

AskScience AMA Series: We're scientists on a NOAA mission to explore the deep, unseen waters off Hawaii. Ask Us Anything!

NOAAgov¹ and r/Science AMAs¹

¹Affiliation not available

April 17, 2023

Abstract

Hello Reddit! We are Chris Kelley (deep-sea biologist, University of Hawaii at Manoa), Daniel Wagner (research specialist, NOAA Papahānaumokuākea Marine National Monument), Kelley Elliott (NOAA ocean explorer) and Meme Lobecker (NOAA seafloor mapping expert). We are joined by the Mission Team onboard the NOAA Ship Okeanos Explorer to answer your questions about our expedition to explore the deep waters off Hawaii. We are on the second of four expedition legs and are exploring in Papahānaumokuākea Marine National Monument. We will also later explore Johnston Atoll in the Pacific Remote Islands Marine National Monument. These large marine protected areas are national symbols of ocean conservation; however, given their remote location, the vast majority of deeper waters in these areas remains unseen by human eyes. Learn more about the expedition here: <http://oceanexplorer.noaa.gov/okeanos/explorations/ex1504/welcome.html> Throughout the expedition, we are using remotely operated vehicles (ROVs) to explore the seafloor, and our ROVs' video streams are being transmitted via satellite from ship to shore. This means anyone with an Internet connection can tune in LIVE with scientists from around the world sharing an unprecedented glimpse of never-seen-before deep marine habitats. Access the live video here: <http://oceanexplorer.noaa.gov/okeanos/media/exstream/exstream.html>. We expect to encounter large, diverse coral and sponge communities; explore ancient seamounts; map the seafloor; and learn more about the geologic history of the area. Information collected during the expedition will support management decisions to protect what we know as well as what we have yet to discover. We have all participated in numerous deep-ocean exploration missions. (joining us is /u/melanostomias) We're here from 2:00 pm ET to 4:00 pm ET to answer your questions about the Hawaiian expedition or ocean exploration in general...AUA! Thanks everyone for participating today! Great questions! We got a lot of questions regarding advice for folks looking to get into careers in deep-ocean exploration. A couple of good resources on this topic include: <http://oceanexplorer.noaa.gov/okeanos/explorations/ex1404/logs/sept21/sept21.html> and <http://oceanexplorer.noaa.gov/edu/oceanage/welcome.html>. The NOAA Corps Program is another opportunity worth looking into (<http://www.noaa.gov>). Also, for those interested in the weird and wonderful discoveries we are making on this expedition, be sure to visit our website (<http://oceanexplorer.noaa.gov/okeanos/explorations/ex1504/welcome.html>) often, as we are adding new logs, images, and videos all of the time. And of course, you can tune in to the live video feeds and join us for our dives:<http://oceanexplorer.noaa.gov/okeanos/media/exstream/exstream.html>. Weather and all other things permitting, we'll be diving through the end of September. Thanks again! Onward and downward!

[REDDIT](#)

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NOAAGOV [R/SCIENCE](#)

ABSTRACT

Hello Reddit!

We are Chris Kelley (deep-sea biologist, University of Hawaii at Manoa), Daniel Wagner (research specialist, NOAA Papahānaumokuākea Marine National Monument), Kelley Elliott (NOAA ocean explorer) and Meme Lobecker (NOAA seafloor mapping expert). We are joined by the Mission Team onboard the NOAA Ship Okeanos Explorer to answer your questions about our expedition to explore the deep waters off Hawaii.

We are on the second of four expedition legs and are exploring in Papahānaumokuākea Marine National Monument. We will also later explore Johnston Atoll in the Pacific Remote Islands Marine National Monument. These large marine protected areas are national symbols of ocean conservation; however, given their remote location, the vast majority of deeper waters in these areas remains unseen by human eyes. Learn more about the expedition here:

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Throughout the expedition, we are using remotely operated vehicles (ROVs) to explore the seafloor, and our ROVs' video streams are being transmitted via satellite from ship to shore. This means anyone with an Internet connection can tune in LIVE with scientists from around the world sharing an unprecedented glimpse of never-seen-before deep marine habitats. Access the live video here:

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We expect to encounter large, diverse coral and sponge communities; explore ancient seamounts; map the seafloor; and learn more about the geologic history of the area. Information collected during the expedition will support management decisions to protect what we know as well as what we have yet to discover.

We have all participated in numerous deep-ocean exploration missions. (joining us is [u/melanostomias](#)) We're here from 2:00 pm ET to 4:00 pm ET to answer your questions about the Hawaiian expedition or ocean exploration in general...AUA!

Thanks everyone for participating today! Great questions! We got a lot of questions regarding advice for folks looking to get into careers in deep-ocean exploration. A couple of good resources on this topic include:

<http://oceanexplorer.noaa.gov/okeanos/explorations/ex1404/logs/sept21/sept21.html> and

<http://oceanexplorer.noaa.gov/edu/oceanage/welcome.html>.

The NOAA Corps Program is another opportunity worth looking into (<http://www.noaacorps.noaa.gov/>).

Also, for those interested in the weird and wonderful discoveries we are making on this expedition, be sure to visit our website (<http://oceanexplorer.noaa.gov/okeanos/explorations/ex1504/welcome.html>) often, as we are adding new logs, images, and videos all of the time.

And of course, you can tune in to the live video feeds and join us for our

dives: <http://oceanexplorer.noaa.gov/okeanos/media/exstream/exstream.html>. Weather and all other things permitting, we'll be diving through the end of September.

Thanks again! Onward and downward!

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CORRESPONDENCE:

DATE RECEIVED:
August 13, 2015

DOI:
10.15200/winn.143938.81812

ARCHIVED:
August 12, 2015

CITATION:
NOAAgov , r/Science ,
AskScience AMA Series: We're
scientists on a NOAA mission
to explore the deep, unseen
waters off Hawaii. Ask Us
Anything!, *The Winnower*
2:e143938.81812 , 2015 , DOI:

Hello guys! Thanks for taking some field time to do this AMA!

A couple of questions:

- Sounds like there is quite a lot of terrain to look at - how do you select specific targets for the dives?
- Could you elaborate about the geological objectives of your project? What are you hoping to see in those parts?
- Have you encountered any hexactinellids in the sponge communities you have encountered so far? If so, what can you tell us about them?
- Could you please share the link to your live feed? I'm sure several of us would love to peek over your shoulder as you carry out your underwater traverses so to speak, and might even have some specific questions about what they see onscreen as the AMA progresses. Thanks for the link!

[10.15200/winn.143938.81812](https://doi.org/10.15200/winn.143938.81812)

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Gargatua13013

Hi Gargatua13013,

Here are answers to a couple of your questions. We're waiting for our sponge expert to weigh in and answer your last question. Will edit this answer when we have more info.

The priority operating area for this expedition was identified by management needs in the region. We identify the specific dive targets by looking at high-resolution multibeam bathymetry and choosing a feature of interest. We also are specifically looking at deepwater features, as there has never been any work in Papahānaumokuākea National Marine Monument deeper than 2,000 meters. We are using this expedition to investigate habitats that no one has ever seen before!

One of the geologists on our science team wrote a web log about the geologic objectives of the cruise. Check it out: <http://oceanexplorer.noaa.gov/oceanos/explorations/ex1504/logs/aug6/aug6.html>

We have seen lots of hexactinellid sponges down there; in fact, almost all of the sponges we've seen are in that group. Some are well known to myself because I am a sponge enthusiast; however, some are species that I have never seen before. We have collected a few of these and I have done quick and dirty spicule preps to take a look under the microscope. I did that this morning with a sponge that I think I know to genus level, but it has a completely different colony morphology than any of the other three known species in this genus. Furthermore, this genus is fascinating because it has a commensal anemones that live throughout the sponge and we don't know what those are either. --CK

Thanks for doing this AMA! Exciting work!

- **Are there any organisms in particular you are expecting to see aside from corals and sponges?**
- **Even a smaller section of the ocean is a big place! How do you decide where to focus?**

Alantha

(Chris) We expect to see lots of animals living in the corals and sponges, such as squat lobsters, feather stars, shrimps, and anemones. We also expect to see other types of animals not living on the corals and sponges, such as crabs, sea lilies (stalked crinoids), and some fish -- but not many. Most fish at this depth seem to prefer soft substrates rather than rocky areas.

On this expedition, we are focusing on ridges, which we believe provide consistent topography. What I mean is that a ridge runs in one direction, and if that direction is appropriate for disrupting current flow, you can get current acceleration over the top as the water tries to get up and over. This is where we hope to find the most corals and sponges, which filter the water and thus benefit from higher current flow.

A few slightly more technical questions:

- **There's a lot of ocean to cover and little time to do it! What sort of fraction of the ocean floor do you visit with the ROVs within a given expedition area?**
- **Are there any other instruments fitted or measurements that will be done other than visual and sonar imaging?**
- **If any interesting sites are found, are they given additional mission time for more intensive study, or is the focus more on charting as large an area as possible? Are there other missions that are likely to follow up on any results?**

Dannei

We usually cover anywhere from 300 to 1,000 meters of seafloor during a dive, but this varies greatly depending on what we are seeing, if we are stopping to take samples, and the terrain. So on an individual dive, we only get to see a small fraction of the seafloor, but usually it is the first time anyone has ever seen that particular area where we are exploring -- even just this small peek is useful for others as they look to conduct follow-on research.

Our ROVs have CTD (conductivity, temperature, and depth) sensors and dissolved oxygen sensors. During this expedition, we have also been collecting biological samples of novel observations and geologic samples that will provide clues as to the origin of the Hawaiian volcanoes.

We always hope that the explorations that we conduct on NOAA Ship Okeanos Explorer inspire follow-on research. All of our data is publicly and freely available 60-90 days after an expedition ends, making it really easy for scientists to spend additional time investigating what we find. Find out more information about accessing our data here: <http://oceanexplorer.noaa.gov/oceanos/data.html>.

After this leg of the current expedition concludes on August 24, we will have two more legs (August 28-September 3 and September 7-30) that focus on the deepwater habitats around the main Hawaiian

Islands, Geologist Seamounts, and Johnston Atoll.

Thanks for taking questions on this! I have a few specific questions based a bit on my background.

Electromagnetic waves don't really penetrate very far in water, so it can be hard to control ROV's with radio or other EM at long distances. How are you guys communicating with your ROV's? Is it a cabled system?

Aside from the ROV's, what other sensors do you have going to measure things? Do you have any acoustic systems, like line arrays or sonobuoys? Given that it's a conservation area, are there rules that you need to be conscious of regarding underwater noise?

What's the most interesting biologic you've found from an acoustic perspective? Anything that makes a cool sound, or has neat echolocation or anything like that?

[therationalpi](#)

Part of the permit application process to work in the Papahānaumokuākea Marine National Monument included describing our sonar systems. Information about each sonar was provided to the Monument team, and we were given a set of operating parameters to work under: If cetaceans or other protected species (sea turtle, scalloped hammerhead, monk seal) are present within 400 meters of the ship, the ship should stop until the animals depart the area but the sonar should continue transmitting. Minimize turning the multibeam system on and off to reduce the possibility of startle responses by marine mammals that could be in the vicinity of the ship, particularly at night. Leave the sonars on also provides marine mammals advance warning that the ship is in the vicinity, further reducing the possibility of a collision. When the systems have been shut down for any reason, the multibeam soft start mode should be used to minimize any impact on cetaceans. Only after the multibeam has been brought from soft start to full power should the SBP and other sonars then be turned back on. --ML

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[therationalpi](#)

The technology used to position the ROV on the seafloor is called ultra-short baseline, or USBL. A USBL consists of a transceiver mounted on the ship's hull, and a transponder on the ROV. The transceiver creates an acoustic pulse (a measured amount of sound at a specific frequency and length), which can be thought of as the ship saying "Where are you?"

The transponder receives the pulse, and immediately sends back a response pulse, which can be thought of as the ROV saying "I'm over here!"

The transceiver on the ship can tell (1) how long it took for the response pulse to come back, which provides the range (distance) between the ship and the ROV, and (2) the angle that the response pulse was received at, which provides bearing. When combined, the range and bearing provide the ROV's position on the seafloor. --ML

Sorry, but we haven't heard any animals so far. The ROV is not set up to detect biological sounds during the dives but if it were, I'm sure we would hear all types of sounds that shrimp and fishes in particular would be making. --CK

On a previous cruise in Puerto Rico this spring, we detected a large school of dolphins that was swimming around under the ship for several minutes. Occasionally we have observed interference on the multibeam, which looks like a large parabola under the ship, and hypothesized it was a whale.

In addition, we have detected over a thousand gaseous plumes emanating from the seafloor on the Atlantic continental shelf break of the US and in the Gulf of Mexico. When we investigate the plumes with the ROV, we discovered chemosynthetic communities at several sites. We would not have discovered these biological communities without the help of the sonar! --ML

What's the weirdest creature that you've come across, that people here may not know about?

[tdobson](#)

(Daniel) On this expedition we have come across a couple of predatory tunicates that look extremely bizarre. Tunicates, commonly known as sea squirts, have a body with two openings that they use to pump water in and out of their bodies to filter out food.

The specific deep-sea species we have seen on this trip so far looked like a weird translucent alien with a big head that was elevated from the seafloor by a base -- almost like a mix between a Venus fly trap and a jellyfish. What is even weirder is that these tunicates will wait for tiny objects to move inside their mouths and then ingest them.

Good day,

A few questions:

- **What are the operating costs of operating a ROV? How much depth significantly alters the cost?**
- **Any things about the general operation of offshore research vessels that you would like to see change? Anything that, as scientists, you would like to see incorporated into the structure of your endeavor?**
- **How does the funding work for this? Is it lump sum or broken into quarterly (/insert any time) payments?**
- **The Okeanos Explorer is a fascinating ship, anything in particular that you like about it more than other platforms?**
- **Deepsea mapping and research - is it notoriously underfunded? What sort of changes, or initiatives could be incorporated to step up the marine research across the board?**
- **What are the hurdles in the way of researchers currently? How much is funding related, and how much is material (ships/tools/ROVs...etc.) related?**

I've been very curious about the economics of this type of operations.

Appreciate all of your time. Wish a safe journey and may the abyss grant you knowledge.

[TwoCansOfToucan](#)

(Kelley) In general, the costs associated with this expedition fall into two categories: 1) operating and maintaining the ship itself and 2) operating and maintaining the science gear onboard. The later includes things like the ROVs and multibeam mapping system. Though planning and executing this expedition involves many individuals from many different organizations, most - but not all - of the funding comes from NOAA. Since NOAA is a U.S. federal government agency, it receives annual funding through the federal budget process. That process involves both the Executive and Legislative branches of the federal government. Funding for the Hohonu Moana expedition comes from a variety of sources within NOAA.

Okeanos Explorer is one of only a few telepresence-enabled ships on the planet, and the only one that routinely conducts ROV cruises with the majority of the science team located on shore. This presents remarkable opportunities for more scientists and expertise than would typically be available on a traditional research cruise to join the expedition and help characterize previously unknown habitats, increasing the number of observations and potential discoveries!

Telepresence also offers a wonderful opportunity to train and engage the next generation by both allowing student participation in expeditions, and giving the general public a front-row seat to the excitement of ocean exploration and discovery by tuning into the live feeds.

Finally, telepresence can enable a remarkably efficient use of ship time. During a 2014 cruise to the Gulf of Mexico, the power of telepresence was shown when a ROV dive on a site anticipated to be a shipwreck instead revealed an asphalt volcano or "tar lily." Within an hour, the team on shore participating in real-time via telepresence switched from maritime archaeologists to appropriate marine geologists and biologists, including a leading expert on asphalt volcanism.

I'm currently a graduate student in conservation ecology studying things like habitat loss, climate change, and biodiversity impacts.

How does it make you feel when projects like trying to terra-form Mars have incredible publicity, even though the odds of success are slim to none? By that, I mean things like atmosphere and

soil taking millions of years to get just right to support human life. Do you feel like I do that this money is essentially being flushed down the toilet and would be better spent understanding and preserving the planet we actually have?

I feel like reddit loves space because of sci-fi, and they believe in climate change, but everyone seems to accept that earth is screwed and we should hurry up and find the next planet to consume.

[WolveyMcWolverine](#)

Money spent on exploration and gaining a better understanding of our environment, both here on Earth and in space, is never wasted -- we are constantly learning and advancing technology based on what we discover.

Despite the role that the ocean plays in supporting our well being, 95 percent of the ocean remains unexplored. Increasing baseline knowledge of ocean habitats is critical to the conservation and management of these remarkable ecosystems.

Exploratory missions, such as those conducted on NOAA Ship Okeanos Explorer, are necessary to expand our knowledge of the unknown and to provide baseline data for resource managers. We are constantly discovering new habitat, potential new species, and behaviors and interactions that have never been seen before.

We have also found some pretty alien looking things in the deep sea. For example, check out these photos from our recent expedition to the Caribbean:

<http://oceanexplorer.noaa.gov/okeanos/explorations/ex1502/logs/apr13/apr13.html>!

We're also accumulating some good images and videos from our current mission in Hawaii...check out this page: <http://oceanexplorer.noaa.gov/okeanos/explorations/ex1504/logs/photolog/welcome.html>

Thanks for this AMA! How much are deep water environments subject to changes in the ocean due to stuff like climate change and ocean acidification? Also, since we're talking about Hawaii, I'd imagine it's a pretty geologically active area. What do you expect to see with regards to that?

[oceanisneat](#)

Honestly, we know so little about the deep ocean that predicting how it will respond to climate change and acidification is really difficult -- if not nearly impossible. That is why the work we are doing is so important. We need to collect baseline data about the deep ocean so we can see what is changing and how quickly.

Regarding the geology, the area where there is active volcanism in Hawaii is limited to the Big Island and the area just off shore. The area we are focusing our efforts on for this leg of the expedition is much further to the northwest in the Papahānaumokuākea National Marine Monument (<http://www.papahānaumokuākea.gov/>), so we don't expect to see any active volcanism; however, the rocks we collect and the observations we make will help us better understand the geological history of the island chain and may give geologists a better understanding of what is happening in the areas that are currently volcanically active. Here is some additional information about the geological objectives of our current mission: <http://oceanexplorer.noaa.gov/okeanos/explorations/ex1504/logs/aug6/aug6.html>.

I have always wondered why it is that NASA has the semi autonomous probes scowering the solar system for 20+ yrs and the same approach hasnt been taken here on earth within the oceans. Why is it that it seems much of the exploration has been manned and that ROVs usually have operators from submersibles or surface ships? Are there technical challenges or limitations that are more difficult to solve? Budget issues?

[John02904](#)

(Daniel) There are actually quite a few autonomous underwater vehicles (AUVs) that survey the seafloor and require much less regular ship-based support than ROVs or manned submersibles. While these have several advantages over surface-supplied operations, they also have some disadvantages, particularly when they do malfunction and it is hard to get them back to where they can be fixed.

Good luck on your voyages. What sponges do you anticipate, and what do you hope you may find?

Are you also cataloging other invertebrate life you encounter?

[SigmaStigma](#)

We expect to find massive sponges that don't have a common name but are in the family Pheronematidae. Most are also in the genus Poliopogon. These are common, yet spectacular sponges

out here in Hawaii. --CK

We catalog every single organism we encounter during the dives to the lowest taxonomic level possible. This is usually to the genus or family level, because we have not surveyed this area before and therefore many of the organisms are either completely new species or new records to the region. -
-DW

First, thank you for making this AMA. My question is, have you seen any effects from ocean acidification? And if so can you please share with us the results of your experiences. I live on a small island nation & right now ignorance is bliss for a lot of people and without any evidence I can't convince people to change. So my second question is, does your team have a Facebook group or similar social media outlet that I can follow for inspiration? Much obliged and thank you for this chance to speak out.

[deliriouswalker](#)

There are several groups of scientists that work on ocean acidification in the Papahānaumokuākea Marine National Monument, but that is not one of the objectives of this expedition.

To study a phenomenon like ocean acidification you need to be able to return to the same site over time, which is unfortunately not a possibility for many of the deep-water environments that we are targeting during this mission. Recent research on ocean acidification in shallow-water environments of the Monument suggests that reefs in the northernmost section of the Monument are going to be some of the first in the world to experience the effects of ocean acidification, highlighting the importance of protecting and studying this area. --DW

You can follow us on Facebook (<https://www.facebook.com/OceanExplorationResearch>), on Twitter (@oceanexplorer), or on YouTube (<https://www.youtube.com/oceanexplorergov>).

If you find a yellow dive light, probably at about 10,000 feet, that's mine. I was doing a blue water dive about 6 miles off the coast off the southwest side of O'ahu in the late 1980s, and dropped it by accident when we saw a pelagic tiger shark patrolling the area. I'd really like it back! :-) In all seriousness, fantastic research, keep up the great work. There is so much we can learn from the deep oceans, and so many things we can figure out about preserving our ecosystems from the work you folks are doing.

[hmasing](#)

We'll keep an eye out. Unfortunately, isn't uncommon to find human debris on the seafloor, even miles below the surface of the ocean and hundreds of miles offshore!

You can also follow along with the expedition live and look for the dive light yourself (but we probably won't be able to pick it up for you if it's spotted):

<http://oceanexplorer.noaa.gov/oceanos/media/exstream/exstream.html...>

Are these marine protected areas always coral or can they also consist of something else.

[formgry](#)

(Daniel) The Papahānaumokuākea Marine National Monument is a perfect example of a marine protected area that contains a wide variety of species and habitats that include rugged island cliffs, sand dunes, a saltwater lake, shallow-water coral reefs, deep-sea canyons, seamounts, and abyssal plains. In fact, the Monument is home to over 7,000 marine species, only a small fraction of which are corals.

What's the most intriguing creature you've come across so far? Have you discovered any new-to-science species yet?

Thanks for taking the time to answer our questions :D

[ElkeKerman](#)

(Chris) I think the most intriguing animal we have seen so far was a stalked tunicate which apparently is predator. I have never seen anything like that and it was simply gorgeous and bizarre.

How do you find the age of the corals beneath? And what factors are responsible to know how healthy the current environment is for ocean life?

[dacricketer](#)

Corals have a very slow growth rate and can live to be hundreds of years old. For example, one black coral specimen, which is the species *Leiopathes*, has been aged at over 4,000 years, making it the

longest-lived marine organism known. Although it is difficult to tell a coral's age, it is possible to do so by collecting the base of a coral skeleton and counting the growth rings (similar to how we age trees). Find out more here: <http://oceanexplorer.noaa.gov/explorations/13midatlantic/logs/may11/may11.html>.

Several factors play into what makes an environment ideal for marine life and over time species have adapted to live in their specific habitat. There are several places where it seems amazing that life exists where the hostile conditions would seem to preclude life, for example in the deep ocean (where there is immense pressure, no light, and nearly freezing temperatures) and at hydrothermal vents and methane seeps, where many creatures actually rely on chemicals for nourishment.

Hey thanks for doing this AMA!

I was always curious about what are those straight and somewhere parallel lines visible from GoogleEarth on the ocean floor west of the Canary Islands, more accurately at 31 °N;24° W. I couldnt find any facts on the internet concerning these, only fictional assumptions.

Was there any scientific research on these, or is there anything planned?

[Aint_Kitten](#)

The lines you are seeing show the paths taken by ships using sonar to map small sections of the ocean floor in greater detail. While these formations are human-made, they are only made of data. In other words, there are no physical lines on the ocean floor. These lines are artifacts of the ocean floor mapping process. Here's more information: <http://oceanservice.noaa.gov/facts/atlantis.html> and <http://oceanservice.noaa.gov/news/weeklynews/feb12/atlantis.html>.

Hi there, thanks for doing the AMA!

As you may know, the surface waters around Hawaii contain an incredibly diverse array of deep-diving cetacean species due to the heterogenous submarine canyon systems. Are you doing an sort of prey-mapping for pelagic species, or are you strictly surveying the benthos?

[wolfboyx](#)

While most of our surveys are focused on the seafloor, we have an EK60 split-beam sonar onboard which can be used to map biomass in the water column. Learn more about our sonars here: <http://oceanexplorer.noaa.gov/oceanos/explorations/ex1503/logs/jun6/jun6.html>.

Sometimes we do visual mid-water transect surveys, where we just move through the water at the same depth for about 10 minutes before moving to a different depth so see what lives there. Here are some of the things that scientists are looking for on the way down:

<http://oceanexplorer.noaa.gov/oceanos/explorations/ex1404/logs/oct1/oct1.html> and <http://oceanexplorer.noaa.gov/oceanos/explorations/ex1502/logs/apr28/apr28.html>.

This'll be fun.

A couple of questions:

- **How accurate is your sea-floor mapping? And will you be creating topography maps of this? I'm specifically curious in the accuracy of the elevation changes.**
- **What mistakes did you make on your first expedition leg that you hope to correct this time (if any)?**

Thanks!

[i_hate_the_yankees](#)

We are careful throughout the field season to ensure the accuracy of our mapping data. We conduct an annual patch test, which determines that the position of the sonar transducers is correctly measured and offset from the GPS antennas and vessel motion/attitude sensor. We conduct periodic crosslines to compare overlapping swaths of data over the same area of seafloor to make sure we are getting the same values in each swath. We correct our data in real time for variations in sound speed in the water column. We examine our data daily for erroneous data points. All of these efforts ensure that our data is vertically accurate to within 1-2 % of water depth, and horizontally accurate to within a few feet to a few tens of meters, depending on water depth. The International Hydrographic Organization sets internationally recognized standards for seafloor mapping around the world, and our data meets their standards for water depths >200 meters.

We create daily grids of our data while at sea. These grids are shared with scientists and others onshore who are participating in the mission. Let us know if you would like access. All of our data in raw and processed formats, including topography maps, is publically accessible through NOAA's

national data centers (National Centers for Environmental Information) within 60-90 days of the end of every cruise. --ML

I would not say we would have any "mistakes" on the first two legs of the expedition, but we have certainly encountered some unexpected challenges that resulted in the loss of an ROV dive, and us only streaming two live video feeds to shore instead of three during the current cruise. You can read about this online here:

<http://oceanexplorer.noaa.gov/oceanos/explorations/ex1504/logs/july31/july31.html> --KE

Hey thanks for taking these questions:

- 1. At the depths that are diving the pressure is so great, how do the animals live with that much pressure, we've seen sponges that**
- 2. We've seen incredibly beautiful corals with vibrant pink and yellow colors, since there isn't any light that penetrates down as far**
- 3. I imagine the corals and sponges you've imaged must grow very slowly and some that you've seen are huge (especially some of [shornik](#)**

The effects of pressure are greatest for animals that have air spaces in their bodies, such as humans (lungs) and fishes (swim bladders). If an animal doesn't have an air space (corals, sponges, others), the effect of pressure is much less because water hardly compresses at all, unlike air. --CK

Good question! All I can think to say is that molecules and components that have color do not necessarily have a visual function. We always think if it has color, it must have some type of visual function since the most important sense we humans have is vision -- but many molecules and components reflect and absorb light differently. --CK

We don't really know how old most of these species are, as ages have only been determined for a handful of deep-sea species. To age an organism, scientists look for structures that are laid down on a periodic basis, such as growth rings. For example, many corals have growth rings on their stems, and you can count them and infer their age. Similarly, the earbones of many fishes have growth rings that can be used to determine their age. Using these techniques, scientists have recently been able to determine that one Hawaiian black coral species can live up to 4,500 years, making it the longest living marine organism known to date. --DW

I am a follower of the Okeanos who would like to participate and ask questions of the science party while the dive is happening. When the Nautilus and Falkor livestream they have a live chat, and it seems you have a science-only chat room, so is there a location for me to ask questions? When you identify critters you mention genus and species names, which are sometimes hard to follow, and I would like to look up more information on them. Having them posted in text, along with the dive site and estimated depths, would be helpful!

Also - am I correct that you have the TOS intercom whistle as a notification on the ship? Pretty sweet.

[coffee_inthat_nebula](#)

Unfortunately, live text interaction is not a capability that we currently have on NOAA Ship Okeanos Explorer, but we do often take questions via Twitter (@oceanexplorer) and Facebook (www.facebook.com/OceanExplorationResearch).

Our scientists use a IM chat called the Event Log to annotate the video from the ROVs. All of their observations are UTC timecoded and can be linked to the other datasets (such as the video, sensor, and depth information). Once we are back to shore, you can access the record of this log along with all of the data collected on Okeanos Explorer through the National Archives. Find out more here -- <http://oceanexplorer.noaa.gov/oceanos/data.html>.

Yes! The whistle onboard is a bosun whistle meant to mimic the alert on the Starship Enterprise.

If you were to imagine the creatures and plants in the different zones of the ocean as taking an elevator down to the bottom, what kinds of colorful characters would get on at each floor? How would they change as you went down? Are any of the "floors" comparatively empty? Do things start getting more freaky and prehistoric looking the further down you go?

[hilarymeggin](#)

The top 100-150 meters is what is known as the photic zone, where you still have photosynthetic organisms like algae and photosynthetic corals. Below that you start seeing exclusively non-photosynthetic organisms like black corals and gorgonians.

At around 800-1100 meters, you enter what is known as the oxygen minimum zone, where oxygen

levels are very low and there is a general scarcity of organisms.

Below that there is an increase of the abundance of animals, and you start seeing many animals that have adaptations to the deep sea, such as smaller bodies, enlarged eyes, and translucent colors. --DW

- **Would you ever take a bio-informatician with you on such expeditions? Or do you happen to know if bio-informaticians also ever come along with marine expeditions?**
I'm one (with a marine biology side interest) and I would definitely sign up for such projects.

[tchnl](#)

Our expedition team is filled with a diverse group of explorers. We have scientists, data managers, hydrographers, ROV engineers, video engineers, and that only covers the small group we have on board! Learn more about some of the people we have on board right now here:

<http://oceanexplorer.noaa.gov/oceanos/explorations/ex1504/background/explorers/explorers.html>

Through telepresence we can engage a much broader science team. You don't need to be on the ship to join the expedition -- follow along live here:

<http://oceanexplorer.noaa.gov/oceanos/media/exstream/exstream.html>. Once we are back to port, you can dive into all of the data here: <http://oceanexplorer.noaa.gov/oceanos/data.html>.

Native Hawaiian advocating for Science. Love the work you are all doing! I want to go off topic a little. Perhaps you can discuss the atmosphere in the Islands regarding exploring sacred waters/lands for scientific purposes.

- **Do you feel the public is educated enough to understand the work you are doing will actually help the native people? What work is being done to increase education?**
- **Can you share experiences you've had with natives discussing science.**

[BabaluluPangus](#)

The Papahānaumokuākea Marine National Monument contains some of the most spectacular cultural and natural treasures on Earth, including diverse and pristine ecosystems, as well as sacred cultural sites to native Hawaiians. As such, all activities that happen up here need to be permitted, and permit applications need to demonstrate that the activity will not impact the resources of the Monument and will benefit the people of Hawai'i, the United States, and the world. --DW

Hey, thanks for taking the time to do this.

I think there's significantly less interest in exploring our deep oceans than there is in exploring worlds lightyears away-- for better or for worse. However, what would you say to convince someone of the importance of exploring our oceans? In other words, why should the general public care?

[chivestheconquerer](#)

Money spent on exploration and gaining a better understanding of our environment, both here on Earth and in space, is never wasted -- we are constantly learning and advancing technology based on what we discover.

Despite the role that oceans play in supporting our well-being, 95 percent of the ocean remains unexplored. Increasing baseline knowledge of ocean habitats is critical to the conservation and management of these remarkable ecosystems.

Exploratory missions, such as those conducted by Okeanos Explorer, are necessary to expand our knowledge of the unknown and to provide baseline data for resource managers. We are constantly discovering new habitat, potential new species, and behaviors and interactions that have never been seen before.

Here's more info about our oceans and why they are so important to explore:

<http://oceanexplorer.noaa.gov/facts/facts.html>.

We have also found some pretty alien-looking things in the deep sea. For example, check out these photos from our recent expedition to the Caribbean:

<http://oceanexplorer.noaa.gov/oceanos/explorations/ex1502/logs/apr13/apr13.html>.

Hello there! I have a special interest in NOAA missions as last year I was a Policy Debater in the NSDA. We were debating ocean exploration and/or development.

My question: With current tech, is there any feasibility to mapping all of the ocean floor? Could some unmanned probe successfully do it (perhaps through electromagnetic mapping) or are

the cost/tech/time barriers too steep?

[Boldly Going](#)

During the last expedition, we had our Explorers-in-Training tackle this very question. Check out their answers: <http://oceanexplorer.noaa.gov/oceanos/explorations/ex1503/logs/jun2/jun2.html>.

Aloha, and thanks for taking questions.

Chris, I know you have experience with both manned and unmanned exploration. Can you or others describe the pros and cons of each mode, and if you care to, share your preference for this type of exploration.

[Wrathchilde](#)

(Chris) I have always been a big enthusiast for manned submersibles because it is such an adventure to actually be down there and see what you see with your own eyes. Then along came the Okeanos Explorer and its Deep Discoverer (D2) ROV. The engineering and camera systems on this vehicle are so amazing that I am now reconsidering my stance. D2 can get close-ups that are so amazing, you can see things that you cannot possibly see with your own eyes if you were down there. For example, coral biologists can actually see microscopic structures in the polyps that allow them to identify the animals to genus and even species level. That is extraordinary and for that reason, I think I am coming over to the ROV side.

Also, I think manned submersibles are better for intermediate depths such as 1,000-2,000 meters. This is because they are battery operated and have limited bottom time. If the dive is too deep, you wind up spending a great deal of time on the descent and ascent rather than on the bottom.

Thank you for doing the AMA! I have been watching every day while I work, and I enjoyed watching the stream from the expedition to Puerto Rico as well. I would love to know if the video footage is archived and available for the public to go back to after the dives are complete? I'm a science illustrator and I use screenshots as references for sketching but I don't always catch the names of animals as they are mentioned and it would be helpful to be able to go back to listen to some of the discussion.

Also, could you describe your animal collection methods, and where the specimens end up residing after the cruise? How much identification work occurs onboard and how much back on shore?

(ps. I appreciate the daily tutorial on how to pronounce Papahānaumokuākea !)

[wanderingfalcon](#)

Your art is amazing (seen some of your Twitter posts)!

(Kelley) All data and information collected during Okeanos Explorer cruises are made publicly available within 30-90 days of cruise completion, including the video footage from the ROV. Different datasets are made available from different archives. Video footage primarily goes to the NOAA Central Library. You can search for past Okeanos Explorer expeditions by visiting the OER Digital Atlas, then do a "search by text" for Okeanos Explorer. Alternately you can fill out a data request form:

<https://docs.google.com/a/noaa.gov/forms/d/1pU3jbcV5funMKUbYgnA2OK-ZT9qj2Dh6JgZ79TTORM/viewform?formkey=dHAycC1MYndJb0hTdGRaYXAZVTVBdWc6MA&fromEmail=true>

(Chris) Once the ROV comes on deck, the ROV crew and science team work very quickly to get the animals back up into the lab using buckets of cold water. The boxes in the ROV are also designed to keep the water cold at the surface. Once we get the animals in the lab, they are processed in the order of more to less vulnerable to deterioration. They are photographed with labels and a ruler for scale, then a piece is removed from each and placed in a special buffer agent for DNA/RNA analysis. The remainder of the sample is usually placed into 95% alcohol solution. Once back on shore, the animals will all be sent to the Smithsonian for curation and for other scientists to access.

Hey guys! I'm on my last to years of undergrad and I want to be doing something similar to this. Dive deep in the ocean, swim and explorer marine life. I am doing biology for undergrad. What can I do to prepare myself for a career such as this?

[pervysage1608](#)

I would encourage you to get as much practical experience as possible by doing internships and volunteering. Such experiences will not only give you a better sense of what the actual work will be like, but also allow you to get to make connections with people that are involved in this field. --DW

Hey! Thanks for doing this AMA!

- What is a typical day like aboard the Okeanos Explorer?
- What are your favorite, and least favorite, aspects of life on the ship/at sea?
- What is one area of the ocean that you would really like to explore more of?

[rouge_oiseau](#)

(Daniel)

- I typically wake up at about 0600h and review the dive plan of the day. Then we have a pre-dive planning call with all of our shore-based science partners around 0830h. The ROV is usually on the bottom between 930-1530h, during which time we continuously watch the ROV monitors and narrate the dive. After the ROV leaves the bottom at the end of the dive, we have a post-dive call with our shore-based scientists to plan for the next day's dive; this call typically lasts ~30 minutes. The ROV comes on board around 1700h, and we then process specimens for about one to two hours. After that, I work on the dive summary report for about an hour, and shortly thereafter I go to bed.
- My favorite aspect of life on the ship is that I get to see spectacular places that very few people get to see. My least favorite thing about life at sea is being away from friends and family for prolonged periods of time.
- I am particularly interested in exploring ecosystems that have not been explored before, and therefore I absolutely love being able to study remote locations like the Northwestern Hawaiian Islands and extreme depths like the ones we are targeting on this expedition.

I'm a huge history nerd, so this peaked my interest a bit.

Is any special attention going to be given to searching for ship/submarine remains leftover from Pearl Harbor, Midway, and other close-proximity battles?

If not, what efforts would be made for study, preservation, etc. if wrecks were to be found accidentally?

[DearLeader420](#)

(Daniel) Most of the ship and plane wrecks around Midway Atoll are found in depths that are too shallow (<200 meters or 650 feet) to explore with the deep-sea vehicles we have on this expedition. However, currently there is another NOAA expedition that is surveying for exactly those sites in shallow-waters using divers. When maritime heritage sites are discovered, these are meticulously documented, so that they can be preserved and protected in perpetuity.

Hi all. I'm curious about what happens to exploration missions when equipment goes down. The Okeanos had a variety of problems earlier this summer that kept it in port for repairs. Did this upset your mission, in terms of timing or resources? Were you scheduled late enough in the season that you weren't impacted? Or did you have to rearrange your field plans?

[mringham](#)

(Chris) You always try to have a backup plan in the event there is either bad weather or an equipment failure, but some incidents are worse than others. The problems the ship experienced during our Puerto Rico expedition were very unfortunate and very uncommon; the ship's A/C unit went down, making the ship uninhabitable. That should not happen again. If the ROV experiences a failure that causes a dive to be aborted, the ship will then turn to mapping, subbottom profiling, and running the EK60 sonar to keep generating useful data.

You have my boyfriends dream job. How does he get started? He's got his degree in something other than oceanography or marine biology, but he has a lot of knowledge and intern experience because he has friends within NOAA and the Scripps institute of oceanography that hook him up with volunteer opportunities. In fact, he just completed a 3 week research cruise with NOAA as a lab tech and night mammal watchman.

Is a degree more important for him to move up or is it the hands on experience he's getting that will get his foot in the door?

Good luck, guys!

[Helloooooo_NURSE](#)

(Chris) Depends on what type of work he wants to do in this field. There are all types of people involved in an operation of this size and at all types of levels. If he wants to lead this type of expedition,

then he does need a higher-education degree. However, if he wants to participate at a different level, helping to do something out here that makes the cruise successful, then the advanced degree is less of a requirement. Lots of people start in one career track and change directions as they get older. He isn't restricted to being in his current field if he wants to do something else. The goal is to be happy and feel like you are doing something useful, whatever you are doing, and that is what brings satisfaction.

Hey everyone aboard Okeanos.

My name is nick. I live in savannah, Georgia and voluntary regularly with Gray's reef national marine sanctuary out here. I am currently looking to get some 3D mapping of the reef going for local organizations, schools and the general public. So, would you, Meme, I suppose in particular, know of any good, easy 3D mapping apps or software besides photoshop?

I can get photos of the reef to compile them into the image or use bathymetry readings to help.

Keep speaking for the ocean! Cheers.

[nsd3](#)

(Meme) Our office recently provided federal funding for a similar project; details are here: <http://oceanexplorer.noaa.gov/explorations/15portroyal/welcome.html>. Perhaps you could get some ideas from that project.

For software, one free software package used to process bathymetry is MB-System. MB-System is maintained by Monterey Bay Aquarium Research Institute and Lamont-Doherty Earth Observatory of Columbia University.

Also, I am a pretty big fan of a GIS package called Global Mapper. It is very affordable and remarkably robust in terms of data types that it can handle. It's also pretty user friendly. Good luck and keep in touch about your work!

Hello! Thanks for doing this AMA; I am so excited to see what you guys discover! As for my question, it's more of a career question I guess... I am 18, going into college this fall, majoring in Biology, and deeply passionate about the ocean and marine biology. Everytime I mention these facts about myself to family members, friends, strangers, I tend to get the usual questions along the lines of: "Are there gonna be jobs for you? Are you gonna be okay to support yourself and your family? Shouldn't you go into the medical field to find more opportunities for a job?" etc. It's kind of annoying but it really concerned me about my future. But no matter what, I don't think I could ever become anything else; I love biology and I love the marine life. I know that it's going to be rough finding a career position but I know this is what I am going to do.

So I guess my questions are: * How do I and what do I do, as a young adult, have more of a successful chance to land a researching job out in the ocean field? * What tips should I keep in mind throughout college? * How did you guys survive college and get to be in your position today? * Also, what should I say to those folk who keep pressuring me to change my mind?

I hope these make sense, haha, thanks again for taking your time to answer our questions!

[milanoly](#)

(Daniel) I absolutely commend you for following your passions. As far as how to jumpstart your career, I would encourage you to do internships and volunteer as much as you can, so that you get a feeling of what the work will be like. In addition to gaining valuable skills and knowledge, you will also get to know people in the field, who might have connections to other job opportunities.

In terms of what to say to people pressuring you to choose careers that are better paid, it is important to point out that many marine scientists make a very decent living, and the vast majority of them love their job (which is priceless).

(Kelley) Hi and thanks for reaching out with this question. I've heard this question asked by a lot of students interested in marine science and would say first and foremost - follow your passion. You need to get appropriate degrees to move forward in ocean science and as you pursue those degrees, my biggest advice is to take advantage of internship, work/study, and fellowship opportunities where you can and this will significantly increase your career opportunities and help you network. Find mentors in school and when you enter the work world, and look into learning other related technical skills such as geographic information systems that will make you more marketable. Finally, for those discouraging you from following your passion - they are not you. Listen to yourself and your heart. Inspiration and determination comes from within, and you spend nearly as much time working at your full-time job than you spend with friends and family during the average work week, so it's important to enjoy and find

meaning in what you do.

Mackenzie Gerringer, who will be on NOAA Ship Okeanos Explorer for the fourth leg of our expedition, recently offered some advice to aspiring deep-sea explorers:

<http://oceanexplorer.noaa.gov/okeanos/explorations/ex1504/logs/aug4/aug4.html>.

Also, we recently asked some members of the Okeanos Explorer team what advice they would give to the next generation of explorers. We work with a diverse group, who all have very different backgrounds. Check out their responses:

<http://oceanexplorer.noaa.gov/okeanos/explorations/ex1404/logs/sept21/sept21.html>.

Thanks for providing the video feed. It really has been both educational and entertaining! To your knowledge has anyone used variable spectrum lighting on an ROV to shine light of varying colors on the fish, inverts, and corals? A blue light, coupled with a yellow filter over the camera lens should highlight which species are capable of biofluorescence. I have often wondered if biofluorescence is as common in the depths as it is in the shallows.

[Merman_Dan](#)

Hi - bioluminescence and fluorescence in the ocean is a field that is not well understood and ripe for more exploration and technology advancement. This is a topic that is currently being studied by other researchers. You can learn more about a recent expedition focused on this topic on the Ocean Explorer website at: <http://oceanexplorer.noaa.gov/explorations/15biolum/welcome.html>

what difficulties are being caused by the local Hurricane? How does weather and currents impact your work?

[lablizard](#)

(Daniel) Good weather always makes work easier, and these expeditions are usually done in the summer months when weather conditions are best. So far, we have not felt the impacts of the storms that are affecting the Main Hawaiian Islands -- and we hope that it stays that way. Our crew carefully monitors the weather forecast, and if bad storms were to head our way, we would need to adjust our course accordingly.

Hi, recent bio grad here.

First, how did you end up doing your line of research? (Im interested in what youre doing, you hiring?)

Second, how much of the benthic ocean is actual diverse, and how much is it the same? Species wise that is. In other words, do you see the same organisms across the ocean floor, or as you go along do find different/new types of species?

Third, has mapping or visualizing the deep ocean improved over the years? I feel like besides the unmanned robots, that sonar and direct camera feed are the only two methods of actually seeing the bottom. Why havent other methods been used? (infrared)

[jeeppbrahh](#)

1) I did a lot of internships and volunteered at several labs when I was in college, which helped me to get to know different people who work in the field. Such information is always very valuable, and there are no textbooks that can provide that information. --DW

2) Sorry but I can't really answer that yet, except to say that the abyssal seafloor is much the same -- an enormous expanse of sediment spanning the globe. I think you would therefore expect to find much less diversity there than you would on seamounts, where you essentially have deep-sea islands popping up from the otherwise featureless plain. --CK

3) I will take a shot at the third question. There is one other type of technology that has been developed for imaging the seafloor: Laser Line Scanning. This system involves the use of a laser that moves back and forth across the seafloor creating a laser swath somewhat similar to multibeam mapping. The difference is that it is light-based, not sound-based, so as a result, it has to be on a towed vehicle and has to be towed very close to the seafloor. You wind up with very fine imagery of the seafloor that can be imported into mapping software such as a GIS so the data is sort of a hybrid between visual and mapping data. Because you have to tow it so close to the bottom (maximum 10 meters usually), it is very vulnerable to collision with the seafloor in high relief areas. Therefore it has limitations but in suitable areas with relatively flat terrain, it can be very useful. --CK

Hi guys, I would like to start by thanking all the efforts you have been doing to allow us to see live the bottom of the Ocean. As a Palaeontologist, it has been exciting to see how animals

behave in today's oceans and the fantastic geologic landscapes. I must say that I am a bit jealous of not being able to be there with you.

Now the questions, the diversity of corals and sponges has been fantastic. Were you expecting to be so great, when you planned this expedition, or it has been a surprise for you too? I know that the ROV is reaching great depths, but wouldn't be expected to see a few more fishes around? Would you be surprised to see carcasses of being animals, like whales, on one of the dives? From your observations, do you see a lot of anthropogenic disturbances, like rubbish or ocean acidification, during your dives?

Many thanks! And keep the good work. It has been some fantastic days.

[BClaroPereira](#)

(Chris) You don't need to be here -- you can see everything we see, only seconds after we see it, by tuning into the live video feed: <http://oceanexplorer.noaa.gov/oceanos/media/exstream/exstream.html>. Check out other ways that you can get involved: <http://oceanexplorer.noaa.gov/oceanos/getinvolved.html>.

We were hoping to find many corals and sponges but didn't know if we would, because we didn't know if our hypothesis was correct. The hypothesis was that we would find high-density coral and sponge communities on ridges, because ridges provide consistently oriented topography, and this is important to filter-feeding animals such as corals and sponges. If the ridges are oriented appropriately to the prevailing and dominant benthic current flow (perpendicular?), then they might create areas of topographically induced upwelling, which would increase current flow and provide better habitat for corals and sponges.

Fishes, on the other hand, seem to prefer quiet sediment areas down at these depths because swimming is energetically costly and the sediment holds more food for them perhaps.

How deep do you explore?

Expect to find any glowy deep sea creatures down in the dark waters?

[shonkalot](#)

Our vehicles can go down to 6,000 meters -- nearly 20,000 feet, or 3.74 miles.

Bioluminescence (the ability of living organisms to make their own light and thus become "glowy" creatures!) is fairly common in the deep sea.

Although ROV Deep Discoverer isn't set up to capture this type of light, other vehicles can! Check out the recent Bioluminescence and Vision on the Deep Seafloor expedition: <http://oceanexplorer.noaa.gov/explorations/15biolum/welcome.html>.

Thanks for doing the AMA. As a rising senior in high school, my question is what do you recommend to somebody who is pursuing biology as a career? I'm still unsure as to any decisions I have to make but I'm very passionate about biology and am considering majoring in it in college dependant on where I go.

[kick10](#)

Mackenzie Gerring, who will be on NOAA Ship Okeanos Explorer for the fourth leg of our expedition, recently offered some advice to aspiring deep-sea explorers: <http://oceanexplorer.noaa.gov/oceanos/explorations/ex1504/logs/aug4/aug4.html>.

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There are so many different directions to go! Best of luck!

Thank you for doing an AMA!

- **When in the ROV's what do you guys do in the amount of time it takes to get down to your destination? Do you still keep your eyes out for potential info and research even in the upper layers of the ocean?**

I wish you all luck in your endeavors!

[stevenmeyerjr](#)

We are always exploring! While we are not physically in the ROVs, during our descent we frequently do have researchers who are interested in seeing what is in the water column tuning in to see what we

might stumble across on our commute to the bottom.

Sometimes we do mid-water transects, where we just move through the water at the same depth for about 10 minutes at different depths so see what lives there.

Here are some of the things that scientists are looking for on the way down:

<http://oceanexplorer.noaa.gov/oceanos/explorations/ex1404/logs/oct1/oct1.html>.

Could you tell us a bit what it was like meeting various deep sea fish like this little guy?

<http://oceanexplorer.noaa.gov/oceanos/explorations/ex1504/dailyupdates/media/aug7.html>

Also do you know more about the parasite clinging to him/her? Is this fatal or an inconvenience?

[AsAChemicalEngineer](#)

We have not seen that many fishes on this expedition, and therefore every fish encounter is a special treat. We are not yet completely certain what genus and species this fish belongs to, but the images captured will help shed light on that mystery.

As far as the parasite, it is fairly common to see fishes with parasites and in very few cases is such an interaction fatal. --DW