



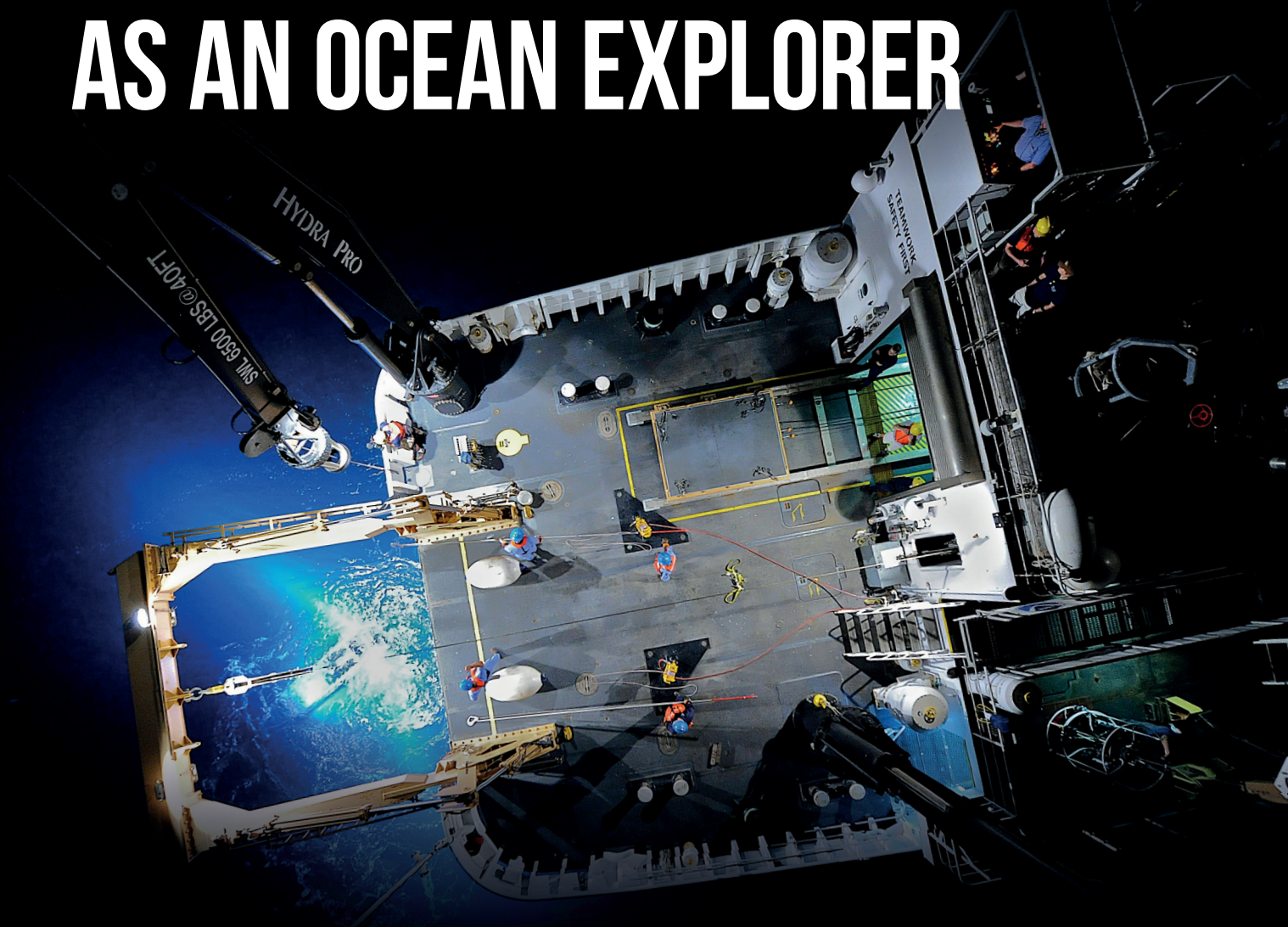
SOCIETY

 PATRICIA ALBANO

# A SEA OF OPPORTUNITIES: SEE YOURSELF AS AN OCEAN EXPLORER



NOAA Ocean Exploration is dedicated to exploring the unknown ocean, unlocking its potential through scientific discovery, technological advancements, partnerships, and data delivery. We are leading national efforts to fill gaps in our basic understanding of the marine environment, providing critical ocean data, information, and awareness needed to strengthen the economy, health, and security of the United States and the world. Explore with us: [oceanexplorer.noaa.gov](https://oceanexplorer.noaa.gov)



## EXPLORING THE OCEAN IS A BIG JOB

Close your eyes and imagine a big ship, far out at sea, no land in sight. What is going on inside that ship? Can you see filmmakers on their computers, editing videos from the day's remotely operated vehicle (ROV) dive? Chefs in the galley, making sure the team is well-fed for the day ahead? How about scientists in the lab, cataloguing deep-sea rock samples? Now, stretch your imagination and see yourself on that ship, exploring the ocean and learning about the mysteries of the deep.

▼ When you close your eyes and imagine an ocean exploration expedition, can you see yourself on this ship? NOAA Ship *Okeanos Explorer* is equipped with cutting-edge technologies and capabilities that allow mission personnel onboard to retrieve data from the deep and livestream exploration efforts to the world!



The ocean is a big place. It is the largest livable space on our planet, housing more life than anywhere else on Earth. Despite its importance, our understanding of the ocean is limited, especially its deep waters. Only about 20% of the global seafloor has been mapped to modern standards and scientists estimate that two-thirds of marine species are yet to be discovered or described. As a community, ocean explorers have made awe-inspiring strides toward increasing our understanding of the chemical, biological, geological, physical, and archaeological

aspects of the ocean; however, there is a lot of work left to be done. Knowing this, you can now picture how busy it must be on that ship that you imagined earlier and why ocean explorers need you to join them in accomplishing this mission.

Ocean explorers aim to make discoveries by systematically mapping and exploring unknown or poorly understood areas of our global ocean. In the process, explorers take observations and collect data that can be used for scientific research serving a variety of purposes. This includes supporting policymakers who introduce new laws

or international agreements to restore and conserve our oceans. By revealing the ocean's secrets, we can uncover new resources for the food we eat, the energy that keeps our lights on, and even life-saving medicines. Ocean exploration can give us a better sense of weather and climate patterns which help to predict and respond to natural disasters. As the Earth's climate changes around us, we look to the ocean to learn more about how we are affecting our home planet and what these changes mean for the future of humanity.

Exploring remote, hard-to-reach places is no small feat. The crushing pressure, endless darkness, and extreme temperature of the deep ocean create big challenges that require creative solutions from exploration teams. Oftentimes, these challenges are turned into opportunities that drive the development of new innovations. From underwater robots to depth-defying sonars and from environmental DNA to satellites in space, ocean exploration brings our imaginations to life by going to places that no one has been before—and bringing back vital data in the process!

Now, ask yourself, what would you do as an ocean explorer? What new species might you discover? Which technology might you design? Luckily for you, ocean exploration is a big job. Let's learn about how it's done!

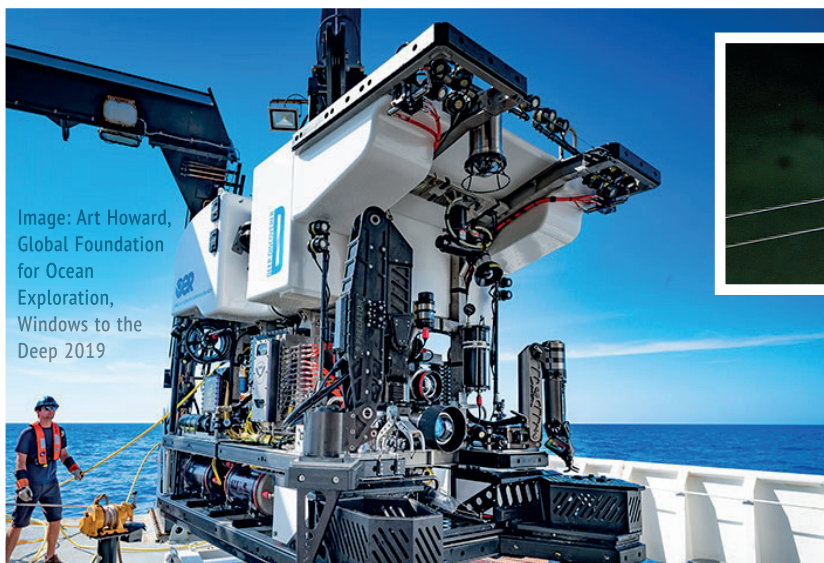
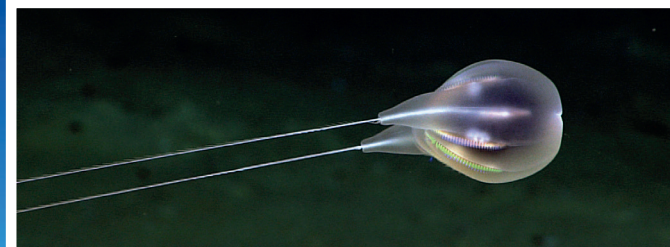


Image: Art Howard, Global Foundation for Ocean Exploration, Windows to the Deep 2019

Image: NOAA Ocean Exploration, Océano Profundo 2015



Remotely operated vehicles (ROVs) like *Deep Discoverer* (left) help us reach previously unexplored areas of the deep sea. ROVs require highly skilled engineers to design, operate, and maintain them. Processing, analyzing, and organizing the data they collect requires the expertise of scientists and data managers. Sometimes that data even contains glimpses of new species, like this comb jelly (above) that was seen in the deep waters off of Puerto Rico and was identified as a new species using video data alone!

# SO WHAT DOES AN OCEAN EXPLORER DO ANYWAY?

Ocean exploration is a diverse field. While it can be easy to assume that exploration is only conducted by scientists or SCUBA divers, the reality is that anyone can be an explorer, and it takes all sorts of interests and expertise to accomplish mission goals.

The day-to-day life of an explorer varies depending on job focus area, educational background, and the type of organization you work for. The thought of ocean exploration can seem like something straight from an adventure movie: sailing the high seas in search of the unknown. While some jobs will fulfill this fantasy and others will have you

play a critical role back on dry land, all ocean exploration careers require hard work, the ability to navigate challenges, and usually a lot of time spent working behind your computer. Let's take a deep dive into some of the categories that ocean exploration jobs may fall into and the levels of education that they typically require.

"My love for science inspired me to have a career where I get to explore the world and everything that's in it."

Dr. Kimberly Galvez, Expedition Chief Scientist, Viking Cruises



**Marine Geologist**



**Remotely Operated Vehicle Pilot**

"As ROV engineers we get to explore parts of the deep ocean that no person has ever seen before!"  
Chris Ritter, ROV Engineer and Pilot, The Global Foundation for Ocean Exploration

"Since I was really young, having a camera in hand to document life around me was just part of living for me."



Alex DeDiccio, Media and Production Specialist, University of Rhode Island Inner Space Center

**Documentarian or Media Specialist**



**Science Communicator**

"My work involves explaining scientific information in a way that inspires people."  
Shelby Johnson, Outreach Specialist and Coordinator, NOAA Ocean Exploration



**Deep Sea Biologist**

"As a deep-sea biologist, I get to be an explorer."  
Dr. Diva Amon, Science Advisor, Benioff Ocean Initiative, University of California, Santa Barbara

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**Hydrographer (seafloor mapper)**

"What I enjoy most about being a seafloor mapper is providing the "where are we in the world" for all of the exciting things that we discover."

Shannon Hoy, Lead Expedition Coordinator, NOAA Ocean Exploration



Learning about unknown places



Teaching people exciting things



**Ocean Educator**



"I chose to become an ocean educator, because I am able to use my expertise to share my passion for our living waters."  
Suraida Nanez-James, Education Specialist, NOAA Ocean Exploration

Learning about history



**Maritime Archaeologist**



"A combined love for our oceans and history led me to maritime archaeology."  
Phil Hartmeyer, Maritime Archaeologist, NOAA Ocean Exploration

Writing code and making things on a computer



**SO I COULD BE A...**

**Computer Scientist or Technologist**



"As a technologist, I build the tools that allow scientists to do their work and report their findings to the world."  
Patrick Cooper, Artificial Intelligence and Machine Learning Architect, NOAA Ocean Exploration

Playing video games

**SO I COULD BE A...**

Writing stories and connecting with people



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Learning about the Earth

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Creating photos and videos to tell stories

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Learning about animals and plants

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## Maritime Archaeology

Maritime archaeologists investigate sites, objects, and remains in the ocean that have a connection to human society. This can include searching for shipwrecks, identifying sunken airplanes, or even investigating flooded coastal landscapes from the last ice age! This field is one of the ways that social science overlaps with ocean exploration. Many maritime archaeologists hold undergraduate and postgraduate degrees in history, maritime studies, anthropology, or one of the natural sciences (like geology, biology, or chemistry).

## Physical Oceanography

These scientists study the physical conditions and processes that occur in the ocean, including currents, air-sea interactions, waves, tides, and the relationships between these features. Physical oceanographers use ocean observations and datasets derived from satellites to develop models that increase our understanding of the ocean's properties. They typically have undergraduate and postgraduate degrees in physics, marine or environmental science, oceanography, biology, geology, or chemistry.

## Marine Biology

Marine biologists study life in the ocean. Some may focus on specific species, ranging from microscopic bacteria to giant whales, and others concentrate on entire ecosystems like coral reefs or seagrass beds. Marine biologists provide information about ocean life that deepens our understanding of ecosystem functionality, which can help us be better caretakers of the ocean's living resources. These explorers usually hold undergraduate and postgraduate degrees in ecology, environmental or marine science, marine biology, general biology, fisheries, or other natural sciences.

## Marine Chemistry and Biochemistry

Marine biochemists study the chemistry of living organisms, while marine chemists are focused on the chemical composition, processes, and conditions of the ocean that these organisms call home. If you are interested in how the ocean can support human health, then this may be the field for you! One major facet of marine chemistry and biochemistry is the study of marine microbes that have potential pharmaceutical or biotechnical applications. Marine chemists or biochemists often hold undergraduate and postgraduate degrees in chemistry, biochemistry, biology, or marine science.

## Marine Geology

Marine geologists study seafloor structure, sample and age rocks and sediments, and map seafloor features. These explorers often focus on the origin and age of seamounts, crustal plates and their processes, the occurrence and distribution of hydrothermal vents and methane seeps, and geohazards.



Marine geologists usually have undergraduate and postgraduate degrees in geology, earth science, geological oceanography, geography, or marine science. Some may even have degrees in climate science if their work is more focused on learning about the Earth's history to understand climate change.

## Hydrography

Hydrography is the science of measuring and describing physical features of bodies of water like oceans, rivers, lakes, and coastal areas. In the ocean exploration world, hydrographers are often involved with mapping the bathymetry (depth) of the seafloor and discerning what lies underneath it using sonars and other instruments that provide measurements using sound. Hydrographic data is essential for future exploration and research in poorly understood regions of the ocean and can be critical for safe maritime navigation. Hydrographers can come from many different educational backgrounds, but most have either undergraduate and/or postgraduate degrees in geography, geospatial information systems, geology, marine science, or oceanography. Sometimes, professional hydrographers also obtain special licenses or certifications that qualify them to do their seafloor mapping jobs!

## Science Communication

Sharing scientific findings with different audiences can bridge gaps in knowledge between scientists, policymakers, and the general public. By engaging with people who care about the ocean, science communicators help to translate research into new laws and personally connect people with discoveries that will inspire them. Science communicators rely on strong skills in writing, storytelling, and public speaking. And work closely with scientists to ensure that the excitement of exploration reaches as many people as possible! These explorers often hold undergraduate and/or postgraduate degrees in one of the natural sciences, communications, English or creative writing, or sometimes even the social sciences.

### Visual and Creative Arts

Through different mediums of creative work, artists can visually display scientific findings and discoveries in engaging ways. Art has the power to connect on a deeper level, which can inspire and encourage people to care more about the ocean and its conservation. As a filmmaker, multimedia artist, photographer, or graphic designer, you can apply your skills to have a major impact on scientific engagement by sharing the wonders of the ocean with many people. Visual and creative artists often have undergraduate and/or postgraduate degrees in fine arts, communications, media and design, or natural science. This versatile career path is great for those who love science but are also skilled artists!

### Ocean Engineering

Ocean engineering is a subdiscipline of the field of engineering. Those with mechanical, electrical, or computer engineering backgrounds can apply their knowledge of technology, software development, and physics to advance exploration operations and achieve scientific goals. Many ocean engineers specialise in the development and use of innovative equipment, like ROVs, used to study the ocean. These engineers adapt technology to the dynamic marine environment and are essential in enabling the exploration of areas where no one has ever been before. Many ocean engineers hold undergraduate and/or postgraduate degrees in various types of engineering including mechanical, electrical, computer, aerospace, chemical, and, of course, ocean engineering!



### Education

Ocean educators teach the next generation of explorers by laying the foundations for scientific investigation, inspiration, and ocean stewardship. From classroom teachers to education staff at aquaria, science centers, and even the government, educators support all types of ocean learning. Through collaborations and partnerships, ocean educators advance science, technology, engineering, and maths (STEM) education globally. Typically, ocean educators hold undergraduate and/or postgraduate degrees in education or one of the natural sciences.

### Vessel Operations

A functioning ship and knowledgeable crew are critical to successful ocean expeditions. From navigation to onboard engineering and daily maintenance, there are many shipboard roles to be fulfilled. Ship personnel can include officers, engineers, deckhands, chefs, technicians, and more. Their roles are key in ensuring ship safety and operation, which allows for mission personnel to successfully conduct exploration, mapping, and research activities. Oftentimes, these explorers may hold certifications or other qualifications to safely operate research vessels. Many will hold undergraduate and/or postgraduate degrees in engineering or one of the natural sciences.

### Computer and Data Science

At the forefront of technological innovation, computer and data scientists provide important skills and knowledge that advance ocean science. Computer and data science involves the study and use of computing systems with incorporation of data, information systems, and artificial intelligence. This discipline has a foundation in maths, engineering, and statistics and these explorers are typically interested in coding, building things on their computers, or creating graphs and charts. This fast-growing field is important for progress in understanding our ocean. Computer and data scientists typically have undergraduate and/or postgraduate degrees in computer science, data analytics or data science, computer or software engineering, or mathematics. No matter which degree they hold, these explorers usually have strong skills in computer coding or web development.

As you now know, ocean exploration has many potential career paths to choose from. Explorers who hold these positions are unique in their own ways, but they share common values of curiosity, determination, creativity, and an eagerness to learn. Hopefully you are pretty excited about the depths of possibility ahead and, like a true explorer, are wondering what you can do to get there. Doing well in school and staying curious about the natural world are great ways to start. As you consider higher education, think about which degree programs will suit your interests and help you achieve your goals based on careers you could see yourself having. While it is important for ocean explorers to have good grades in the classroom, it is also essential to gain hands-on experience through training or internship opportunities. These special programs will help you develop the skills you need to have competitive job applications in your future career and can be very useful in determining where your interests lie. With so much left to explore, any career pathway you choose will be crucial for advancing our collective understanding of the ocean!

## “SEA” YOURSELF AS AN OCEAN EXPLORER

Exploring the ocean is a team effort. Whether you are an officer on the ship’s bridge guiding safe navigation (top left), an engineer deploying sensitive instruments for data collection (top right), an intern in the control room learning seafloor mapping operations (bottom left), or a submersible pilot or scientist awaiting vehicle launch (bottom right), you are essential to furthering our collective understanding of the ocean.

▼ Brianna Pacheco, NOAA Commissioned Corps (Image credit: NOAA Ocean Exploration, Deep-Sea Symphony: Exploring the Musicians Seamounts).

▼ Christina Rodriguez and Kira Smith, University of Washington Applied Physics Lab (Image Credit: Coordinated Simultaneous Physical-Biological Sampling Using ADCP-Equipped Ocean Gliders).



▲ Kathrin Bayer and Daryin Medley, NOAA Ocean Exploration Explorers-in-Training. (Image Credit: Caitlin Bailey, GFOE, 2022 Caribbean Mapping).

▲ Bureau of Ocean Energy Management (BOEM) archaeologist Willie Hoffman and pilot Randy Holt (Image credit: John McCord, UNC CSI, Battle of the Atlantic expedition).

From describing new species to designing cutting-edge technologies, the ocean is full of opportunity. As explorers, we meet the challenges and demands of the deep with excitement, not just for the discoveries to be made but for what we will learn along the way. With millions of square kilometers of seafloor left to be mapped and the deepest depths of the ocean remaining largely unseen, we need future explorers like you to aid in humanity’s understanding of our home planet. While there may

be long days, sleepless nights, and questions that we sometimes just cannot yet answer, ocean explorers have the privilege of being the first to see things that no one has ever seen before and sharing that thrill with the public. With each expedition, we learn new ways of working together as a community, have our breath taken away as underwater robots glance at never-before-seen features, and, most importantly, we inspire the world to explore with us. What will we discover next? Well, that’s up for you to explore. 🌐