

Marine Citizen Science:

Towards an engaged and ocean literate society



European Marine Board

The European Marine Board provides a pan-European platform for its member organizations to develop common priorities, to advance marine research, and to bridge the gap between science and policy in order to meet future marine science challenges and opportunities.

The European Marine Board was established in 1995 to facilitate enhanced cooperation between European marine science organizations towards the development of a common vision on the strategic research priorities for marine science in Europe. Members are either major national marine or oceanographic institutes, research funding agencies, or national consortia of universities with a strong marine research focus. In 2017, the Marine Board represents 33 Member Organizations from 19 countries. The Board provides the essential components for transferring knowledge for leadership in marine research in Europe. Adopting a strategic role, the Marine Board serves its member organizations by providing a forum within which marine research policy advice to national agencies and to the European Commission is developed, with the objective of promoting the establishment of the European Research Area.

European Marine Board Member Organizations



This policy brief is based on Position Paper 23* of the European Marine Board, drafted by an interdisciplinary working group (WG Citizen Science, November 2015 – May 2017) of 12 experts from 9 countries, nominated by the European Marine Board. The working group aimed to provide new ideas and directions for Marine Citizen Science in a European context.

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Why Marine Citizen Science?

Citizen Science is the collaboration between scientists, and the general public as volunteers, to gather and/or analyse data relating to the natural world. With regard to the ocean, it has a special role to play. The vastness of the ocean and the lack of connection most people feel with the blue part of our planet, make Marine Citizen Science a vital tool to promote ocean literacy and engage citizens in coastal and ocean research.

Citizen Science is a research approach which allows science and civil society to cooperate, to learn, and to work together to generate and use scientific knowledge and understanding for mutual benefit. These benefits include enhanced monitoring capability for scientific research, empowerment of civil society and increased environmental awareness. The use of Citizen Science is becoming increasingly widespread, and indeed there have been calls to consider research on the actual process itself as a distinct discipline.

Why do we need Marine Citizen Science?

Our ocean system is one of the most diverse, productive and yet highly threatened ecosystems on earth. The human use of, and reliance on, the ocean is vast and yet the importance of the marine environment is habitually overlooked. For these reasons alone, it is vital to humankind to maintain these marine environments in a healthy and productive state. Due to both anthropogenic and natural impacts from global warming and climate change, overfishing, pollution, habitat loss and the introduction of invasive alien species, this health is under increasing threat,

which is forecast to continue and increase in the future. The speed at which the health of the marine environment is declining is particularly alarming. Scientists cannot address these global issues alone.

Studying marine systems poses unique challenges due to the scale of these environments, their accessibility and their variety. It would be impossible for scientists alone to gather enough data to generate a comprehensive understanding of them, especially given the increasing urgency for scientific knowledge. Working together with large amounts of interested volunteers cannot only significantly increase the amount of information gathered, but can also make these, sometimes apparently remote and unconnected, marine environments more accessible to the general public.

Citizen Science enables the co-generation of knowledge and understanding of the current health of ocean systems, how these are being impacted and how they can be protected. It also promotes education of the general public regarding these issues, and also makes the ocean seem more accessible, including in the context of its importance to human health. The engagement of young citizens at this crucial stage of development of their value system is likely to lead to better informed stewards of the marine environment and development of a lasting 'Marine Citizenship'. A shared knowledge and identity can instil behavioural change at the level of the individual, as well as a sense of care and responsibility within the general public, and can empower them to act. In turn, this knowledge can directly combat the growing trends in post-truth, and negation and distrust of scientific thinking, restoring confidence in facts through a greater understanding of their source and their implications.



The Shore Thing project in the UK.

Spotting, observing, measuring and listing

The contributions that citizens can make to marine science are many and varied, ranging from collecting data and information to data analysis. Citizen Science projects can be based on incidental observations as well as on standardized surveys and monitoring protocols. These can include:

- Ongoing presence/absence reporting;
- Organised snapshot records at set times and in set format;
- Measurements which require instruments or materials and training;
- Chance sightings or unusual observations ideally with photographic evidence;
- Dedicated scientific exploration programmes with citizen participation;
- Interactions with traditional knowledge holders.



Credit: Mick Montley

Interacting with traditional knowledge holders can be a very valuable exercise.

In terms of what is being studied, the aims of Marine Citizen Science projects can be as diverse as the marine systems themselves, and can focus on marine and coastal flora and fauna, marine pollution or beach litter, local ecosystems, fishing, water properties and many other physical features. The wide range of possibilities means there is likely to be a project to suit everyone.

In addition, Citizen Science projects are not limited to easy-to-reach beaches and coastal areas. While coastal and beach areas do lend themselves particularly well to public participatory projects, many initiatives focus on the open ocean. For example, scientists collaborate with sailors, divers, surfers, the fishing community and other water users to utilize not only the equipment but also the considerable human resources and expertise developed by citizens that engage regularly with the marine environment. Some initiatives do not even require participants to leave the comfort of their own homes.



Credit: © John Rafferty Photography, Marine Photobank

A Green Crab (*Carcinus maenas*).

Types of data amenable to Marine Citizen Science

On land and along shorelines

- Online identification of organisms and features etc. from image banks and archives;
- Microclimate monitoring;
- Monitoring of beach morphology changes;
- Reports on shoreline changes (sand, water level);
- Reports on stranded organisms (fish, cephalopods, gelatinous organisms, marine mammals) during periodic visits to the shoreline;
- Monitoring of fresh fish catches for invasive species;
- Beached seabird observations;
- Mammal and turtle observations;
- Reports on stranded litter and organic matter (wood, flotsam).

In shallow waters

- Surveys of shallow water hotspots by diving clubs or other watersports associations;
- Long-term monitoring programmes of Marine Protected Areas;
- Monitoring of changes in protected benthic communities;
- Reporting on anthropogenic damage to shallow water communities;
- Coral and artificial reef monitoring;
- Night observations of shallow water biodiversity;
- Invasive species observations;
- Studies of diverse but accessible habitats;
- Extensions of fish and seafood databases by divers and anglers.

In the open sea

- Sampling from ships of opportunity;
- Mobile applications to determine water colour, reflectance, clarity;
- Collaborations with eco-volunteer organizations for survey and sampling;
- Use of drones for observations of mammals and floating debris or coastal and intertidal habitats;
- Ferry boxes for underway sampling;
- Use of tethered underwater robots.

A sea of opportunities

The rise of Marine Citizen Science is well timed. Technological advances in automated systems, marine measurement equipment and digital capabilities are continuously improving/developing, offering new and enhanced ways to conduct data collection and analysis in Citizen Science projects.

Access to smartphones and the internet is extremely widespread, meaning that most projects already include some online interaction between participants and scientists, and this will only grow and develop. Options can include apps for data submission and mapping, as well as communication tools such as websites, portals, discussion forums and social media. Some initiatives go even further and are exclusively run online, through platforms such as Zooniverse and others, with innovations including online games or tasks which can help identify species, spot creatures and analyse existing information or data. The relative ease of using these systems can benefit both the public and the scientists by helping to maintain good communication, increase data acquisition and spatial coverage, and assist with data quality management. It also means that marine citizen science is open to a large and increasing percentage of the world's population.



Credit: MARIS / Veerder

The Eye-on-Water project smartphone app.

Looking ahead, automated and autonomous equipment such as drones, remotely operated sensors, autonomous underwater vehicles (AUV's) and underwater gliders are predicted to play an increasing role in Marine Citizen Science. Locations which are hazardous or difficult to access can be explored safely and efficiently using such technologies, which have the potential to vastly expand the scale of data that could be gathered. Engaging citizens through



Credit: Shutterstock

A do-it-yourself drone.

monitoring and operating the equipment, “sponsoring” a system and analysing the many exciting types of data generated would all be options for projects using such equipment. The draw of exciting technology could prove an added attraction to potential volunteers, and could further engage and educate the public in new and innovative ways.

Additionally, such exploration of previously unknown or unseen environments will undoubtedly generate entirely new knowledge. Space exploration has already managed to become mainstream, and new discoveries of the unknown create a buzz of interest and excitement amongst scientists and the public alike. Through Marine Citizen Science, it is hoped that marine science could achieve the same.

As climate change and global warming continue to influence global marine environments, the importance of, and hence focus on, ocean observing is continuing to increase. Ongoing and comprehensive datasets are needed to help understand the changes that are occurring and their implication, in order to inform future policy and management. The contribution of citizens to ocean observing, including community remote sensing and sampling, could support activities in all these areas of observing.

The possibilities are indeed endless, but they will not be initiated without dedicated support and development. Recommendations and identification of these needs can be seen at the end of this policy brief.



Credit: NOAA National Ocean Service, USA

Scientists and crewmembers prepare to launch an ocean glider from the rear of the NOAA ship Nancy Foster. Once released, the pre-programmed glider will operate autonomously.

A tool for marine policy

The Aarhus Convention of 2001 established the right of the public to receive environmental data held by public bodies, and the right of citizens to participate in environmental decision-making. Citizen Science initiatives are well placed to facilitate this right on the part of the participating volunteers, either through the generation of data to underpin evidence and advise policy, or by enabling two-way exchanges of understanding between the public and scientists.

In the context of Europe, focus is increasingly turning towards sustainable growth and development, protecting biodiversity and ocean health, and both understanding and mitigating the impacts of climate change. This is reflected in a number of directives and frameworks adopted by the European Union including the Marine Strategy Framework Directive, the Water Framework Directive, the Integrated Marine Policy, the Common Fisheries Policy and the Habitats Directive.

In the short-term, Marine Citizen Science is a feasible option for enabling more comprehensive data collection to support and inform the implementation of these policies and wider understanding of marine systems and decision making.

In the longer term, Marine Citizen Science could be a catalyst for cultivating positive behavioural change at the level of the individual towards more environmentally friendly and sustainable living. Furthermore, it could also more directly involve the general public in the development of policy on a local, regional and European level which have implications both for marine environments and society. Additionally, collaboration between the various stakeholders can be strengthened through shared experiences, which may help to solve existing or potential future conflicts arising from conservation and management issues.

The collective voice of science and civil society is much more powerful than science or civil society alone, and together, real change can be achieved. Marine policies, informed and guided by scientific evidence, can be co-developed by all relevant stakeholders, which will go a long way to ensuring full support, cooperation and implementation.



An Eco Dive volunteer gathering data.

Marine Citizen Science: Co-creating the future

In order to progress Marine Citizen Science in Europe, action is required in these 8 strategic areas:

Short-term Action Areas

Understanding wider benefits

Explore the knowledge gaps where Citizen Science can play a role so that its scope and scale is better understood, while better quantifying Citizen Science impact for a more holistic view of good practices.

Driving good practice

Develop a framework and guidelines for Marine Citizen Science Initiatives, from ethics requirements to the use of standard parameters, supported by a forum aiming to share experiences and good practices.

Building competencies

Build competencies across multiple disciplines to support the growth of Marine Citizen Science including facilitation, alternative funding, data storage and management, and digital and devices technologies.

Cultivating Ocean Literacy

Promote Ocean Literacy for improving the awareness of all actors on the value of marine research and furthering the interest and participation amongst civil society for all aspects of marine policy.

Long-term Action Areas

A European Platform

Launch a central hub for information and expertise, and providing an inventory of existing initiatives. The hub could also facilitate communication, collaboration and sharing of successful strategies.

Better funding opportunities

Ensure that funding enables scientists to conduct research and Citizen Science initiatives in parallel, ensuring appropriate financing for all players, and explore alternative mechanisms such as crowdfunding.

Improved data management

Develop open source data management systems, fulfilling the rights of the public to access information, and create adequate and long-term data storage, while fostering compliance with metadata standards.

Supporting marine policy

Improve the understanding of how Citizen Science can be used to co-develop policies and embed its principles in the implementation (e.g. monitoring) of both EU and international policies.

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Suggested further reading

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Cover Photo: Children engaging in coastal surveys and monitoring.

Credit: Institute of Marine Research, Norway

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