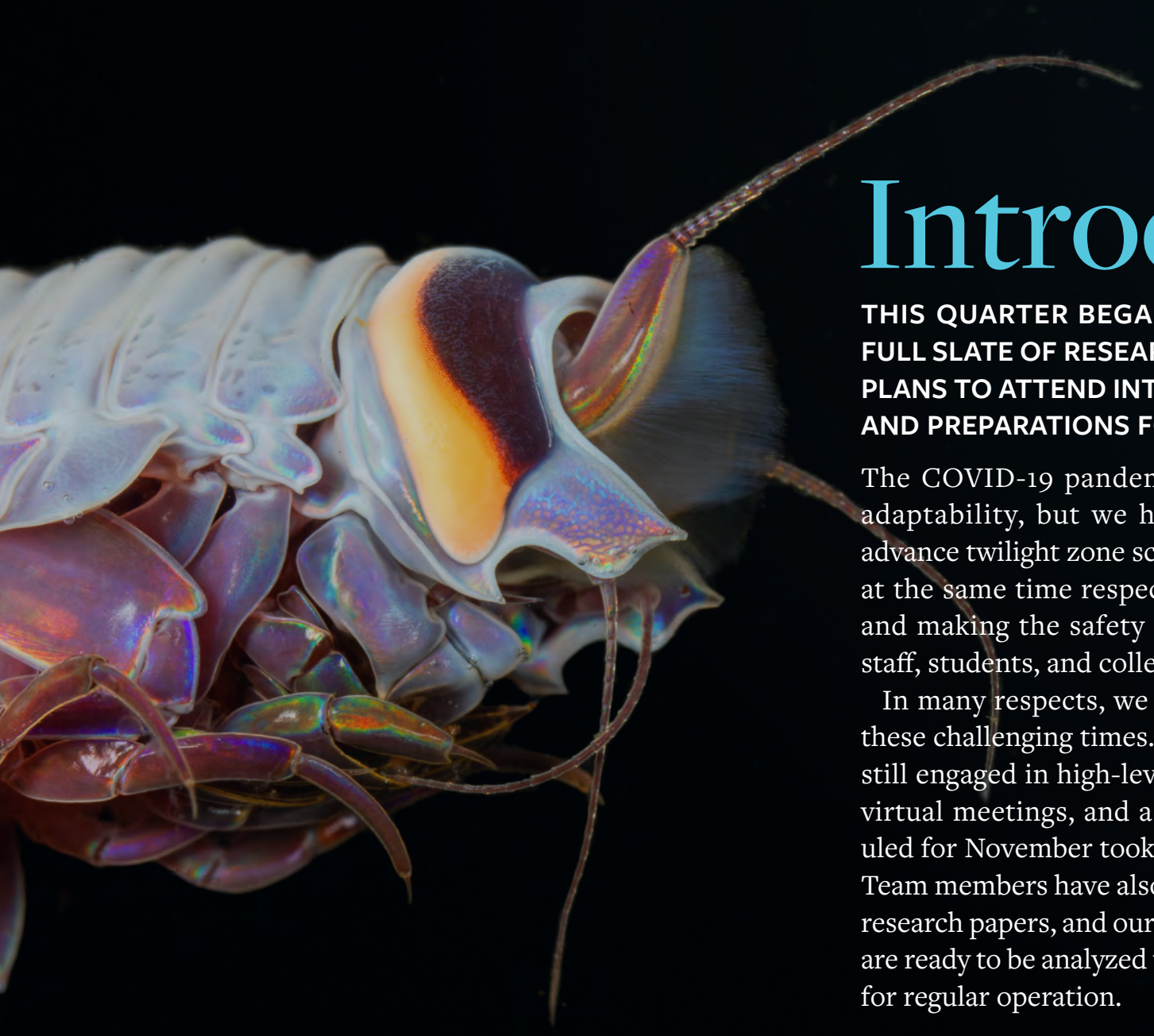
OCEAN TWILIGHT ZONE

WOODS HOLE OCEANOGRAPHIC INSTITUTION

2020 Q1 REPORT



Introduction

THIS QUARTER BEGAN LIKE MANY OTHERS, WITH A FULL SLATE OF RESEARCH AND OUTREACH ACTIVITIES, PLANS TO ATTEND INTERNATIONAL POLICY MEETINGS, AND PREPARATIONS FOR UPCOMING CRUISES.

The COVID-19 pandemic has tested our resilience and adaptability, but we have forged ahead, continuing to advance twilight zone science, technology, and policy, while at the same time respecting social distancing restrictions and making the safety and health of our team members, staff, students, and colleagues our first priority.

In many respects, we have been fortunate in the face of these challenging times. Key members of the OTZ team are still engaged in high-level policy discussions via email and virtual meetings, and a research cruise previously scheduled for November took place in March with barely a hitch. Team members have also used their time to write and revise research papers, and our freezers remain full of samples that are ready to be analyzed the moment the Institution reopens for regular operation.

LEFT: This **hyperiid amphipod** is a member of the crustacean family, many of which typically act as parasites to gelatinous neighbors, such as salps. COVER: The mouth of this **pelican eel** (*eurypharynx pelecanoides*) is loosely hinged, and can be opened wide enough to swallow a fish much larger than the eel itself. Both images were taken on the March R/V Armstrong cruise by Paul Caiger © Woods Hole Oceanographic institution.

2020 Q1 Highlights

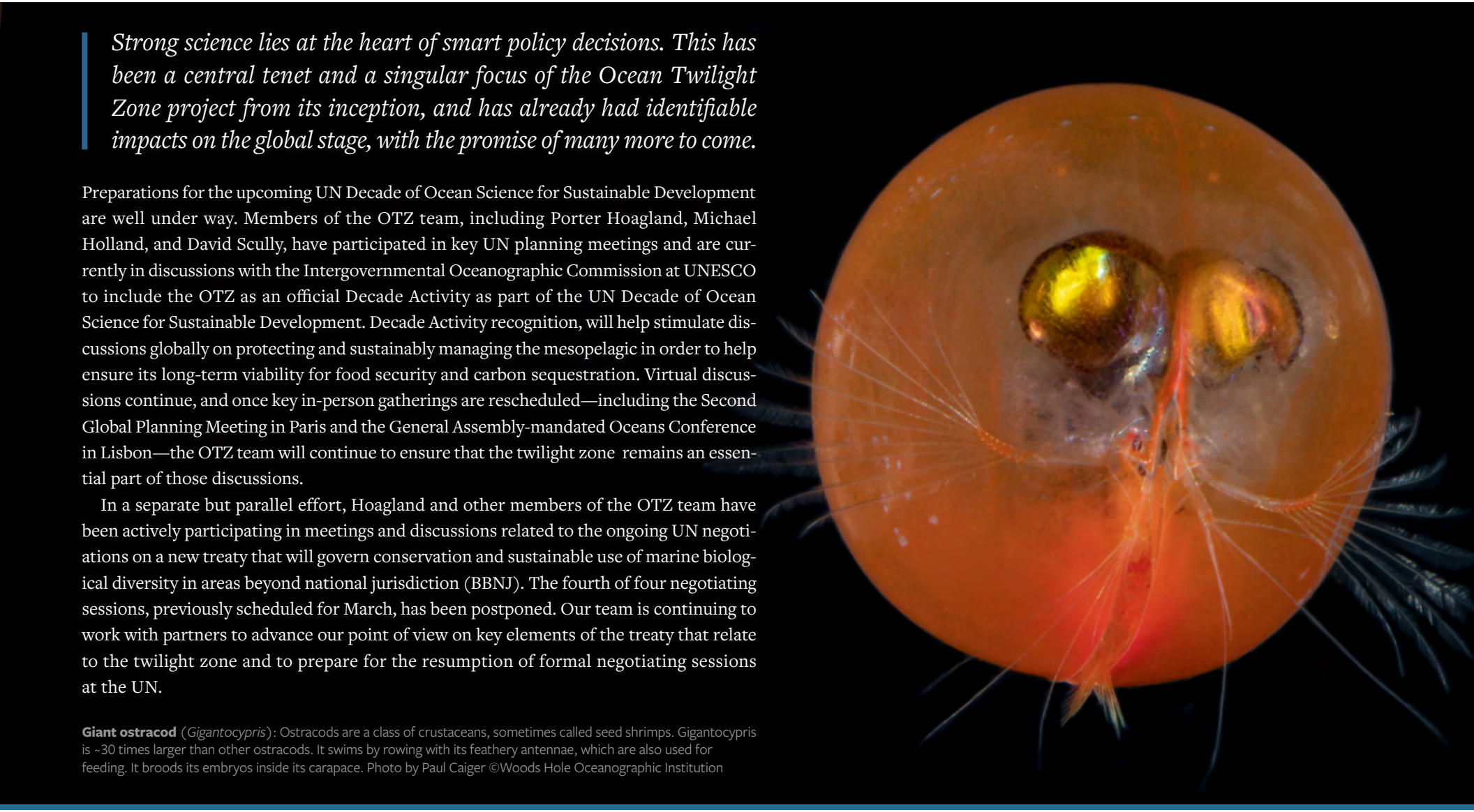
- The team completed an ambitious six-day research cruise on R/V *Neil Armstrong* out of Woods Hole. With five net tows, five successful deployments of the robotic vehicle *Mesobot*, and 28.5 hours towing a shadowgraph camera system (pictured right), the expedition exceeded our already ambitious goals. Pictured right, lead scientist Heidi Sosik lowers the plankton imaging system into the water.
- Marine policy expert Porter Haogland and other members of our team hand-delivered copies of the OTZ Ecosystem Services Report to key UN delegates, including the European Union's, at two international meetings.
- The team released a new video highlighting discovery and exploration: The Ocean Twilight Zone: Earth's Final Frontier.
- OTZ project carbon expert, Ken Buesseler, chaired the first meeting of JETZON, an international collaboration of mesopelagic research groups at the Ocean Sciences Meeting, a biennial conference organized by the American Geophysical Union. In addition, six other team members presented new OTZ research at the conference.
- Ken Buesseler published two high profile papers, one in Nature about the need for more research in the twilight zone now and one in PNAS about improving climate models by accurately defining the twilight zone based on light levels rather than depth.
- The OTZ team welcomed a new dedicated science writer, David Levin. David has worked with WHOI as a freelancer for almost a decade and has a strong background in covering oceanographic research.

Spotlight on Policy

Strong science lies at the heart of smart policy decisions. This has been a central tenet and a singular focus of the Ocean Twilight Zone project from its inception, and has already had identifiable impacts on the global stage, with the promise of many more to come.

Preparations for the upcoming UN Decade of Ocean Science for Sustainable Development are well under way. Members of the OTZ team, including Porter Hoagland, Michael Holland, and David Scully, have participated in key UN planning meetings and are currently in discussions with the Intergovernmental Oceanographic Commission at UNESCO to include the OTZ as an official Decade Activity as part of the UN Decade of Ocean Science for Sustainable Development. Decade Activity recognition, will help stimulate discussions globally on protecting and sustainably managing the mesopelagic in order to help ensure its long-term viability for food security and carbon sequestration. Virtual discussions continue, and once key in-person gatherings are rescheduled—including the Second Global Planning Meeting in Paris and the General Assembly-mandated Oceans Conference in Lisbon—the OTZ team will continue to ensure that the twilight zone remains an essential part of those discussions.

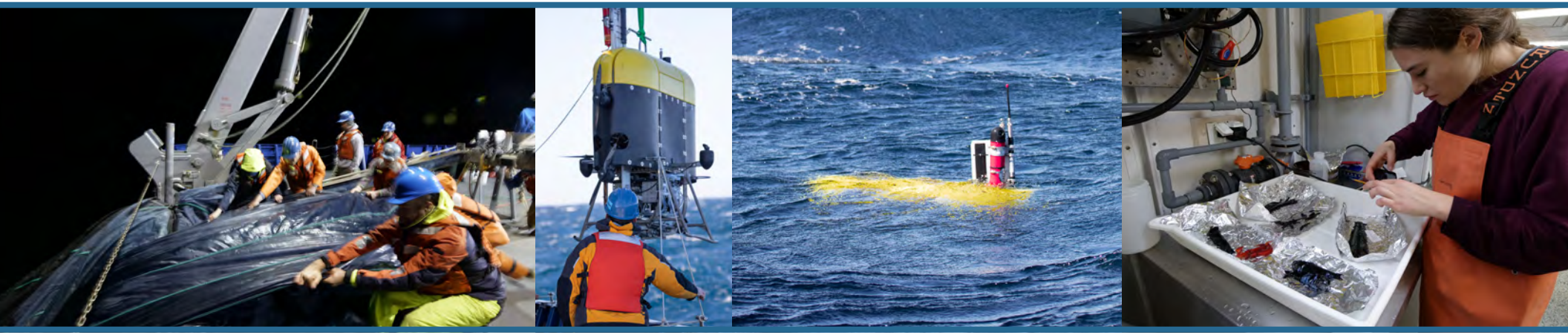
In a separate but parallel effort, Hoagland and other members of the OTZ team have been actively participating in meetings and discussions related to the ongoing UN negotiations on a new treaty that will govern conservation and sustainable use of marine biological diversity in areas beyond national jurisdiction (BBNJ). The fourth of four negotiating sessions, previously scheduled for March, has been postponed. Our team is continuing to work with partners to advance our point of view on key elements of the treaty that relate to the twilight zone and to prepare for the resumption of formal negotiating sessions at the UN.



Giant ostracod (*Gigantocypris*): Ostracods are a class of crustaceans, sometimes called seed shrimps. Gigantocypris is ~30 times larger than other ostracods. It swims by rowing with its feathery antennae, which are also used for feeding. It broods its embryos inside its carapace. Photo by Paul Caiger ©Woods Hole Oceanographic Institution

OTZ on *Neil Armstrong*

Back in November, forecasts of strong winds and high seas forced the cancellation of an OTZ expedition aboard R/V Neil Armstrong. *The rescheduled cruise sailed from Woods Hole under fairer skies in March, but only after the science party and crew had completed a risk-assessment for exposure to COVID-19.*



Photos: Ken Kostel, Paul Caiger ©Woods Hole Oceanographic Institution

Once safely away from the dock, the team turned their attention to making the most of their six days at sea. After deploying two MINION prototypes and a surface drifter—a device that helped the team follow the same mass of water for several days and nights—everyone set about deploying other instruments. These included MOCNESS (Multiple Opening/Closing Net and Environmental Sampling System); a plankton imaging system; a conductivity, temperature, and depth (CTD) rosette; and *Mesobot* equipped with two new radiometers and a multi-chamber eDNA sampler. These numerous deployments made for a rigorous schedule, with two teams standing 12-hour watches, and several people staying up to lend a hand after their watch ended. The only unfortunate turn occurred when, at the very end of the cruise, the MINIONs failed to report back so that they could be collected.

In all, the team completed five MOCNESS tows, seven CTD casts, five *Mesobot* deployments, and 28.5 hours of continuous imaging by the towed system at a rate of 14 images per second. The team came back with enough samples, data, and images to make delaying the cruise well worth the wait. Image and data processing began at sea; processing and analyzing the physical samples will resume as soon as the Institution re-opens in the near future.

Making carbon models more accurate

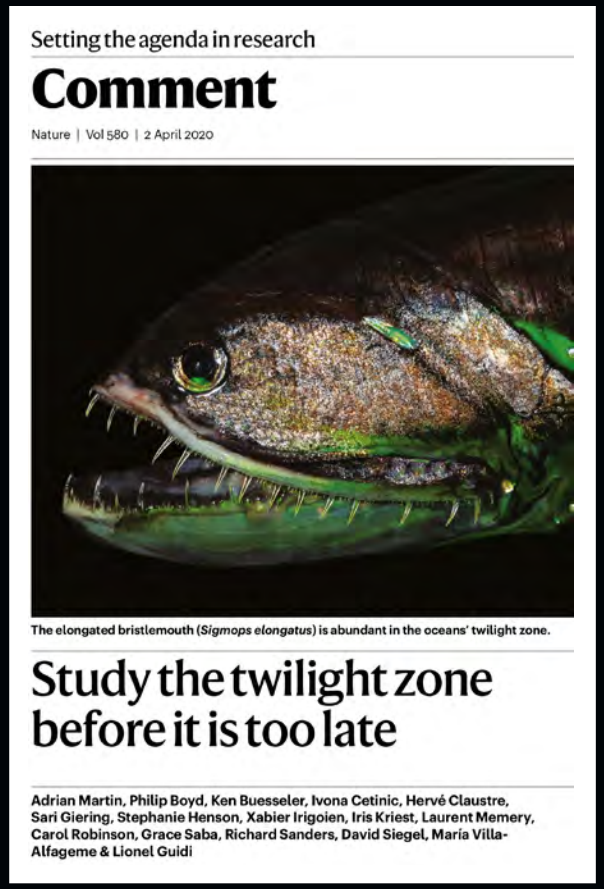
TWILIGHT ZONE RESEARCH SHOWS THE OCEAN CAPTURES FAR MORE CARBON THAN EXPECTED

A more accurate definition of where the sunlit zone ends and where the twilight zone begins reveals that the ocean may be storing more heat-trapping carbon than we thought. The biological carbon pump, which moves carbon from the surface into deeper waters, and away from the atmosphere, may be twice as efficient as previously estimated, when you define the twilight zone with light, rather than by depth. Climate modelers can use this more accurate measurement to improve the accuracy of their predictions. Read more about this article published April 6 in the journal PNAS.

Marine chemist Ken Buesseler (right) deploys a sediment trap from the research vessel Roger Revelle during a 2018 expedition in the Gulf of Alaska. Buesseler's research focuses on how carbon moves through the ocean. Buesseler and co-authors of a new study found that the ocean's biological carbon pump may be twice as efficient as previously estimated, with implications for future climate assessments. Photo by Alyson Santoro © Woods Hole Oceanographic Institution

Forging international collaborations

KEN BUESSELER, LEAD OTZ PROJECT SCIENTIST FOR THE STUDY OF CARBON AND CLIMATE, CO-LED THE FIRST FORMAL MEETING OF THE Joint Exploration of the Twilight Zone Ocean Network, or JETZON, in February at the biennial Ocean Sciences Meeting in San Diego. The discussion focused on how the international community of twilight zone researchers can coordinate their work to provide a forum for all interested in the twilight zone to interact, build collaborations, and share data and opportunities. JETZON currently involves 18 projects led by scientists from 12 different countries. Read more about this critical effort in an article published April 2 in Nature.


Setting the agenda in research

Comment

Nature | Vol 580 | 2 April 2020

The elongated bristlemouth (*Sigmops elongatus*) is abundant in the oceans' twilight zone.

Study the twilight zone before it is too late

Adrian Martin, Philip Boyd, Ken Buesseler, Ivona Cetinic, Hervé Claustre, Sari Giering, Stephanie Henson, Xabier Irigoien, Iris Kriest, Laurent Memery, Carol Robinson, Grace Saba, Richard Sanders, David Siegel, María Villa-Alfageme & Lionel Guidi

JETZON

Web, Earned Media, and Social Media

ALL DATA REPORTED FOR THE FIRST QUARTER

WEB

44 STORIES **21,447** PAGE VIEWS

EARNED MEDIA

88 STORIES WORLDWIDE **346,675,309** POTENTIAL REACH

TOP MEDIA Q1

14 million REACH

SOCIAL MEDIA

406,991 TOTAL IMPRESSIONS **13,983** TOTAL ENGAGEMENTS

153,339 IMPRESSIONS
7,142 ENGAGEMENTS

114,403 IMPRESSIONS
1,968 ENGAGEMENTS

99,716 IMPRESSIONS
7,202 ENGAGEMENTS

415 CLICKS
610 ENGAGEMENTS

3489 VIEWS
11,517 IMPRESSIONS

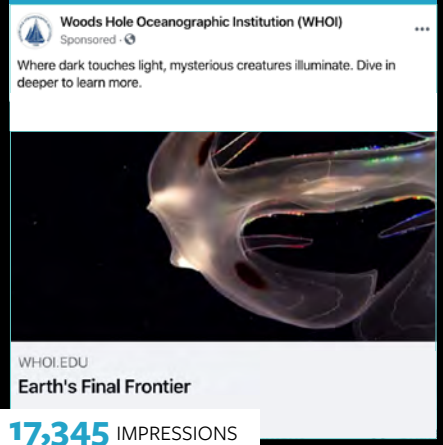
TOP WHOI NEWSLETTER STORY

1,371 CLICKS

TOP SOCIAL MEDIA POST

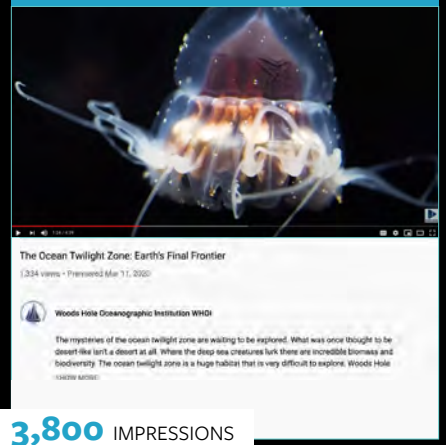
16,480 IMPRESSIONS

TOP FACEBOOK AD



17,345 IMPRESSIONS

TOP YOUTUBE VIDEO



3,800 IMPRESSIONS

A new Ambassador to the Twilight Zone

ARIA RITZ FINKELSTEIN thought she wanted to pursue a career in land-based natural resource management. Then she bought a sailboat and her ambitions changed course. Now that boat has become her home, and the ocean—specifically, the twilight zone—has become her primary focus.

Finkelstein, a Ph.D. candidate in Urban Studies and Planning at MIT, is currently a guest student in WHOI's Marine Policy Center, where she helps make recommendations for sustainable management of the ocean twilight zone.

"When I realized that people were using the same ecological planning methods on land to manage ocean spaces, I got really excited to learn about the work going on," Finkelstein said.

Today, she works with her WHOI advisor, Porter Hoagland, to help translate insights from the Ocean Twilight Zone project to policymakers. In 2019, she accompanied Hoagland and members of the Deep Ocean Stewardship Initiative to speak about this unique ecosystem at meetings to negotiate an international treaty that regulates biodiversity beyond national jurisdiction. *Read more about Finkelstein's work here.*

The Ocean Twilight Zone Project is embarking on a journey to explore and understand one of our planet's last great frontiers—the ocean twilight zone. Our project will combine exacting science, innovative technology, and broad engagement to turn knowledge into actions that improve understanding of our planet and how to live sustainably on it.

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