

# A sea change regarding our ocean

By Marshall Terrill , ASU News  
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**By Marshall Terrill and Joe Rojas-Burke**

The ocean matters more than most of us may realize.

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## About this story

There's a reason research matters. It creates technologies, medicines and other solutions to the biggest challenges we face. It touches your life in numerous ways every day, from the roads you drive on to the phone in your pocket.

The ASU research in this article was possible only because of the longstanding agreement between the U.S. government and America's research universities. That compact provides that universities would not only undertake the research but would also build the necessary infrastructure in exchange for grants from the government.

That agreement and all the economic and societal benefits that come from such research have recently been put at risk.

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Our seas offer soothing scenes for millions of vacationers. They provide seafood for our tables. They are a conduit for global logistics — from the screens we scroll to the cars we drive.

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Additionally, they drive our current weather and general climate, no matter where we are on Earth. The ocean shapes temperature, humidity and the very air we breathe.

So, addressing current crises related to wildfires, floods and hurricanes demands better stewardship of the waters that make up most of our world.

This holistic perspective has defined Arizona State University's approach to marine science and the creation of the [School of Ocean Futures](#) in 2024.

"There is no future for any of us without the ocean. If the ocean fails, so does life as we know it. The planet becomes uninhabitable," said [Susanne Neuer](#), founding director of the School of Ocean Futures in the College of Global Futures. "We want to train students with an eye towards protecting what we have and figuring out the role that the ocean will play in the future."

It's a bold approach to ocean science that has already shifted the collective perception of global stewardship.

Today's students are the scientists and problem-solvers of the future, and the need for ocean stewardship falls to them. So, ASU's approach to ocean science has moved from the abstract to actual application.

Here's how this program propels impact for everyone, irrespective of their major, to draw an interest in the subject and shape our society.

## Countercurrents in the classroom

It's a pretty sure bet that a school based in the desert but dedicated to the study of the ocean is not going to do things conventionally. And such an alternative approach reflects the school's development from scratch.

"It is very rare in the world of ocean science to create a school rather than inherit one," said Neuer, who is a biological oceanographer and marine ecologist. "We have no baggage because we didn't inherit a curriculum. We designed a curriculum based on science but one that also keeps in mind the perspective of ocean communities, Indigenous knowledge, partnerships and teaching students."

The School of Ocean Futures focuses on the current and future states of the ocean while also addressing the challenges our oceans experience due to increasing pressure from human activities. It combines research and teaching facilities in the Pacific and Atlantic oceans with cutting-edge research facilities housed within the College of Global Futures on ASU's Tempe campus.

These resources will provide students with a wide array of experiential learning opportunities that will prepare them to conduct work of significant impact.

# There is no future for any of us without the ocean.

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**Susanne Neuer**

Director, School of Ocean Futures

“The health of our planet is inextricably linked to the health of our oceans,” said Peter Schlosser, the vice provost of Global Futures at ASU. “So, at the School of Ocean Futures, we are empowering a generation of changemakers to safeguard the ocean’s vital role in sustaining all life on Earth.”

Neuer added that the university is investing heavily in ocean study for several reasons: to prepare ocean-literate students for a rapidly changing world, put to use the university’s educational expertise, and broaden the impact of ASU locations dedicated to research and academia.

“Arizona might be landlocked, but we have many students interested in marine science,” Neuer said. “Before this school was created, they had to leave the state and go to places like California, Washington or the East Coast to study the subject. Now they can stay here, or others can come here and study the ocean.”

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This novel effort is not just about training oceanographers but also creating better stewards of the ocean among all of us.

For example, the school offers coursework for every ASU student, not just those focused on oceanography. This is by design, according to [Amy Maas](#), an assistant professor in the School of Ocean Futures with a joint appointment in the School of Life Sciences.

“I designed [SEA 101: Ocean Futures](#) so that students have a general understanding how our lives are connected to the ocean no matter where they are or what they do,” said Maas, a comparative ecophysiologicalist who studies the biogeochemical role of zooplankton in open ocean systems and the effects of climate change on these organisms. “The ocean informs how people choose to live their lives, how they act as citizens and how they act as neighbors. This course offers a good basic understanding for these students.”

It's not an exaggeration to say Maas' class is exploding in terms of popularity. She grew it from a trial with 14 students a year ago to 86 enrolled students this past semester. Maas expects the fall will surpass the 100-student mark. She attributes this growth to expanding awareness about the planet and the challenges we face.

“Among Arizona youth, there’s wide acknowledgment that the state and the world are facing some big issues. There’s a lot of passion for the ocean, even in the desert,” Maas said. “This also taps into the college experience — figuring out what you don’t know, figuring out the edge of your knowledge and learning about something completely different and seeing how it changes you.”

Maas teaches almost side-by-side with her husband, [Leocadio Blanco Bercial](#), at Arizona State University's [Bermuda Institute of Ocean Sciences](#), or BIOS — home to some of the longest-running sets of ocean observations available anywhere in the world.

He likes the fact the School of Ocean Futures now provides a cohesive grouping of faculty whose interests and research align with the ocean.

“Previously, we were distributed across several schools and units within ASU. But graduate students with interests in marine and oceans topics are now enrolled together, sharing a common space that fosters cross-pollination of ideas, research interests and even discussions about the latest cool paper they have read,” Blanco Bercial said, who is also an assistant professor in the School of Ocean Futures.

He also loves the idea of meeting students who he believes will “shape the future of our society.”

“They come from diverse backgrounds but share a common interest in the ocean — not only in the basic, classic science and engineering topics but also in societal aspects, such as how we interact with the ocean and how different societies have used similar or different resources,” Blanco Bercial said. “Furthermore, the school provides an opportunity to connect with potential undergraduate students interested in participating in my research, as well as future graduate students for my lab.”

## **Improving outcomes with coastal communities**

On a tiny remote island in Mexico's Sea of Cortez, marine biologist [Jesse Senko](#) and his students make careful observations of endangered sea turtle populations, but they also spend time with local fishers — at sea working their gillnet boats, and onshore sharing family meals and trading stories. It's all part of an effort to understand and learn from coastal communities and help protect sea turtles and other ocean resources that sustain the people living there.

“Our work combines a little bit of engineering, fisheries science, sea turtle biology and animal behavior, but also social science and human behavior,” said Senko, an assistant professor in the School of Ocean Futures. “It's about improving the livelihood of the fishers, improving outcomes for coastal communities and, by doing so, saving sea turtles.”

Around the world, some ocean fishing fleets discard 40% or more of their catch, including species such as sea turtles and sharks unintentionally entangled in nets and other gear. Senko and colleagues work with fishers, regulators and NGOs to develop new solutions to reduce wasteful “bycatch” while maintaining productive fisheries.

In one series of controlled experiments, Senko and his team showed that illuminating gillnets with green LED lights could lower total bycatch by 63% while helping fishers save time retrieving and disentangling nets — all without interfering with the harvest and value of targeted fish.

“The lighted net is certainly a technical innovation, but the true innovation is working with the fishers,” Senko said. Their ideas were pivotal to making the concept applicable in the real world. In the earliest version, the LED lights in the net used hundreds of batteries that required frequent replacement and added cumbersome weight to the fishing gear.

“It was costly, wasteful and totally impractical,” Senko said.

Collaborating with gillnet fishers and ASU colleagues from the School of Electrical, Computer and Energy Engineering, Senko developed a solar-powered version. The lights shine down from the floating buoys that suspend the net, an idea proposed by Sea of Cortez fishers. The lights can flash for a week without recharging, and the batteries can last several years before needing replacement.

This summer, Senko and his team will travel to their study site in coastal North Carolina, where they are collaborating with fishers to reduce sea turtle and shark bycatch in pound nets, bottom-anchored net systems that funnel fish into a trap. The ASU researchers are deploying a custom underwater video camera to record sea turtle encounters with lighted nets.

“We know very little about how sea turtles behave in relation to fishing gear,” Senko said.

Detailed observations could help researchers refine the design and function of lighted nets to more selectively reduce bycatch while maintaining target catch. Another goal is to optimize the design to make the gear inexpensive to manufacture and affordable for small-boat fleets that account for the majority of the world’s ocean fisheries.

Senko grew up in coastal Connecticut, but he says ASU, in the Sonoran Desert, was the best place for him to pursue a PhD because of its emphasis on solving problems.

“We don’t do science just for the science,” he said. “ASU really embraces use-inspired interdisciplinary work and engagement with communities. People can benefit from that.”

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**Jesse Senko**

Assistant professor, School of Ocean Futures

## **Harmonizing science with traditional knowledge**

A magnificent coral reef extends 120 miles along the west coast of Hawaiʻi. Here, [Greg Asner](#), a professor in the School of Ocean Futures and director of ASU’s Center for Global Discovery and Conservation Science, has put in place some of the world’s most advanced technologies to study reef life — and the many threats to its existence.

An aircraft called the Global Airborne Observatory carries a bevy of instruments to map reef features and water quality in high resolution. A massive coral nursery facility handles large-scale studies on assisted propagation of corals. And a fleet of ocean-going vessels deploys scientific dive teams.

But among the most important assets are the cultural advisors from West Hawai'i, says Asner, founder of the [Maui Reef Restoration Program](#). These advisors contribute ancestral wisdom and guidance to harmonize the science with traditional knowledge.

"I talk to them every week, and they're deeply involved," Asner said.

Together, they are advancing one of the boldest coral restoration projects ever attempted. Coral reefs provide essential habitat for one-quarter of marine species. Tens of millions of people depend on coral reefs for livelihoods and food. Around the world, coral ecosystems continue to lose ground as they struggle against overfishing, pollution, and hotter temperature extremes.

At the Ridge to Reef Restoration Center in Kailua-Kona, Asner's team has developed systems to accelerate coral reproduction and generate millions of offspring, the free-floating larvae that settle to the ocean floor, attach permanently and grow into adulthood.

For added resiliency, the team is growing some corals in higher-than-normal temperatures and selectively breeding those that can handle the heat.

"We have enough coral genetic diversity to sift through what we have and hedge our bets towards the ones that are a little more thermally tolerant," Asner said.

Damien Kenison, a cultural advisor, led a crew of Hawaiian fishers who designed dome-like nets to concentrate coral larvae in position at desirable spots for coral recolonization. They call the nets "pololia," which is the Hawaiian word for jellyfish.

This summer, the team plans to stage a massive release of coral larvae. Some of the millions of larvae will be held in position under pololia; others will be allowed to drift freely. Mimicking a natural synchronized reproduction event, the release of coral larvae will extend along the entire 120 miles of the reef.

"Nobody has attempted such a thing anywhere on the Earth's surface," Asner said.

Asner, like Senko, chose to do marine science at ASU because he wanted to work at a place committed to using science to change the world.

"Yes, we do research, but that is one part of a larger process. We're really into implementation and intervention and change-making at that larger scale," Asner said.

## Next-generation oceanographers

What are students learning?

In short, they're finding out ways to make the ocean a sustainable place by addressing the issues that threaten its health.

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Andrea Brenner, a third-year PhD candidate, is studying marine biochemistry and the links between sinking particles and how organisms like zooplankton eat and interact with them.

"It's important because we want these particles to sink. When they are removed from the upper layers of the ocean, they're taking carbon with them," said Brenner, who is developing her dissertation based on this research. "Over a long period of time, this helps with climate change mitigation."

Regarding climate change and how it impacts the ocean, Brenner said the cynical side of her is extremely worried about our ocean and our drinking water supply. But she also sees the flip side.

"I work around these amazing researchers, and we really do try to understand these processes," Brenner said. "It gives me the hope that we're going to work through this and essentially build our knowledge base to make it better, to fix the oceans and mitigate climate change."

Fourth-year student Viktor Meszaros was studying to become a veterinarian but transferred from a community college to study biological sciences and ocean futures.

"I took an introductory class to ocean futures and was hooked," Meszaros said. "I would say it changed the trajectory of my career path because it's more in line with what I wanted to do."

Meszaros is currently working with Brenner to study the relationship between sinking particles and zooplankton and has helped her out in the lab for a few semesters. He believes this school in the desert is giving him a broad view of the ocean.

"I'm getting a big-picture view of the ocean from coral reefs, remote sensing, ocean chemistry, zooplankton and collecting data," Meszaros said. "Plus, I'm working on a research project of my own alongside some of the graduate students."

One of the big benefits offered to Meszaros was a [study abroad program](#) he took advantage of at ASU BIOS.

"It was a great experience and one of the best things I ever did for my education," said Meszaros, who hopes to become an academic researcher when he graduates. "It was great to go out on boats and collect data and see where the science is being conducted."

Miguel Arteaga is just starting his academic journey at the School of Ocean Futures. He initially planned to study sustainability with a focus on ecosystems, but when an academic advisor pointed out the new degree, he was all in.

"Even though the ocean is widely researched and studied, it's like a new universe to me," said Arteaga, who will major in ocean futures with a concentration in coastal and marine science. "There are so many cool and distinct-looking species to discover and learn from and how all of these creatures interact with each other."

Arteaga is currently conducting research on microscopic jellyfish.

"They're super invasive and can destroy entire ecosystems," Arteaga said, who is also part of the [inaugural cohort of Global Futures Impact Scholars](#). "They tremendously hurt Turkey's fishing economy a few decades ago. So, it's about stuff like that and how climate change is going to



impact mammals and their interactions in the future.”

The Tempe native said he has applied for a summer abroad program at the Bermuda Institute of Ocean Sciences after the end of the spring semester, hoping to enhance his studies.

“It’ll be a great opportunity to see exactly what I’ve been learning in the classroom,” Arteaga said.

And that’s exactly what Neuer is hoping for.

“Not only are we conducting impactful research that serves the nation and the state, but we are providing our Arizona students with degrees and opportunities they might not have otherwise,” Neuer said. “I’d say that serves ASU’s charter very well.”

## **Future proofing our planet**

In western Greenland, where glacial meltwater flows to the sea over bedrock and permafrost, [Laura Larocca](#) hopes to soon begin taking sediment samples from some of the region’s thousands of freshwater lakes.

Larocca is an assistant professor in the School of Ocean Futures, and she studies the planet’s frozen zones — polar ice sheets, glaciers and other components of the cryosphere<sup>1</sup> — and how they are responding to ongoing warming.

The sediment cores hold clues about the climate 6,000 years ago, during a relatively warm period called the Holocene Thermal Maximum, when Arctic summers were warmer due to changes in Earth’s orbit. Studying this time can help us understand the consequences of today’s Arctic warming — and what might lie ahead.

“My motivation is to understand how much and how fast the Arctic is changing today, and to place these rapid shifts in the context of the last 10,000 years,” Larocca said.

In earlier work, she used an archive of aerial photographs from the World War II and Cold War eras, along with satellite imagery to examine how Greenland’s mountain glaciers have responded to warming over the last 130 years. She found that Greenland’s glaciers have been retreating about twice as fast over the past two decades compared with the 20th century — a recent acceleration that is widespread, even among Earth’s northernmost glaciers.

The consequences reach far. Globally, the loss of glaciers threatens freshwater supplies for communities that rely on seasonal meltwater, as well as the health of downstream ecosystems. Melting glaciers and ice sheets are raising global sea levels. The influx of freshwater from ice-melt is also driving changes in the large-scale circulation of water and heat across the ocean.

Larocca’s research highlights how the mission of the School of Ocean Futures extends beyond traditional oceanography. Its leaders, faculty and students are working to more comprehensively address the role of the ocean within the Earth’s climate system.

“The School of Ocean Futures is taking a comprehensive approach to tackling the challenges we face in the coming decades,” Larocca said.



“No matter where you live, the ocean is important. The Arctic is important,” she said. “What happens with the Arctic, what happens with our global oceans will affect everyone.”

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*Gary Werner, ASU senior media relations officer, also contributed to this article.*

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*This story originally appeared on [ASU News](#).*

<sup>1</sup> The cryosphere includes the components of the Earth system at and below the land and ocean surfaces that are frozen, including snow cover, glaciers, ice sheets, ice shelves, icebergs, sea ice, lake ice, river ice, permafrost, seasonally frozen ground, and solid precipitation. Source: World Meteorological Organization

## Main image



Susanne Neuer, a scientist and founding director of the new School of Ocean Futures at ASU, gathers samples from the Conductivity, Temperature and Depth equipment aboard the RV Atlantic Explorer. Photo by Jeff Newton/Enterprise Brand Strategy and Management

## Text image(s)



Students attend SEA 101: Ocean Futures at Hayden Library in Tempe, taught virtually by ASU Assistant Professor Amy Maas, an assistant scientist at the Bermuda Institute of Ocean Sciences (on screen), on Aug. 28, 2024. Photo by Samantha Chow/Arizona State University



School of Ocean Futures Assistant Professor Jesse Senko measuring an East Pacific green turtle with fishing partners Felipe Cuevas Amador (left) and Juan Cuevas (right) on a boat in Baja, Mexico. This is part of Senko's ongoing research linking applied conservation science with innovation and governance. Photo by Ryan Fitzgerald/ASU





Greg Asner (left), a professor in ASU's School of Ocean Futures and director of ASU's Center for Global Discovery and Conservation Science, works with ASU student Uhiwai Wall on coral restoration as part of the Āko'āko'ā Reef Restoration Program in Hawai'i. Photo by Rob Ewing and Joel Farias Godinez/ASU Enterprise Partners



Arizona State University PhD student Andrea Brenner aboard the RV Atlantic Explorer. The ocean vessel is part of the Julie Ann Wrigley Global Futures Laboratory's Bermuda Institute of Ocean Sciences and houses faculty from the School of Ocean Futures. Photo by Jeff Newton/Enterprise Brand Strategy and Management



School of Ocean Futures Laura Larocca (left) teaches SEA 310: Paleoclimate Perspectives on Contemporary Climate Change to a class of students at Armstrong Hall in Tempe. Photo by Samantha Chow/Arizona State University.