

Mighty oceans and humble ponds play key roles in biodiversity

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Satellite data can help show whether marine conditions are right for certain species to thrive. Credit: CC0 via Unsplash

By monitoring oceans and peering into ponds, European projects seek to protect an array of animal and plant life.

In January, word emerged that scientists had discovered a new colony of penguins in Antarctica using images from Europe's flagship Copernicus satellite network. By coincidence, the same month marked the start of an initiative that will rely on the same Earth-observation system for different purposes.

The [NECCTON](#) project is gearing up to help Europe protect [endangered fish](#) and whales. It will harness the [European Copernicus Marine Service](#)—or CMEMS—to collect more detailed data on species threatened by habitat loss, unsustainable fishing and [industrial pollution](#).

From satellites to seabeds

"This is going to be particularly helpful for policymakers, marine managers and fisheries," said Stefano Ciavatta, coordinator of the project running through 2026. "We want to provide better simulations and projections of the state of marine ecosystems and of their ability to support diverse fish communities."

While Earth-observation satellites, including Europe's flagship Copernicus, number in [the many hundreds](#), it's often claimed that we know less about the ocean floor than we do about the surface of the moon.

Biodiversity protection has received fresh impetus as a result of a United Nations summit in Canada in December 2022 and a landmark UN agreement in March this year on a High Seas Treaty to protect oceans. And with 68 000 kilometers of coastline—more than the U.S. and Russia combined—the EU is [stepping up efforts to improve marine health](#).

CMEMS, one of six Copernicus services, provides analyses and forecasts of marine environments for all kinds of users ranging from fishing hobbyists to the navies of EU Member States. It is run by France-

based Mercator Ocean International, a non-profit entity in the process of becoming an intergovernmental organization.

The Copernicus marine service monitors all the European regional seas and the world's oceans. Its models forecast things like sea temperatures, tides and currents, making it easier to anticipate developments such as fish migration patterns.

NECCTON plans to provide a more complete picture of the environmental state of these waters by gathering data on fish, pollution and the seabed conditions for marine life.

"We will develop new tools to share the modeling capabilities of the Copernicus Marine Service across the different centers in Europe, optimize scientific efforts and boost collaboration," said Ciavatta, an oceanographer at Mercator Ocean International.

Clearer views

The ultimate aim is to help users of the service make better-informed decisions about the sustainable use of marine resources.

The Copernicus marine service could, for instance, deliver information on where tuna populations are located or whether marine habitats have the right conditions for dolphins.

To make sound policy decisions, scientists and authorities need projections on how changes that result from global warming, pollution and overfishing could affect the marine system as a whole.

NECCTON plans to simulate changes in organisms within the food web using climate scenarios. This activity could, for example, enable researchers to get a clearer picture of the impact of declining fish stocks

on the marine system over the coming decades.

Pond treasures

When it comes to protecting biodiversity, it's not just the mighty oceans that have researchers' attention. So do humble duck [ponds](#).

The [PONDERFUL](#) project is examining the relationship between ponds and their surrounding environment. The initiative is focusing on the wide range of living organisms to which ponds are home.

Fish, toads, snails, dragonflies and leeches are just some of the creatures making up a vast, balanced web that, if disrupted, could result in the ecosystem's collapse.

"Collectively, ponds are the richest freshwater habitats," said project coordinator Sandra Brucet, a biologist and researcher on aquatic ecology at the University of Vic in Spain. "They are more abundant than lakes, rivers and wetlands."

Research suggests that ponds make a greater contribution to biodiversity than many larger bodies of water by supporting more plants and animals, many of which are endangered.

Nonetheless, ponds so far have been largely neglected by policymakers. For example, a major piece of EU legislation in 2000 on cleaning up water bodies excludes for the most part those smaller than 50 hectares. Also, research on ponds has long been overlooked.

"Two decades ago, researchers mainly focused on lakes and rivers," said Brucet, who came up with the idea of PONDERFUL.

Home stretch

Now things are changing as the project, which began in late 2020, enters its final two years.

With more than 80 researchers from 11 countries—Belgium, Denmark, France, Germany, Portugal, Spain, Sweden, Switzerland, Turkey, the UK and Uruguay—the initiative is deepening knowledge about how best to manage and restore ponds in a changing climate.

PONDERFUL is evaluating future "pondscapes" at eight demonstration sites that include a total of more than 500 ponds. Testing will help develop a guide for reducing pollution in ponds, creating new ones and helping them serve broader environmental goals such as the preservation of biodiversity.

Runoff from [agricultural fields](#) is one of the main threats to the health of ponds. Nutrients in such runoff can cause [harmful algal blooms](#), a lack of oxygen and dead zones as fish die off.

Key lessons

Brucet and her team have already drawn some important lessons.

An accumulation of debris and an increase in sediment loads, which result mainly from agricultural-field erosion and are usually rich in nutrients from fertilizer runoff, can have a harmful effect on the overall state of ponds.

Sediment increases are accelerated by erosion of ponds' edges and seasonal buildup of organic material such as dead plants and tree leaves, for instance. The nutrients in this material in turn often feed algal

blooms that can produce toxins and kill fish, mammals and birds.

Dredging and removing sediments help prevent such buildup.

Separately, reshaping the edges of ponds that are artificially drained for agriculture can prevent too much water from escaping.

When efforts are made to enhance pond wildlife as a whole, the researchers found that not only do populations of endangered frogs, toads and newts increase but also flora benefits.

"Biodiversity of aquatic plants increases significantly after cleaning up ponds," Brucet said.

Healthy ponds even play a role on another important environmental front: fighting climate change. That's because they act as "carbon sinks" that store greenhouse gases including carbon dioxide.

Brucet's project runs through November 2024 and signals that ponds, after long being disregarded by researchers and policymakers, are finally joining oceans and seas as a focus of Europe's green ambitions.

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