.1. Develop an inventory of existing projects using existing resources, including the NOAA Research and Development Database, and determine a process for updating and maintaining this inventory. (FY26, New Action)

Action 1.C.2. Develop a formal set of metrics to track NOAA citizen science efforts. These metrics may include the number of projects, types of partnerships, the number of citizen science volunteers, and volunteer hours, etc. (Aspirational)

Action 1.C.3. Quantify the economic value of citizen science to NOAA. (Aspirational)

Objective D. Ensure project managers take into consideration the particular needs, skills, and motivations of project participants

Action 1.D.1. Share information about the NOAA Citizen Science Community of Practice to encourage NOAA project managers interested in citizen science to join, learn about, and contribute to best practices. (FY24, Ongoing)

Objective E. Establish a formal program and designate a program manager, pending available resources, to support existing and new projects and facilitate opportunities for collaboration

Action 1.E.1. Develop terms of reference (TOR) for the NOAA Citizen Science Community of Practice (e.g., goals of community of practice, participation, connections to other communities). (Aspirational)

Objective F. Recognize citizen science in NOAA budget submissions

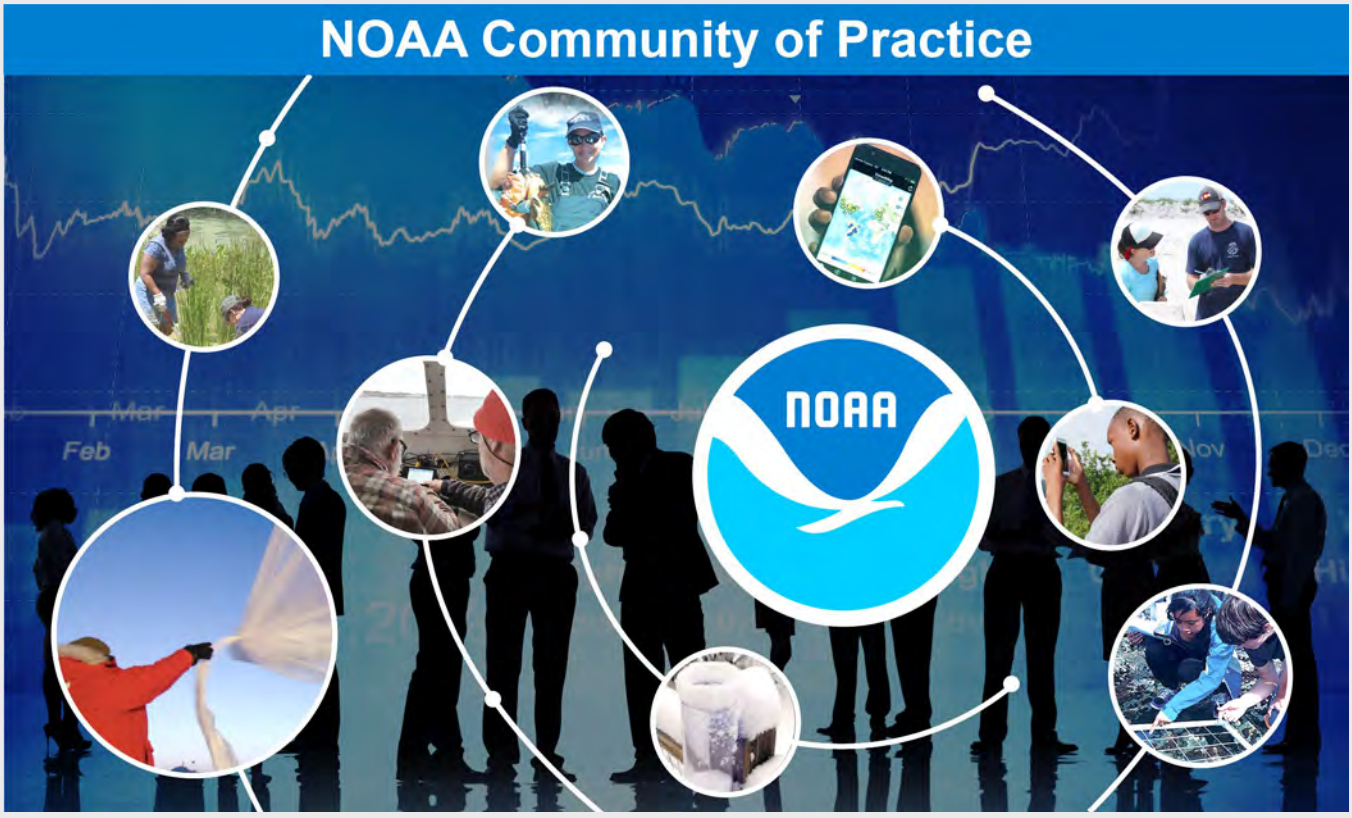
Action 1.F.1. Add citizen science categories into Notice of Federal Funding Opportunities and internal funding opportunities where appropriate to promote the use of citizen science. (Aspirational)

Goal 2: Expand Integration of Citizen Science Into Agency Mission Activities as Resources Permit

Objective A. Consider citizen science and community-based activities, where participants play a key role in project development, to address research and monitoring needs and help develop innovative solutions to complex scientific problems

Connecting Across NOAA Through a Community of Practice

The NOAA Citizen Science Community of Practice connects and supports citizen science work across the agency. It was launched by the Office of Education in 2013. Its formation and structure were informed by the NOAA Education Council and NOAA citizen science project leads. The community relies on voluntary grassroots participation and works to compile best practices, share resources, and maintain a searchable database of projects. It is open to anyone within NOAA working to, or interested in, engaging the public in the scientific process through citizen science. In April of 2020, the Community of Practice organized and participated in the first NOAA Citizen Science Workshop. As of 2022, the Community of Practice had over 225 members and primarily communicates via an email listserv.



We work collaboratively across NOAA. Credit: NOAA NCEI

Action 2.A.1. Invite subject matter experts, with expertise in managing co-created community-based activities, to share best practices with the NOAA citizen science community of practice. Invite others in the agency who are interested in the topic. (FY24, New Action)

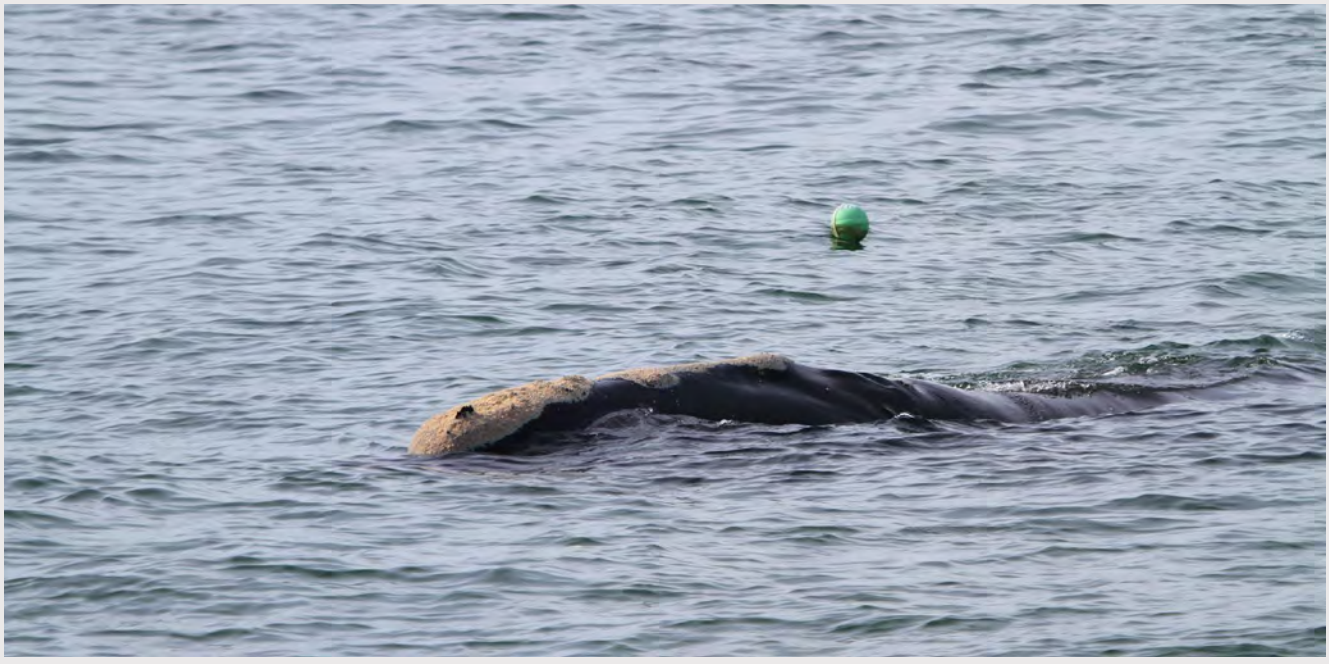
Action 2.A.2. Invite the Federal Community Science Liaison to share best practices for community-based activities and co-development with NOAA. (FY23, Ongoing)

Action 2.B.1. Provide examples to the NOAA workforce of how citizen science, when intentionally designed to do so, can be used to promote STEM learning and careers. (Aspirational)

Objective B. Ensure education and training are considered in project design and implementation to maximize the benefits of citizen science

Ropeless Fishing Gear to Protect Marine Mammals & Sea Turtlese

Using novel solutions to address our challenges will offer NOAA Fisheries the opportunity to solve tough, mission-critical problems by engaging innovative collaborations to achieve a common goal. One such project aims to identify technology options to track the location of ropeless/buoyless fishing gear. There is a great need for ropeless/buoyless fishing gear to reduce the amount of vertical lines in the water column, which pose serious and lethal threats to marine mammals and sea turtles. The threat of entanglement from vertical fishing lines is particularly severe for North Atlantic right whales and leatherback sea turtles, which are endangered species. Tracking technology on ropeless/buoyless fishing gear would allow fishers to relocate their gear without the need for a surface buoy and its associated lines. A collaborative team of NOAA scientists and Yet2, an innovative technology scouting firm, worked to identify robust technology options to track ropeless/buoyless fishing gear deployments. This capability will allow gear locations to be shared with fishermen, as well as enforcement agencies and nearby vessels. This new technology initiative is an important contribution toward NOAA Fisheries' mission in the stewardship of living marine resources, because it would mitigate one of the primary threats to endangered whales and sea turtles, entanglement in fishing gear.



North Atlantic right whale swims next to blue crab fishing gear marked with a green buoy. Credit: Florida Fish and Wildlife Conservation Commission, NOAA Research Permit #15488

Action 2.B.3. Share information about NOAA's student opportunities with NOAA citizen science project managers. (FY23, New Action)

Action 2.B.4. Provide opportunities for NOAA staff to learn about citizen science tools. (Aspirational)

Objective C. Collaborate with NOAA's other Science and Technology Focus Areas to maximize collective impact

Action 2.C.1. Participate in collaborative meetings with other Science and Technology Focus Area representatives to identify and act on opportunities for collaboration. (FY23, Ongoing)

Objective D. Recommend new Cooperative Institute (CI) prospectuses, include citizen science, and encourage current CIs to expand their inclusion of citizen science derived data and application

Action 2.D.1. Include CI science leads in future citizen science workshops to discuss how citizen science can help address CI goals. (Aspirational)

Goal 3: Promote Citizen Science Data Quality and Accessibility at NOAA

Objective A. Ensure projects are designed with scientific quality and data credibility as core considerations

Action 3.A.1. Provide guidance to staff managing or considering initiating citizen science projects on current best practices and known resources. (FY23, Ongoing)

Objective B. Provide strategies and templates to aid NOAA projects in applying and documenting best practices in support of data quality

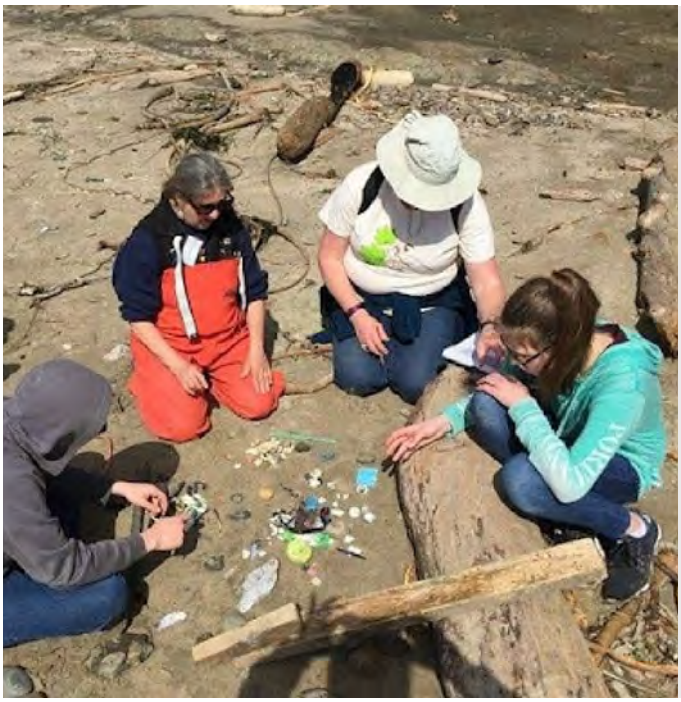
Action 3.B.1. Convene a group to develop strategies, case studies, and templates for NOAA. Draw on existing work (e.g., EPA Quality Assurance Project Plan [QAPP] process and documentation, NOAA Environmental Data Management Committee). (Aspirational)

Objective C. Encourage NOAA projects to maximize accessibility of their data and metadata and provide transparency in the presentation of the methods by which data are collected

Action 3.C.1. Based on existing NOAA data policies, develop a statement about NOAA citizen science data integrity and the commitment to transparency. (Aspirational)

Objective D. Ensure projects have access to data repositories and visualization tools that meet their needs

Action 3.D.1. Develop a process for the National Centers for Environmental Information (NCEI) and other relevant NOAA centers to host, archive, and make publicly discoverable and accessible data and relevant metadata for citizen science projects. (Aspirational)



Adaptive Management with the Marine Debris Monitoring and Assessment Project

The Marine Debris Monitoring and Assessment Project features a national shoreline volunteer monitoring network that is part of NOAA's Marine Debris Program. Data quality and accessibility are high priorities. Efforts to ensure data quality include rigorous testing of data collection methods, data validation as they are published, data analysis to identify biases, and regular communication with volunteers and data users to understand their challenges and needs. Over time, insights gained have led to updates to improve bias control in the survey methods and data input application, and make training resources more robust to increase data quality and usability. In addition, an Application Programming Interface (API) was recently designed to facilitate data discovery and access.

Image: Volunteers with the Oregon Shores Conservation Coalition and the Friends of Otter Rock Marine Reserve sort and count debris during a Marine Debris Monitoring and Assessment Project survey. Credit: Oregon Shores Conservation Coalition/CoastWatch

Objective E. Ensure appropriate data fitness for use, particularly when citizen science data are considered for use for regulatory purposes

Action 3.E.1. Develop metrics for tracking which projects are providing data for regulatory purposes, and which strategies they are applying to ensure data quality. (Aspirational)

Action 3.E.2. Develop and provide a template for a NOAA citizen science Quality Assurance Project Plan (QAPP). (Aspirational)

Objective F. Ensure NOAA sponsored or applied citizen science data adhere to the principles and support the goals of NOAA's Data Strategy

Action 3.F.1. Work collaboratively with NOAA's Data Strategy team to ensure the unique elements of citizen science data are addressed in discussions and decisions regarding data. (FY23, Ongoing)

Action 3.F.2. Partner with NOAA's Data, Artificial Intelligence, and Cloud Strategy teams to help enhance transparency and accessibility of citizen science data on appropriate platforms. (FY23, Ongoing)

Goal 4: Strengthen and Expand Partnerships to Advance Citizen Science

Objective A. Strengthen and expand intergovernmental partnerships through the Federal Community of Practice for Crowdsourcing and Citizen Science and the Federal Community of Prizes and Challenges

Action 4.A.1. Co-convene a federal open innovation summit for citizen science and challenge practitioners across agencies with the goals of shared learning, and identification of potential synergies and partnerships. (Aspirational)

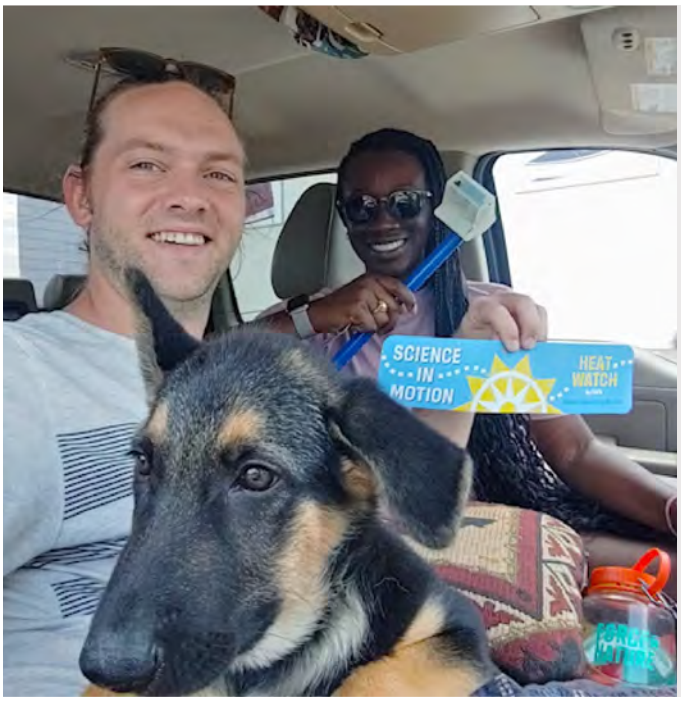
Objective B. Review existing NOAA non-governmental partnerships and modify the corresponding agreements for those which are most amenable to add citizen science components

Action 4.B.1. Request information from the NOAA Citizen Science Community of Practice on existing agreements that include citizen science and add those agreements into our internal portal for resources and information. (Aspirational)

Objective C. Develop new partnerships to expand use of citizen science and supporting technologies in mutually-beneficial projects with the following entities: private sector; philanthropic organizations; institutions of higher education; community-based organizations, formal and informal education institutions and organizations; state and local government agencies; and Tribal governments

Action 4.C.1. Collaborate with organizations recognized as Weather-Ready Nation Ambassadors to involve them to a greater degree in NOAA citizen science efforts. (FY23, New Action)

Action 4.C.2. Run a NOAA Community Science Hackathon and Prize Competition that draws on community-created datasets from NOAA, and attracts new partners. (Aspirational)



Community Science Field Campaign Collaboration

Urban heat exposure is not distributed equitably in our communities. Every summer hundreds of citizen scientists across the nation drive mobile transects with temperature and humidity sensors to map their city's Urban Heat Islands and work with municipal leaders to address heat and its health impacts. By the end of 2021, over 50 communities will have been mapped using the Heat Watch approach. They are supported by a range of partners organized by the National Integrated Heat Health Information System (NIHHIS), including CAPA Strategies (private sector creator of Heat Watch), many federal agencies, national and global organizations, such as the National League of Cities and the Global Cool Cities Alliance, as well as local partners including health departments, chief resilience officers, energy companies, think tanks, schools and museums.

Image: Justin Williams (left) and Arryss Mills (right) were part of the volunteer team that collected temperature data in the Houston area to help produce urban heat maps for the community. Credit: H3AT.org

Action 4.C.3. Establish and strengthen connections to organizations in NOAA science fields. (FY25, New Action)

Action 4.C.4. Increase awareness of and collaboration with orga-nizations that provide high quality citizen science data in support of fishery management (e.g., South Atlantic Fishery Management Council Citizen Science Program). (FY26, New Action)

Objective D. Work with partners to ensure NOAA citizen science project managers are well-informed on the latest technologies and services to support efforts

Action 4.D.1. Share information on new and emerging technologies and services through webinars so that the NOAA citizen science community can use them as appropriate. (Aspirational)

Objective E. Engage the various environmental community listservs, distributions, and professional societies to promote NOAA citizen science applications and the formation of new partnerships

Action 4.E.1. Write and publish a citizen science at NOAA review paper that covers the history, projects, and future possibilities. (Aspirational)

Objective F. Include discussion of citizen science in NOAA executive level engagement and communications with key stakeholders with emphasis on the National Science and Technology Council (NSTC) Select Committee on STEM Education

Goal 5: Increase Workforce Proficiency for Appropriately Using Citizen Science

Objective A. Provide training, information, and tools to guide appropriate application of citizen science to meet desired project goals

Action 5.A.1. Provide training opportunities for NOAA staff to use, contribute to, and appropriately apply citizen science. (Aspirational)

Objective B. Leverage and contribute to a growing body of research and best practices

Action 5.B.1. Support opportunities for the NOAA Citizen Science Community of Practice to learn about new and emerging research and best practices (e.g., with journal clubs, NOAA articles, listserv, messages). (FY25, New Action)

Action 5.B.2. Provide encouragement to citizen science project managers to publish results in the scientific literature. (FY24, New Action)

Action 5.B.3. Collaborate with the NOAA Central Library to track NOAA citizen science in publications (bibliometrics) and social media (altmetrics) and create a category for citizen science in the NOAA Institutional Repository.

Objective C. Provide formal training materials and modules through internal and external venues

Action 5.C.1. Establish an institutional NOAA affiliate membership to the Citizen Science Association so that NOAA staff and affiliates have access to webinars, workshops, and other resources. (Aspirational)

Volunteers Help to Inform Extreme Weather Science

SKYWARN® is a nationwide network of nearly 400,000 trained volunteer weather spotters who provide near real-time reports of extreme weather to officials. The SKYWARN weather spotter reports assist NOAA National Weather Service (NWS) meteorologists in making more informed life-saving warning decisions, and help emergency managers and first responders with situational awareness. The volunteer spotters receive training and are able to report on many natural hazards from thunderstorms and tornadoes to hail and flooding. They are citizen scientists that play an invaluable role in "ground-truthing" the impacts of extreme weather and furthering the mission of NOAA weather science.

Image: SKYWARN logo. Credit: NOAA National Weather Service SKYWARN program

Action 5.C.2. Develop a two-pager for NOAA employees on recruiting organizations that can help promote weather-related citizen science opportunities to audiences like the Weather-Ready Nation Ambassadors. Target audience is the 122 National Weather Service weather forecast offices and other NOAA offices connected to weather, water, climate, and environmental safety. (Aspirational)

Action 5.C.3. Identify existing citizen science learning opportunities and share with the NOAA Citizen Science Community of Practice. (FY23, Ongoing)

Objective D. Conduct outreach and education on NOAA's Citizen Science Program to new supervisors, interns, scholars, fellows, LANTERN detailees, and Mentoring and Leadership Competencies Development Program (LCDP) cohorts across NOAA

Action 5.D.1. Host or co-host an in-person and/or virtual NOAA-wide citizen science summit. (Aspirational)

Conclusion

NOAA is committed to continued support and development of citizen science projects across its mission areas. Both the NOAA Citizen Science Strategy and NOAA Citizen Science Action Plan (this document) identify specific needs and goals within the community and serve as living documents to better promote citizen science collaboration efforts. The field of citizen science itself is continually growing and changing. What may be possible in the future will likely greatly eclipse what we can do now. Together with advances in NOAA's other science and technology focus areas, such as Artificial Intelligence, Unmanned Systems, 'Omics, Data, and Cloud Computing, the NOAA Citizen Science Action Plan will improve cross-agency projects and demonstrate NOAA's leadership in the field.

Acknowledgements

We thank everyone who submitted thoughts during the public comment period for the draft version of our NOAA Citizen Science Strategy. Those comments helped inform the development of the strategy as well as this Action Plan (last updated February 2025).

This plan would not have been possible without the leadership and direction from our Executive Committee, the content contributions of our Writing Team, and editorial and graphic design support provided by the Communications and Outreach Branch of NOAA's National Centers for Environmental Information (NCEI). The membership of these groups are presented below.

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