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OCEAN TWILIGHT ZONE

WOODS HOLE OCEANOGRAPHIC INSTITUTION

The Ocean Twilight Zone project is a six-year, large-scale, interdisciplinary research effort to transform understanding of mesopelagic ecosystems, inform high-seas regulatory decision-making, and ultimately enhance ocean stewardship before large scale commercial exploitation efforts are realized. While based within WHOI, OTZ collaborations and partnerships extend throughout the US and international research community to help meet the ambitious goals of accelerating the pace of discovery and bringing science, technology and society together to foster sustainable interactions between people and the ocean.

Science



CARBON & CLIMATE CHANGE

Our goal is to unravel controls over the flow of carbon through the twilight zone to improve predictions of how climate change will play out there in the future.







A NEWLY DESIGNED TOWED PLATFORM WITH ADVANCED ACOUSTICS AND IMAGERY

Deep-See combines "full spectrum" (1-500 kHz) acoustics with holographic and high resolution camera systems. The towed vehicle is capable of reaching depths of 2000m and conveys data in real time. This combination of sensors is a powerful tool for studying the widest range of questions possible about diversity, abundance, and nature of life in the ocean twilight zone. Funding for the development of *Deep-See* came from the National Science Foundation.

Engagement



POLICY

A central theme of our engagement efforts is to ensure that the twilight zone is a critical part of international negotiations on a future treaty establishing equitable and sustainable use of marine resources that fall outside of national jurisdictions. Our scientists are also working with policy experts to quantify the economic value of mesopelagic resources and their ability to impact the carbon cycle and hence climate.



BIOMASS AND BIODIVERSITY

Using a combination of new technology such as *Deep-See* and eDNA with more traditional towed nets the project aims to identify key methodology to estimate biomass and biodiversity in the twilight zone.



LIFE HISTORIES AND BEHAVIOR

Before we can understand how human activity might affect any given species we need to understand how quickly a population can replenish itself and how organisms behave in their natural environment.



FOOD WEBS

Limited data suggests that mesopelagic life is a critical food source for life in the surface ocean. The OTZ project will provide new insight into how fishery activity in the twilight zone will affect the entire ocean ecosystem.



A SMART, STEALTHY NEW ROBOT TO TRACK LIFE IN THE TWILIGHT ZONE

Mesobot is designed to let scientists observe the twilight zone by autonomously tracking individual animals for hours or even days without disturbing the environment or disrupting their behavior. *Mesobot* is a collaborative effort by WHOI, Monterey Bay Aquarium Research Institute (MBARI), Stanford University, and the University of Texas Rio Grande Valley. The project was initiated with funding from the National Science Foundation.



RAISING AWARENESS

By emphasizing visual storytelling to capture the public's interest and imagination, we aim to inspire a movement raising awareness about the importance of the twilight zone ahead of widespread exploitation.



OPEN DATA

Data produced as part of the OTZ project is available in near-real time. We are working to develop a platform that enables key stakeholders to rapidly access scientific data, analyses, and will serve as our public-facing storytelling engine for the dissemination of multimedia.

A DISRUPTIVE FUNDING MODEL

The OTZ project is grateful for the remarkable generosity and vision of the foundations and individuals who are making science and exploration in the ocean twilight zone a reality through their support of The Audacious Project.

WHAT IF WE COULD DO THINGS DIFFERENTLY THIS TIME?

Much of the twilight zone lies beyond national boundaries, in the high seas where relatively few laws or regulations apply. Knowing that the twilight zone is under imminent threat gives great urgency to efforts to study it and to understand how it is connected to other parts of the ocean and the planet. But this can also be seen as a great opportunity—to build a body of knowledge to support sciencebased policies that ensure ecosystem health and sustainable, equitable use of twilight zone resources.

NEW LOW-COST SENSORS WILL PROVIDE DISTRIBUTED ACCESS TO THE TWILIGHT ZONE IN UNPRECEDENTED WAYS

ROAM TAGS

New satellite tags, both smaller and more accurate than tags in current use, will make it possible to track sharks and other large predators in three dimensions as they move through the twilight zone over months or years.

MINION (MINiature IsOpycNal) floats are a small, inexpensive devices weighted to be neutrally buoyant at a pre-selected depth in the twilight zone that will photograph particles of marine snow as they fall from above.

MINION

RADIOMETER

TWILIGHT ZONE EXPLORER Twilight Zone Explorer (TZEx), will give researchers new insight into the movement of organic carbon.

A new generation of low-cost, easy-to-use radiometers under development will enable virtually any underwater vehicle or instrument to become an ultra-sensitive light sensor.

The Dalio Foundation The James Family The Craig & Susan McCaw Foundation The Robertson Foundation Anonymous (2)

TWILIGHTZONE.WHOI.EDU