Monterey Bay Aquarium
Research Institute

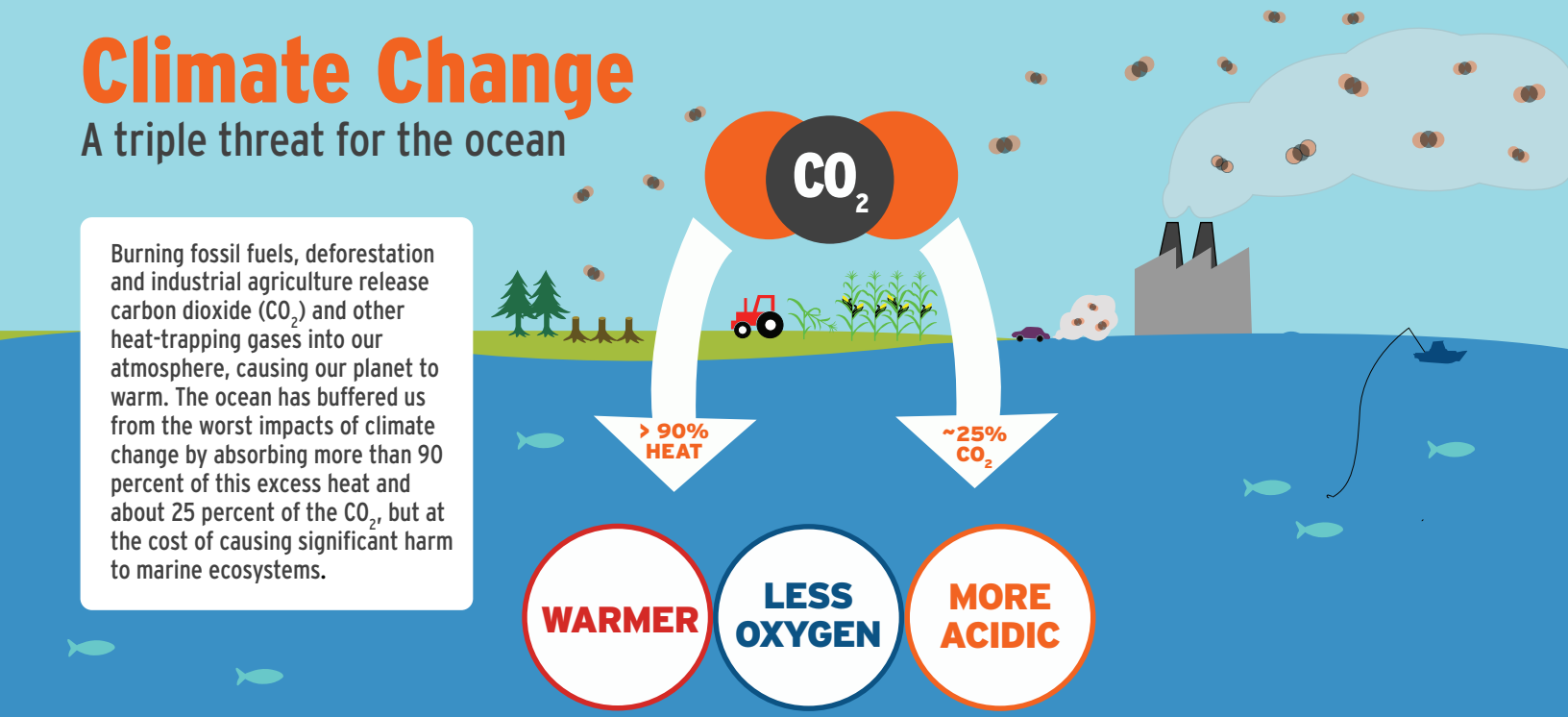
2019 Annual Report

A SUMMARY

Climate Change

A triple threat for the ocean

Burning fossil fuels, deforestation and industrial agriculture release carbon dioxide (CO_2) and other heat-trapping gases into our atmosphere, causing our planet to warm. The ocean has buffered us from the worst impacts of climate change by absorbing more than 90 percent of this excess heat and about 25 percent of the CO_2, but at the cost of causing significant harm to marine ecosystems.



SEA LEVEL

Sea level rise is accelerating, flooding coastal communities and drowning wetland habitats.

BLEACHING

Warm-water coral reefs (marine biodiversity hotspots) could be lost if the planet warms by 2°C (3.6°F).

TOXIC ALGAE

Larger and more frequent blooms are making fish, birds, marine mammals and people sick.

HABITATS

Lower oxygen levels are suffocating some marine animals and shrinking their habitats.

ACIDIFICATION

More acidic water harms animals that build shells, such as corals, clams, and oysters.

FISHERIES

Disruptions in fisheries affect the marine food web, local livelihoods, and global food security.

In 2019, the Intergovernmental Panel on Climate Change report details the triple threat of climate change to ocean ecosystems: Warming, acidification, and deoxygenation.

annualreport.mbari.org/2019

Illustration by Emily Hess

Cover photo: Animation by Frame 48

Source: IPCC, 2019: Special Report on the Ocean and Cryosphere in a Changing Climate (SROCC)

Monterey Bay Aquarium Research Institute | Monterey Bay Aquarium

View from the Masthead

Advancing science and engineering for Earth's final frontier

In his opening remarks at The Oceanography Society's inaugural meeting in 1989, David Packard explained how his family founded the Monterey Bay Aquarium, and how that led to the creation of the Monterey Bay Aquarium Research Institute (MBARI). He began by saying:

> *"This event has a rather special personal significance for me because, over the past 10 years or so, I have become addicted to the vision that within the next few years the Monterey Bay will become one of the major world-class centers for ocean science."*

He went on to add:

> *"In my humble opinion, the oceans are a more important frontier for research that will bring more tangible benefits to the world than space, or high energy physics, or other areas that have received a high level of public interest and, therefore, political support. It is about time someone gave ocean science more attention."*

Packard believed that the ocean was one of the last true frontiers on Earth. Disciplined technological innovation, fueled by teams of scientists and engineers working as peers, could transform the field of oceanography and make it possible to address challenging ocean science problems in new and novel ways. Undoubtedly this would lead to many groundbreaking discoveries.

MBARI's research vessel *Rachel Carson* cruises in Monterey Bay.

Reflecting on Packard's words 30 years later offers a profound perspective. The Monterey Bay region now hosts over 30 institutions representing academic, non-profit, governmental, philanthropic, and for-profit businesses that have made Monterey Bay a mecca for professional marine scientists and engineers.

Immersed in that culture and driven by Packard's vision, MBARI has focused on developing new technologies and approaches to overcome challenges that have historically limited our ability to explore the sea. This year's Annual Report showcases just a few of these technologies that are finding use from the seafloor to the sea surface. The

following articles will leave no doubt that a great deal remains to be learned about the ocean, its basins, and its inhabitants—even within the confines of Monterey Bay. Each year brings new findings that lend credence to Packard's vision of an "ocean frontier" awaiting discovery.

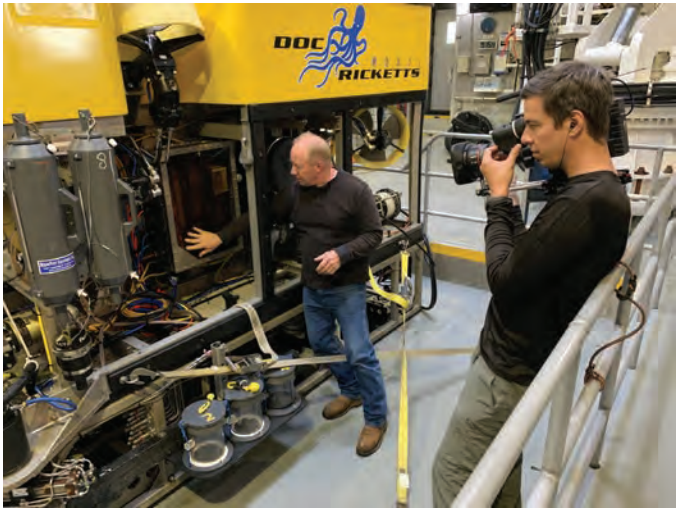
At the same time, we now live in a world that has profoundly changed in recent decades. The Earth has reached an inflection point. Human activities—the burning of fossil fuels, mineral and food extraction, and waste dumping—threaten marine life and related ecosystems that benefit society. This leaves us in a race against time to document, understand, and communicate the consequences of known human impacts on the sea, while simultaneously devising innovative tools and techniques to foster ocean exploration and discovery. Future stewardship of ocean resources will depend on a greater understanding of factors that affect the diversity and abundance of marine species, as well as the function of the ecosystems they inhabit.

Chris Scholin and long-range AUV leave Moss Landing Harbor during a test deployment of the third-generation Environmental Sample Processor using the research vessel *Paragon*.

The emerging footprint of human influence is increasingly clear—fossil fuel emissions are harming the ocean. Photo by Todd Walsh.

This modern-day realization shapes the work we do and builds on Packard's vision. In addition to our core mission of pursuing ocean exploration, we are strategically applying our talent and technology to direct fundamental research in ways that can transform resource management, advance conservation action, and inspire the next generation of ocean champions. Strengthening our unique partnership with the Monterey Bay Aquarium is a primary means by which we are implementing this strategy.

MBARI's partnership with the Aquarium provides a uniquely powerful platform to advance public understanding of ocean science and conservation. Each year the Aquarium welcomes nearly two million visitors with exhibits and lectures. It reaches over 80,000 students through field trips and teen programs that are free of charge, and provides immersive professional development opportunities for hundreds of teachers. In 2019, the Aquarium expanded its science education platform for students and teachers by opening the Bechtel Center for Ocean Education and Leadership. The $42 million center is an historic investment in ocean science education and youth development—evidence that the shared goal of responsibly managing ocean resources for the benefit of future generations is within reach.



Presley Adamson, the producer for the Monterey Bay Aquarium film and video team, filming MBARI ROV pilot Knute Brekke on a research expedition. The MBARI and aquarium video and social media teams have been collaborating closely to amplify outreach for both organizations. Photo by Susan von Thun.

Looking ahead, we at MBARI remain steadfast in the belief that disciplined technological innovation can transform our understanding of the ocean as well as our ability to address the urgent threats it faces. In the coming year we will continue to draw on our unique strengths to meaningfully impact ocean science and technology. We are working toward a future where our ocean is truly visible, a future where our locally grown technology is scaled globally to monitor and predict change, and to foster exploration.

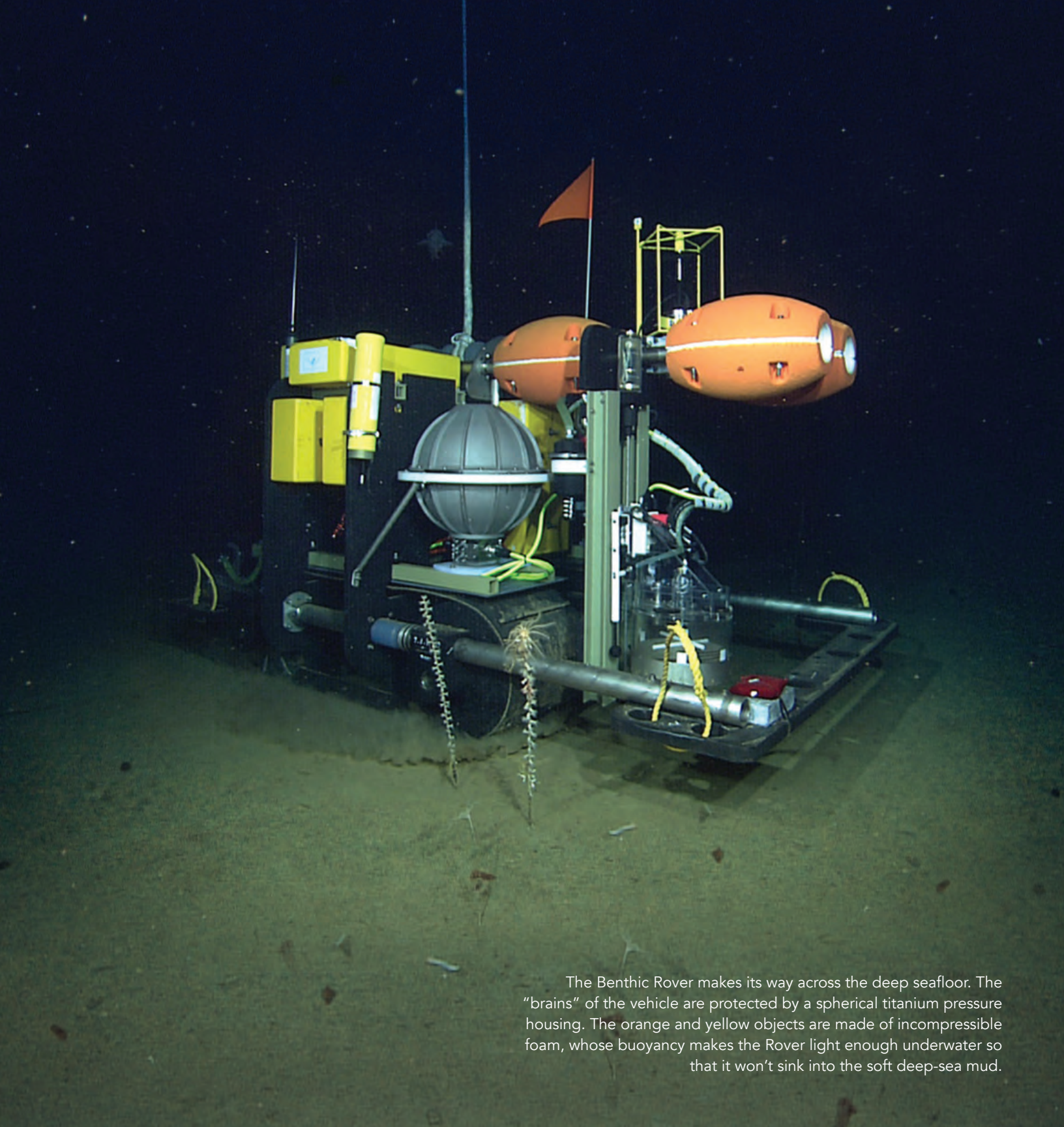
Please join us as we continue our journey by visiting our website, and subscribing to our Facebook, Twitter, YouTube, and Instagram feeds. We love sharing stories about the work we do—oceanography is a contact sport! And we especially like hearing from you, so keep in touch and be a part of our team.

Chris Scholin

President and Chief Executive Officer

Related web content

Values Statement, Strategic Plan, and Technology Roadmap:
www.mbari.org/about/vision



The Benthic Rover makes its way across the deep seafloor. The "brains" of the vehicle are protected by a spherical titanium pressure housing. The orange and yellow objects are made of incompressible foam, whose buoyancy makes the Rover light enough underwater so that it won't sink into the soft deep-sea mud.

ROBOTS IN THE ABYSS

30 years of research on the abyssal plain provide clues to climate change

The deep seafloor—known as the abyssal plain—is one of the largest and least-known habitats on the planet, yet it plays a critical role in the carbon cycle. For 30 years, MBARI Senior Scientist Ken Smith and his colleagues have studied deep-sea communities at a research site called Station M off the California Coast. The results of this research have dramatically changed marine biologists' perceptions of life in the deep sea, and our understanding of climate change.

Organisms on the deep-sea floor get most of their food from the sunlit surface waters thousands of meters above, where the marine carbon cycle begins. This food typically arrives in the form of marine snow—bits and pieces of dead algae or animals that sink down to the ocean bottom. This detritus carries carbon from the surface waters to the deep sea and indirectly reduces greenhouse gas concentrations, sequestering organic carbon in the deep ocean over very long timescales.

Smith and his colleagues have developed and used a suite of oceanographic tools to study Station M, resulting in an underwater observatory that operates 24 hours a day, seven days a week. Ongoing studies such as the Station M time series are essential for understanding long-term changes in the ocean and in Earth's climate.

Read the full article

annualreport.mbari.org/2019/station-m

This image shows the fluorescence of the sea pen *Umbellula lindahli* in white light (left) and blue light only (right).

BIOLUMINESCENCE

Teasing out the mysteries of deep-sea bioluminescence

More than three-quarters of the animals seen drifting in the water column have the ability to create their own light, a phenomenon called bioluminescence. Thanks to recent technological advances, MBARI Scientist Steve Haddock and his Zooplankton Biodiversity Group have made breakthroughs in understanding the behavior, biochemistry, and genomics of bioluminescence.

The team uses a camera that can film in full-color, ultra-high (4K) definition, and with sufficient sensitivity to record natural bioluminescence. The resulting video reveals behaviors never before recorded in the wild, such as luring prey, eluding predators using distracting sparkles, and even communication between species. The scientists use sophisticated instruments to identify the chemical components needed to make bioluminescent emissions—information that has direct applications to the biomedical field. Finally, genetic sequencing techniques are being applied to shed light on the genetic origins of bioluminescence in a number of deep-sea animals.

These discoveries by MBARI scientists offer exciting new insights about how life functions in the very cold, very dark, but also very diverse deep ocean.

Three LRAUVs fly around and through an acoustic signal, detecting migrating animals as part of the CANON field experiment. Illustration by David Fierstein.

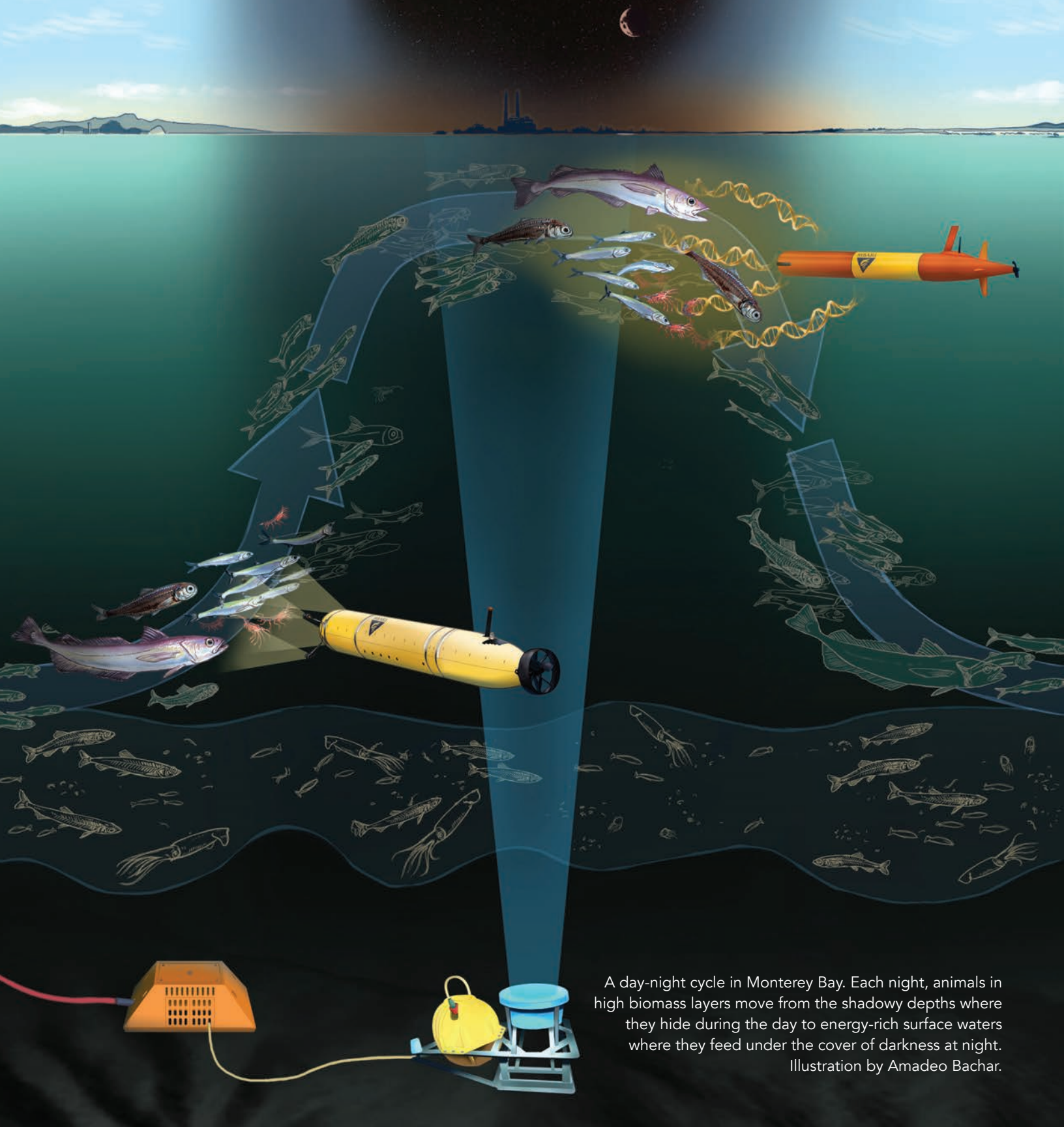
AGILITY OF LONG-RANGE AUVS

Fleet of nimble vehicles provides range and agility to oceanographic research

A growing fleet of agile autonomous vehicles is now carrying sophisticated scientific instruments and outpacing offshore currents to enhance scientific observations. For more than a dozen years, MBARI has applied its technical expertise and its ability to take on sophisticated, long-term development projects to bring this technology to fruition. The long-range autonomous underwater vehicle (LRAUV) is designed to cross the California Current system carrying a suite of oceanographic sensors and samplers and to stop and drift in the water column.

Once these cost-effective vehicles proved effective and durable, the engineering team focused on new instruments for the vehicle. They developed water sampling, turbulence, bioluminescence, bioacoustics, docking, and Wave Glider towing modules. The most ambitious innovation is a third-generation Environmental Sample Processor (3G-ESP), an onboard DNA-sampler for investigating microbes and harmful algal blooms. The ongoing development and use of the LRAUV showcases MBARI's ability to take on high risk/high reward projects that would be difficult to tackle at other non-profit oceanographic intuitions. It also serves as a shining example of what is possible when MBARI's scientists and engineers work as a team, as David Packard envisioned.

annualreport.mbari.org/2019/lruav



A day-night cycle in Monterey Bay. Each night, animals in high biomass layers move from the shadowy depths where they hide during the day to energy-rich surface waters where they feed under the cover of darkness at night. Illustration by Amadeo Bachar.

VERTICAL MIGRATION

While you were sleeping…

While you were sleeping, the greatest migration on the planet was occurring in the sea, affecting food production and Earth's climate. This nightly movement is made up of 10 billion metric tons of animals — a larger net movement of biomass than the migrations of caribou or wildebeest on land or Arctic terns in the air.

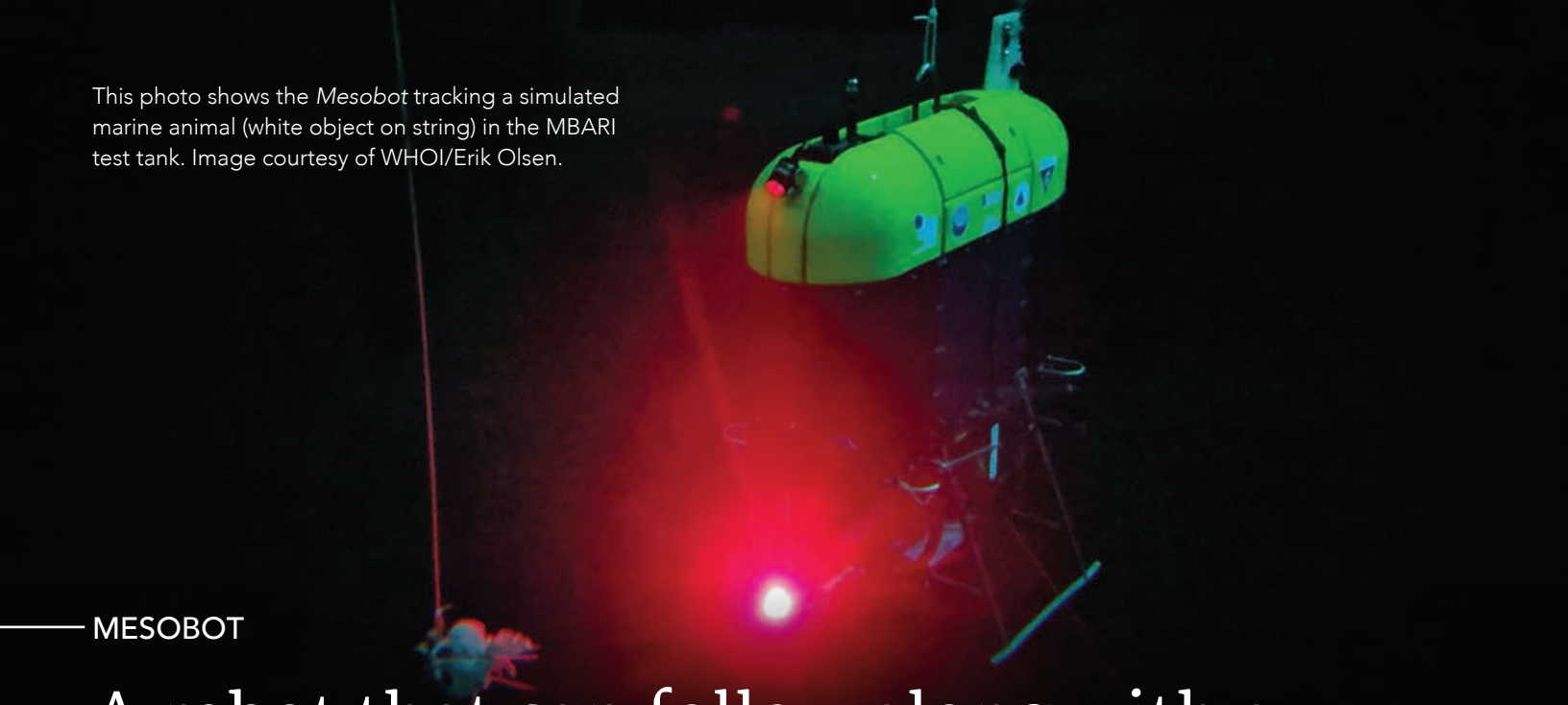
During the day, these ocean animals reside in the mesopelagic zone, a depth range in the water with only minimal light. At sunset, they move hundreds of meters upwards under the cover of darkness to feast in surface waters where sunlight allows plants to grow. They descend again at first light to remain hidden from the eyes of their predators.

These mesopelagic animals play a critical role in ocean ecosystems, serving as a food resource for larger animals. In the process of swimming up and down, mesopelagic migrators also serve as a biogeochemical conveyor belt, moving nutrients and carbon through the water column—with global consequences.

Understanding which animals are migrating, the specifics of their movements, and the role this migration plays in connecting the deep sea with the continental shelf requires MBARI's multi-disciplinary science working hand in hand with engineers and marine operators. In 2019, MBARI brought many new tools together with more traditional ones for two experiments focused on vertical migration around the cabled observatory in Monterey Bay.

Read the full article

annualreport.mbari.org/2019/vertical-migration



This photo shows the *Mesobot* tracking a simulated marine animal (white object on string) in the MBARI test tank. Image courtesy of WHOI/Erik Olsen.

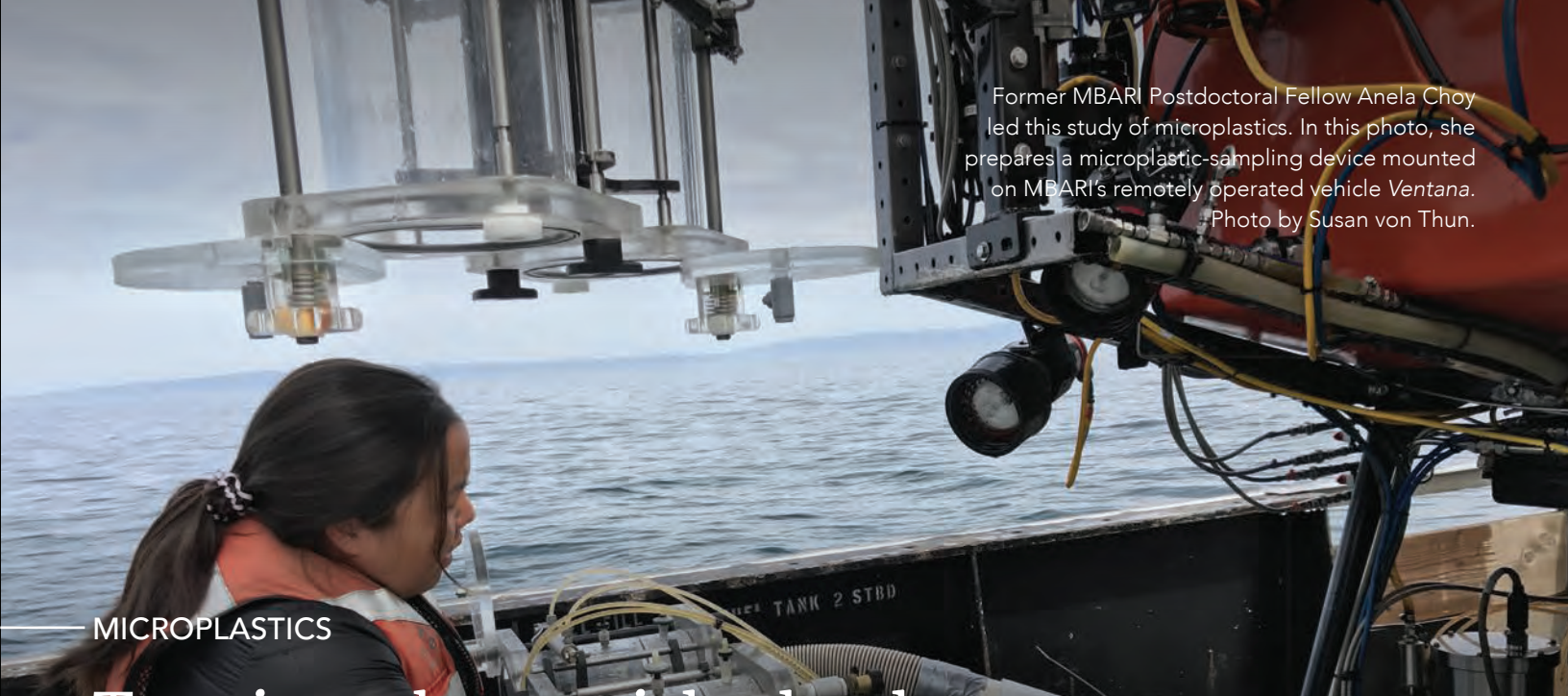
MESOBOT

A robot that can follow along with a swimming jelly

A new breed of robot promises to open up exciting avenues of research in the deep sea by tracking swimming and drifting animals. This new vehicle, the *Mesobot*, is equipped with low-light, ultra-high-definition (4K) cameras and red lights that are less visible to midwater animals. Its large, slow-turning propellers also make the vehicle less disruptive to deep-sea animals than most remotely operated vehicles.

Though midwater animals are seldom seen, these creatures help support major fisheries such as tuna and billfish. They also provide food for other large animals such as sharks and whales, and help regulate Earth's climate by moving carbon from the surface to deep waters. These animals are incredibly important to a number of processes in the ocean, but we have limited understanding of their behavior and functioning in the difficult-to-access midwaters.

Mesobot was developed by engineers from Woods Hole Oceanographic Institution (WHOI), with critical input from scientists and engineers at MBARI, Stanford University, and the University of Texas Rio Grande Valley. The National Science Foundation, WHOI, MBARI, and the Audacious Project housed at TED generously support this project.



Former MBARI Postdoctoral Fellow Anela Choy led this study of microplastics. In this photo, she prepares a microplastic-sampling device mounted on MBARI's remotely operated vehicle *Ventana*. Photo by Susan von Thun.

MICROPLASTICS

Tagging along with sharks to a mysterious deep ocean gathering spot

Most people have heard about the "Great Pacific Garbage Patch,"—a massive area of debris circling the surface of the North Pacific Ocean. But now, research shows the problem persists far below the ocean's surface.

A joint research project of MBARI and the Monterey Bay Aquarium showed that plastic debris less than five millimeters across, known as microplastic, is common from the surface to the seafloor. This is the first study to look systematically at microplastic, with repeated sampling at the same locations and a range of depths, from just beneath the ocean surface to 1,000 meters (3,281 feet).

The team found nearly identical concentrations of microplastic particles near the surface and in the deepest waters surveyed. Perhaps more startling, they found roughly four times the concentration of microplastics in the midwater between 200 to 600 meters (656 to 1,969 feet) than near the surface. The study also found that small ocean animals are consuming microplastic, which introduces the particles into ocean food webs. The findings support a growing body of evidence pointing to the deep sea, Earth's largest habitat, as the biggest repository of small plastic debris.



INTERNS

Internship program gives students an inside look at working in marine science, technology, and communications

Spending a summer on an ocean-science-research project, developing a new instrument for collecting deep-sea samples, or writing science news stories have proven to be life-changing experiences for many of MBARI's summer interns. The primary goal of the 10-week, paid internship is to provide a unique educational experience for the intern and contribute to the general good of the oceanographic community.

In the 23 years since its inception, the MBARI Summer Internship Program has hosted some 340 undergraduate and graduate students and educators. The program has grown to host as many as 21 interns for the summer, offering a wide range of potential projects focused on science, engineering, communications, or education. As we enter the 24th year of the internship program, it is clear that the benefits to the institution, to the science and engineering communities, and certainly to the interns make the program successful and worthwhile.

Read the full article: annualreport.mbari.org/2019/interns

A deep-sea bamboo coral *Isidella tentaculum* with long stinging tentacles ("sweepers") near the bottom to keep predators away. Seamounts are an important habitat for deep-sea corals.

INFORMING CONSERVATION

Informing marine sanctuary management

The long-standing partnership between MBARI and the Monterey Bay National Marine Sanctuary (MBNMS) provides a roadmap for how to successfully combine ocean science and ocean stewardship. With MBARI's sharp focus on increasing access to and understanding of the ocean and the National Ocean and Atmospheric Administration's (NOAA) broad mandate for public service, the collaborations showcase how fundamental research can help shape ocean resource management. Over the years, MBARI has provided MBNMS scientists with access to the deep sea and continues to collaborate on research that can be used to inform policy decisions.

Several MBARI projects are making an impact in the Monterey Bay, with results potentially applicable more broadly:

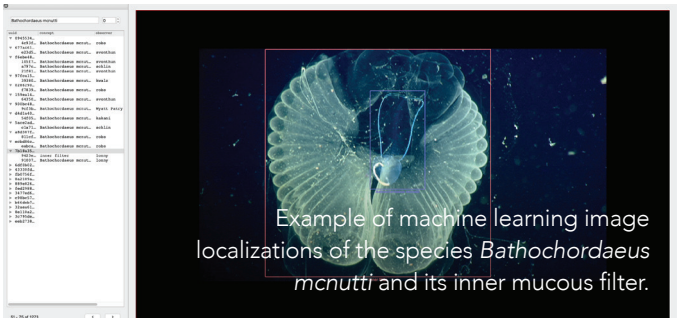
- Seafloor mapping and remotely operated vehicles dives revealed an incredible diversity of life at Davidson Seamount. The discoveries from this exploration were used to support the seamount's inclusion in the sanctuary. It is now considered one of the best-studied and best-protected seamounts in the world.
- While exploring the seafloor with ROV *Ventana*, researchers discovered a lost shipping container within the sanctuary. In the first survey of its kind, MBARI and MBNMS researchers described how deep-sea communities were impacted by the container. The research helped government agencies in formulating standards for the shipping industry.
- A microphone stationed deep on the seafloor in Monterey Bay has given the sanctuary a rare glimpse of animal behaviors and interactions. It has also provided a unique opportunity for public outreach by bringing the sounds of the ocean to the Sanctuary Exploration Center in Santa Cruz, California.

Read the full article: annualreport.mbari.org/2019/noaa

On the Horizon

Read the full articles:
annualreport.mbari.org/2019/horizon

The R/V *Western Flyer* sailing along the calm seas of the Gulf of California.



Example of machine learning image localizations of the species *Bathochordaeus mcnutti* and its inner mucous filter.

Diving back into the Gulf of California

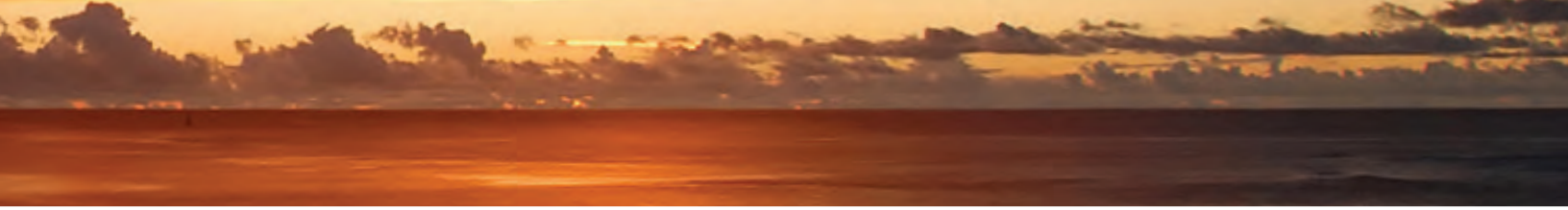
MBARI's research vessels ***Western Flyer*** and ***Rachel Carson*** will return to the Gulf of California, Mexico—a region that holds scientific appeal for many reasons. Returning to the region for the third time in a decade, researchers are interested in studying how the gulf's warm water and expansive oxygen minimum zone are an analog of what Monterey Bay could become in the future, given a warmer climate.

Two MBARI mapping autonomous underwater vehicles (AUVs) will provide high-resolution bathymetric maps to help direct subsequent remotely operated vehicle (ROV) operations. The suite of robots will also include the MiniROV and the i2MAP (Investigations of Imaging for Midwater Autonomous Platforms) video system. This robotic fleet will give researchers the information to further expand our understanding of life in the deep sea, and how it is changing over time.

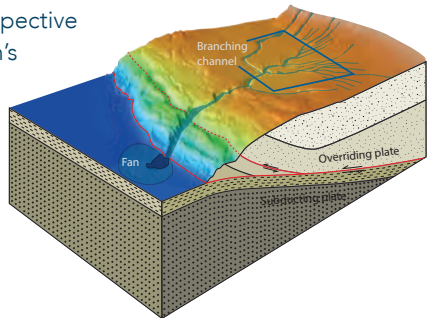
Machine learning offers new insights for analyzing video

As video imagery is collected from an increasing number of MBARI deep-sea cameras, the deluge of data presents both a challenge and an opportunity: How do we capitalize on the valuable information it contains without requiring an armada of highly skilled video annotators? Several machine learning projects aim to leverage this unique data to train algorithms, analyze underwater video, and aid in the tedious manual annotation process.

MBARI and partners at CVision AI and the Massachusetts Institute of Technology's Media Lab are building the FathomNet database, which will generate training data for machine learning algorithms. Another project will develop tools to localize and track objects visible in video. In addition to speeding up the process of analyzing MBARI's deep-sea video and enhancing algorithms for automated detection and classification of marine organisms, this technology can be exported to peer organizations and strengthen the future of machine learning for ocean imagery.



Three-dimensional perspective view of Trinidad Canyon's bathymetry, with schematic drawing of the underlying structure along the Cascadia Subduction Zone.



Deciphering Cascadia's mega-earthquakes history

A suite of robotic seafloor surveying and sampling tools developed at MBARI has made it possible to document previous high-energy, avalanche-like, submarine sediment flows. Expeditions with the US Geological Survey will use MBARI's tools and techniques to explore, map, and sample submarine canyons crossing the lower slope of the Cascadia Subduction Zone in the Pacific Northwest.

The history of mega-earthquakes can be reconstructed from evidence of tsunamis left in the sediment, and seafloor deformation produced by faults. The relationship between the earthquake deformation revealed in mapping surveys, the character of sediment deposits, and the timing and age of those deposits promises to reveal an independent record of recent large earthquakes. These efforts will advance the understanding of tectonic deformation, submarine canyon sediment flows, and earthquake history along the Pacific continental margin and provide critical information for regional hazard assessment.

The ESP team sets up all the equipment and software so they can leave the ESP unattended to operate for weeks at a time.

Can we use DNA to automate fish counts?

Sixty thousand baby coho salmon are released annually into Scott Creek in Northern California. Understanding how this effort helps fish populations has required tedious daily hand counts. Now, MBARI's Environmental Sample Processor (ESP) is gathering data that may revolutionize the way fish counts are conducted.

Without a human presence, the ESP has collected water samples at the creek for a full year, filtering out traces of DNA—known as environmental DNA, or eDNA—from tiny particles of skin, mucus, and waste left behind by animals in the creek. Researchers are now analyzing those DNA samples to determine what animals were present.

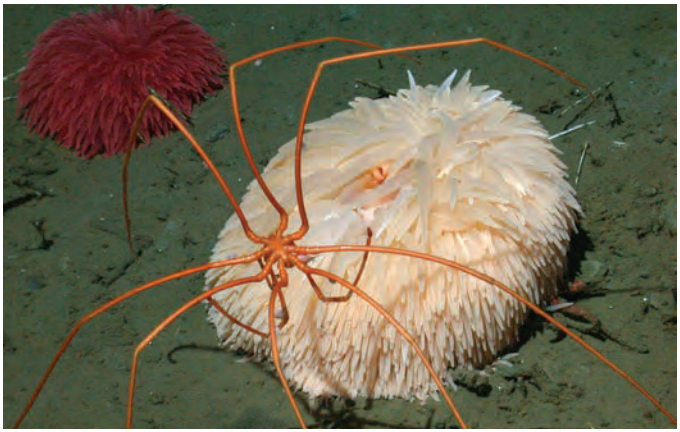
The research is a joint project of MBARI and the Monterey Bay Aquarium, with funding from the Arthur Vining Davis Foundations in collaboration with the National Oceanic and Atmospheric Administration (NOAA). It's part of MBARI's continuing effort to provide scientific data with direct application for ocean and wildlife conservation.

Weird and Wonderful

Read the full articles:
annualreport.mbari.org/2019/weird

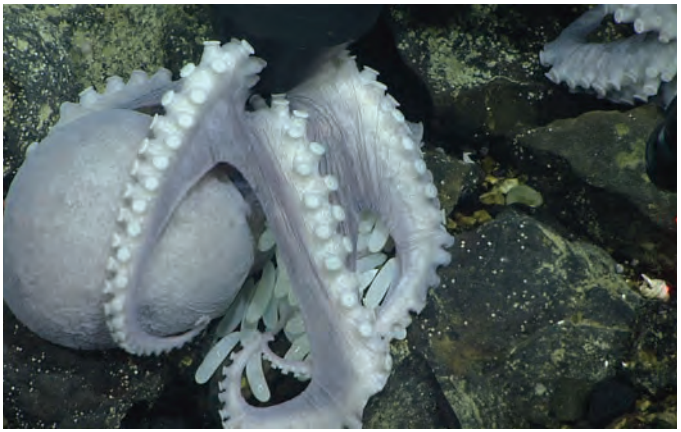
Swimming sea cucumbers

It can be hard to travel from place to place for many of the animals that live on the seafloor and move slowly. Most sea cucumbers (holothurians) live a sedentary life on the bottom of the ocean, eating sediment or detritus that rains down from above. But some sea cucumbers leave their sedentary lives temporarily by swimming. They may do this as a defense behavior, or to find a mate. Sea cucumbers have made remarkable adaptations to master the challenges of living in the deep sea.



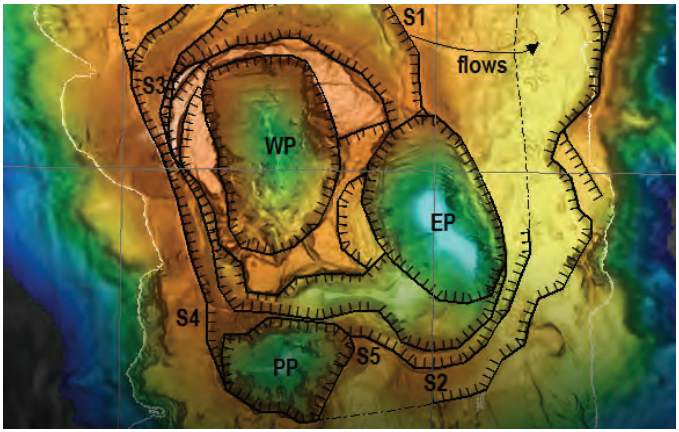
Giant sea spiders

Pycnogonids are deep-sea animals related to the spiders we see on land, so they are often called "sea spiders." They are fairly common in tide pools, but these intertidal species are typically small and hard to see. In contrast, deep-sea pycnogonids can have long legs that grow to over 50 centimeters (20 inches) across! At least two species of the *Colossendeis* group have been observed by MBARI remotely operated vehicles deep in Monterey Canyon. These spiders are quite mobile and can walk or swim using their eight legs. Pycnogonids are "suctorial" predators—most species feed by sucking the bodily fluids from other marine animals. They feed primarily on anemones, such as the pom-pom anemone, *Liponema* sp.



Octopus Garden

An octopus garden seems like the perfect description for aggregations of hundreds of octopuses—most of them brooding females—at the base of Davidson Seamount just outside of Monterey Bay. The aggregations of *Muusoctopus robustus* were discovered in late 2018 during a NOAA Ocean Exploration cruise. Along with NOAA collaborators who discovered the site, MBARI returned to the octopus garden in 2019 to investigate these curious aggregations. Researchers collected data about the warm springs around the egg clusters and the respiration rates of the octopuses to learn more about any advantage they gain from nesting in cozy warm waters.



The birth of a Hawaiian island

Hawaii's youngest volcanic island—known as Loihi—is currently growing 1,000 meters (about 3,300 feet) below the ocean surface at the southeastern end of the Hawaiian Islands. Researchers had previously been unable to make maps because the data from previous surveys were "messy." MBARI researchers used MB-System, a seafloor mapping software package, to create a new map, resulting in a high-resolution map revealing details of several summit calderas. Where multiple calderas overlap, geologists can determine the eruption history of the volcano. Mapping these events will help researchers better understand the life stages of active Hawaiian volcanoes and could help geologists prepare for future eruptions.

In Memoriam

Roman Marin III

Senior Research Technician

Roman Marin III, a 23-year employee of MBARI, helped to develop the first Environmental Sample Processors—robotic bio-chemistry laboratories that have provided unprecedented views of life in the ocean and in freshwater. He was essential in getting these extremely complicated devices to work, and to work reliably, in a wide variety of environments—from the deep seafloor to remote streams in Yellowstone National Park and the mountains of Montana.

mbari.org/roman-marin/

Frank Roberts

Former MBARI Board Member

Frank Roberts was a director emeritus on the MBARI Board of Directors. A prominent lawyer in the San Francisco Bay Area, he was MBARI Founder David Packard's personal attorney and close friend. Roberts was a founding member of the MBARI board; his legal expertise was highly valued in board meetings, and he was a beloved and admired colleague.

mbari.org/roberts-passing/

Walter Munk

Former MBARI Board Member

Walter Munk served on the MBARI Board of Directors from the institute's inception in 1987 until 2003. He was a world-renowned leader in the study of the oceans during his 80-year career as a professor and researcher at Scripps Institution of Oceanography. Munk was one of MBARI Founder David Packard's most trusted advisers when Packard was considering the establishment of an oceanographic research institute.

mbari.org/walter-munk/

Awards

Kelly Benoit-Bird

Norma Slepecky Memorial Lecturer, Syracuse University

Blinks Memorial Lecturer, Stanford University

Knute Brekke

Distinguished Alumnus Award

University of Wisconsin-Eau Claire, Barron County

Rachel Harbeitner Clark

Doctoral degree

University of California, Santa Cruz

Heidi Cullen

Friend of the Planet Award

National Center for Science Education

Andrea Fassbender

Early Career Scientist Leadership Award

US Climate Variability and Predictability Program

William Kirkwood

Distinguished Technical Achievement Award

IEEE Oceanic Engineering Society

John Ryan

Research Award

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San Francisco Culinary Ventures LLC

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The David and Lucile Packard Foundation

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Professor Emeritus
Naval Postgraduate School

Dona Crawford
Associate Director of Computation (Retired)
Lawrence Livermore National Laboratory

Susan Hackwood, Ph.D.
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Eric O. Hartwig, Ph.D.
Associate Director of Research (Retired)
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Dean Emeritus, College of Ocean and Fishery Sciences
Professor Emeritus, School of Oceanography, University of Washington

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Hopkins Marine Station,
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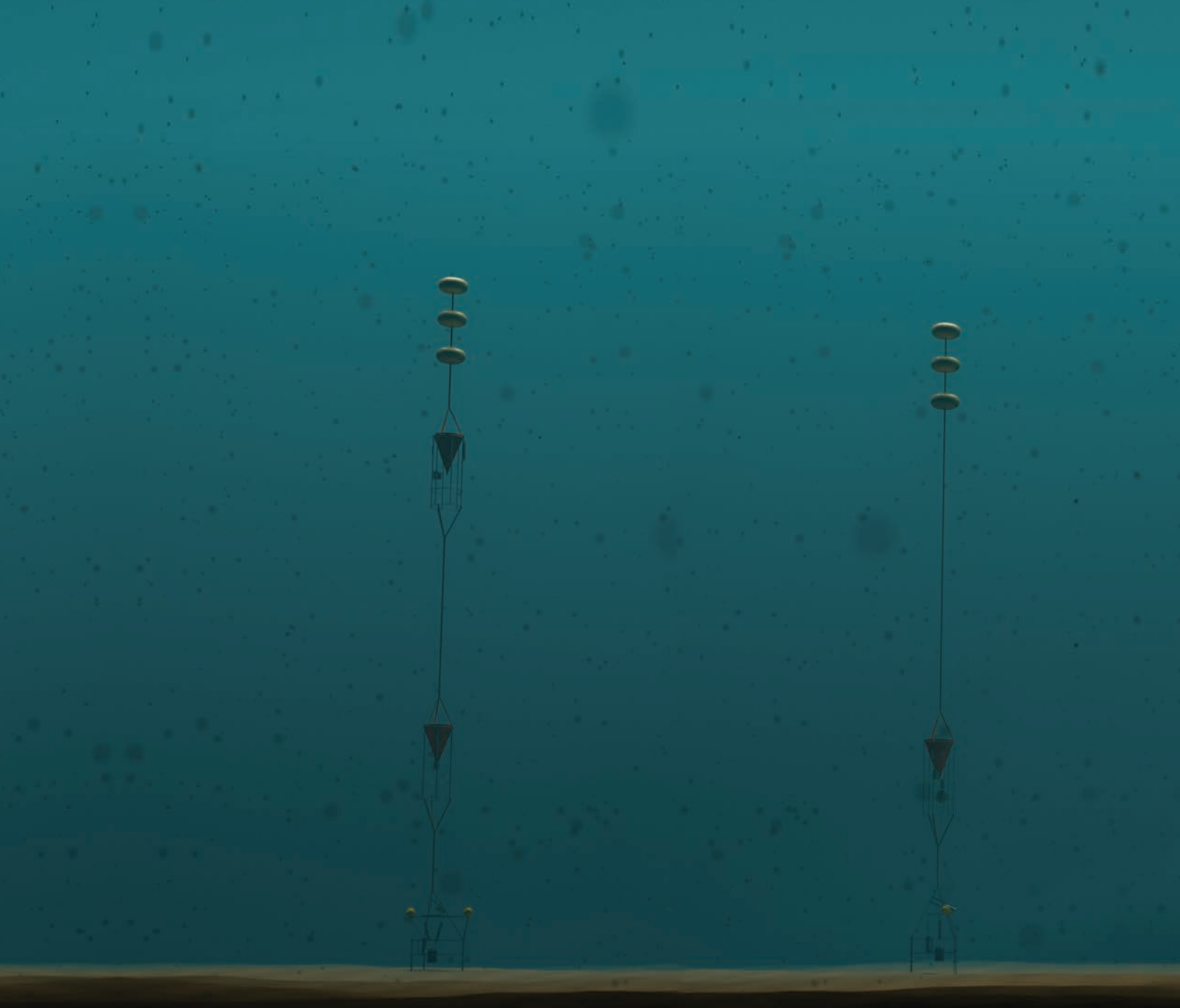
John Zicker
Chief Data Scientist at conDati, Inc.

MBARI

Funded by the David and Lucile Packard Foundation, the Monterey Bay Aquarium Research Institute is a private non-profit research center that conducts fundamental research and technology development in the ocean sciences. The overarching goals of MBARI are to develop innovative technologies for exploring and understanding the ocean and sharing the knowledge and solutions gained with the global marine science and conservation community as well as the general public.

Photo by Bobby Bryant.



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