

US ocean sciences decadal report calls for regaining leadership

Worried about brain drain and national security, US ocean scientists say that the antidote is reinvigorating basic research and the country's research vessels.

The top priorities of the US ocean sciences community through 2035 are a continued investment in basic, curiosity-driven research and a unified effort to improve ocean forecasts to meet national and global environmental challenges. Those and other recommendations are detailed in *Forecasting the Ocean: The 2025–2035 Decade of Ocean Science*, a survey of the field that was conducted over 18 months by a committee of US researchers.

The US “is at a critical juncture,” the committee writes in its report, which was released in February. The NSF research budget in ocean sciences has not kept pace with inflation, according to data provided to *PHYSICS TODAY* by the committee. Additionally, the country's ocean research fleet is shrinking, and the country has lost its only deep-sea scientific drilling vessel, says the report. Investment decisions could either revitalize the discipline or drive US ocean scientists to labs overseas, says report co-chair Tuba Özkan-Haller, dean of Oregon State University's College of Earth, Ocean, and Atmospheric Sciences. The report states that the outcome also has national security implications: Sea-level rise is threatening defense infrastructure, and melting ice is rapidly changing access to the Arctic.

The decadal survey is the second ever issued for US ocean sciences, making it a relatively new practice compared with the long history of decadal surveys in astronomy, which go back to the 1960s. Scientists use decadal reports to present a unified voice when appealing for federal funding.

Recommendations from the decadal survey are aimed at NSF's division of ocean sciences, the US's primary funder

of basic ocean sciences research. The division had a total research and infrastructure expenditure of around \$420 million in 2023, the most recent year with data available. NSF received roughly \$9.9 billion in appropriations that same year.

Proposed cuts to NSF's budget and workforce by the Trump administration have been reported in the time since the decadal survey's release. “The committee didn't know that [ocean sciences] would be facing the potential of significant cuts to NSF funding, but I think that we are very fortunate that [the committee] decided to focus the priorities so clearly,” says Scripps Institution of Oceanography director Margaret Leinen, who did not participate in the report.

Basic research to strengthen forecasts

The roughly 150-page study was written by a committee of 23 scientists convened by the National Academies of Sciences, Engineering, and Medicine. They used a wide pool of published sources and received community input. The committee organized in-person and virtual town halls and heard presentations by more than 100 experts.

The report emphasizes the importance of ocean forecasts, which includes predictions of wave heights for ports, water temperature for fishing boats, and flooding levels for city planners. Linking basic research findings to forecasts is “sorely needed,” writes the committee. Recent advancements in modeling and scientific understanding of ocean phenomena led to the early identification of Hurricane Helene when the storm was still very weak, according to a recent analysis.



But more research is needed to link ocean processes to forecasts, the committee writes. For example, the eastern Bering Sea's snow crab fisheries collapsed following heat waves between 2018 and 2021. If scientists had better understood the scientific links between heat and mass starvation, forecasts could have aided in mitigating the heat waves' effects on the fishing economy. To help fill the gaps, the committee recommends that NSF prioritize research in three key areas: ocean and climate, ecosystem resilience, and extreme events. Continuing strong US leadership in ocean sciences research in those areas will enhance economic prosperity and decision-making about coastal and ocean resources, states the report.

The committee says that NSF can better prepare the ocean sciences workforce by incentivizing transdisciplinary research through skills-sharing among US industry, academia, and mission-based government agencies like NOAA. NSF could fund academic scientists to embed themselves in industry or in federal research agencies for short periods, says Özkan-Haller.

The report's dual emphasis on basic research and a transdisciplinary approach is important, says Hilairy Hartnett, director of the University of Washington's School of Oceanography (she did not participate in the report). “There is some tension in that recommendation, but the problems of modern and future ocean sciences require both,” she says.



A RESEARCHER prepares to release an anchor and chain for an ocean buoy in 2020. Collecting ocean observations for basic research is one of the main priorities of the latest US ocean sciences decadal survey. (Photo by Mitch Lemon/USGS.)

Ships need a refresh

The report says that 90% of US scientific ocean drilling objectives will not be met going forward because of the decommissioning in 2024 of the *JOIDES Resolution* (see *PHYSICS TODAY*, September 2023, page 21), a scientific drillship that had operated since 1985. NSF had been supporting the drillship with \$48 million annually since 2014, but rising costs, stagnating US investment, and large cuts from international funding led to its retirement.

No future drillship has been planned, and “it is unlikely that such U.S. leadership can be regained without a U.S.-based drillship,” according to the report. Deep-sea cores collected from around the world since the 1960s have been key in providing supporting evidence for plate tectonics and geologic climate change (see the article by Rebecca S. Robinson, Sonia Tikoo, and Patrick Fulton, *PHYSICS TODAY*, February 2024, page 28). Maximizing the scientific value of existing deep-sea cores is vital for continuing research, writes the committee. The report praises the International Ocean Discovery Program’s Legacy Asset Projects, a pilot program that supports large-scale studies on previously collected cores.

Collaboration with international scientific drilling partners is “one of the

most important recommendations” of the report, says Binghamton University paleontologist Adriane Lam, who participated in three *JOIDES Resolution* expeditions and presented to the committee during the report’s preparation. Future international connections will be crucial for training the next generation of the US scientific workforce and for obtaining new deep-sea sediment records, she says.

The US Academic Research Fleet is top of mind for Deborah Bronk. She is president and CEO of the nonprofit Bigelow Laboratory for Ocean Sciences in Maine and did not participate in the making of the report. The fleet is a group of ships operated by universities and laboratories through the University-National Oceanographic Laboratory System (UNOLS) for conducting research on the ocean, atmosphere, and seafloor. “We’ve lost half of our fleet in the last 50 years,” she says, from 34 to 17 vessels. In contrast, China has 64 research ships, according to an analysis by the Center for Strategic and International Studies, a bipartisan think tank in Washington, DC.

Although three new regional-class ships are joining the US research fleet this decade, four other existing ships will reach the end of their life by 2030. If they are not replaced, the ocean sciences com-

munity could lose approximately 20% of the fleet’s annual maximum available ship time, according to UNOLS executive secretary Doug Russell, who presented to the committee during the preparation of the report. Three additional ships will reach the end of their already-extended service lives by the early 2040s. Those US Navy-owned global-class research ships make up the most robust ship class in the fleet that can travel in ice-free waters. “Without them, our ability to address the most important issues and questions of ocean science is severely compromised,” says the University of Washington’s Hartnett.

Balancing the portfolio

The first US ocean sciences decadal survey, published in 2015, arose from concern about the rising infrastructure costs of NSF’s ocean sciences division. Scientists worried that without intervention, infrastructure costs would continue to grow and pull money away from research grants. The first report advised that NSF rebalance its portfolio to evenly support infrastructure and research.

Following the 2015 report, NSF pulled back its ocean sciences infrastructure investments to be on par with research funding levels. It decreased funding for the US scientific drilling program, the real-time ocean data network Ocean Observatories Initiative, and one of its academic research ships. But that balance has recently tilted again, with the division spending roughly \$24 million more on infrastructure than on research and education in 2022 and \$35 million more in 2023. The new report says that infrastructure costs are the cause, “particularly due to operating an aging Academic Research Fleet” and the NSF division’s flat budget.

“The US is losing, or maybe has already lost, leadership in the ocean sciences world,” Özkan-Haller says. “We might have a brain drain to other places that are investing heavily in the ocean sciences right now.” The new survey aims to urgently unite the ocean sciences community around specific scientific efforts that the committee believes can safeguard US leadership for decades to come. “Now is not the time to be caught up in the details,” Özkan-Haller says. It’s the time to “come together around a few important priorities.”

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