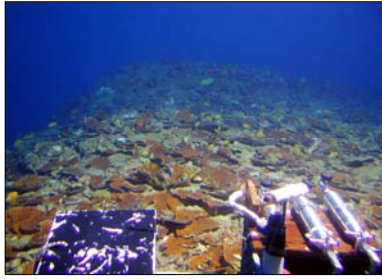


Ask A Scientist At Sea!

Hui Malama Learning Center, 375 Mahalani St., Wailuku, HI 96793

Heather Spalding, Botany Department, University of Hawaii at Manoa

A joint project between the NSF Gk-12 program, University of Hawaii at Manoa and NOAA's Coral Reef Ecosystem Studies program



A deep coral reef off Maui at ~300 ft depth.

Cody: Can you see any changes in the environment such as from global warming? Can you see changes in the coral reefs or algae?

Ray Boland, Research Biologist, Pacific Islands Fisheries Service Center, NMFS, NOAA

The reefs of Hawaii are a bit lucky when it comes to global warming. We are far enough North that effects from global warming such as coral bleaching, have been minimal. But, we're close enough to the equator and tropical waters that the corals can grow! In 2002, researchers in the Northwestern Hawaiian Islands noticed some coral bleaching, but this was small in comparison to the problem world-wide. However, as world temperature averages increase, the chances of these bleaching events occurring will also increase.

Forest: How much does the yellow submarine cost?

Tony Montgomery, Aquatic Biologist, Department of Aquatic Resources, DLNR

If you were a scientist wanting to rent the submarine for a day, then the submarine and ship you need to run the submarine would cost approximately \$28,000 per day. If you wanted to actually buy one of the submarines new, it would cost millions of dollars!

Nohea: How many different types of species of algae are known to scientists?

Heather Spalding, Phycologist (graduate student), University of Hawaii at Manoa, Botany Department

There are thousands of species of algae in the world, and they live everywhere! You can find algae in the desert, in streams, in the ocean, and even in hot springs. Here in Hawaii, we have over 500 species of red, green, and brown algae that occur in the ocean. In deep water (greater than 100 feet), we've recorded over 100 species of algae. Some of these deep water algae are only found in deep water, and have never been seen at shallower depths. Some places are covered in just one species of algae, and look like a large green leafy meadow, swaying in a gentle breeze.

Azea: Where was the most beautiful reef found in Hawaii?

Ray Boland, Research Biologist, Pacific Islands Fisheries Service Center, NMFS, NOAA

That depends on how you would classify the beauty of the reef. Is it lots of colorful corals? Lots of fish? I could tell you my favorites and why I thought they were beautiful. 1) Kure Atoll's Northern barrier reef because of the rare fish, 2) The Northeast corner of French Frigate shoals because of the pillars of coral and the Hawaiian Monk Seal pup that followed me, 3) Maui's submerged land bridge because of the huge black coral forests and fields of deep plate coral, 4) Kona coast/Puako because of the nearly 100% live coral coverage.

Kaleb: Do you love what you do? Why/ why not?

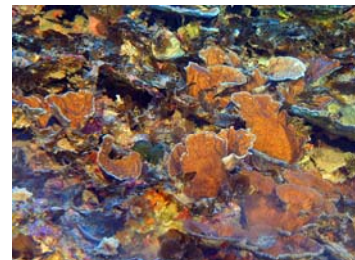
Rich Pyle, Ichthyologist/Database Manager, Bishop Museum

YES!! I absolutely do love what I do – in fact, that's why I do it. Nothing is as exciting to me as the thrill of discovering something new. Sometimes this is finding a new species of fish that nobody has ever seen before. Sometimes it's recognizing some sort of pattern that nobody has ever noticed before. I think that, in general, scientists have the best jobs. They don't get paid a lot of money, but on the other hand, they get paid to do things that most people never get a chance to do, or have to pay a lot of money to do (like go scuba diving in exotic places). Almost every day at "work" is fun and exciting. You get paid enough to live comfortably, but the most important thing is that you love your work – and also your work is important to many other people. Everyone's lives are shaped by scientific discoveries, in more ways than most people realize.

Michelle: How many different kinds of coral are there in the deep coral areas you are studying?

Tony Montgomery, Aquatic Biologist, Department of Aquatic Resources, DLNR

There are a few dominant species in the deep reef, such as great big plate corals called *Leptoseris*. However, because the deep reef is largely unexplored, we do not know all the species. There may be new species yet to be discovered!



A deep water *Leptoseris* reef with algae off Maui at ~200 ft depth.



A team of researchers from the Bishop Museum, Department of Land and Natural Resources, University of Hawaii, and NOAA's Pacific Island Fisheries Science Center participated in six-day expedition aboard the University's research vessel, *Ka'imika-o-Kanaloa*. This included a total of five dives using the deep diving submersibles *Pisces IV* and *Pisces V*, operated by the University's Hawaii Undersea Research Laboratory (HURL). While at sea, they participated in the Ask A Scientist At Sea program with Hui Malama Learning Center. Back row, left to right, Heather Spalding, Brian Popp, Ken Longenecker, Ray Boland, Holly Bolick, Tony Montgomery. Front row, left to right, Thierry Work, John Rooney, Rich Pyle, Daniel Wagner



The *Pisces V* submersible can hold up to three people. It weighs 13 tons and has a maximum operating depth of 6,280 ft.

Holly carefully removes invertebrates from a black coral tree.



Rich holds the suction device used to collect fish with the submersible. It's like an underwater vacuum.

Colin Wollerman adjusts the lasers on the submersible video camera. The lasers are used in the video to measure distance and area.



Halimeda kanalana, a calcified green alga, forms meadows in the sand. It can occur from 10 to 300 ft depths. When it dies, it makes sand.



Left: Heather holds a small deep water green algal ball called *Codium mammosum*. Right: Tony poses with a black coral tree he just collected with the submersible.



The octopus described below off Oahu at 660 ft depth

Keoni: What was the biggest octopus you have seen?

Heather Spalding, Phycologist (graduate student), University of Hawaii at Manoa, Botany Department

The biggest octopus I've ever seen was off the south shore of Oahu in about 200 meters (660 feet) of water. The octopus was about 6 feet across (including the arms) and was on this little reef outcropping. We came up on it with the submersible, and settled down right beside it. The octopus started hunting around the coral with its arms, poking and prodding in the pukas looking for food. There was a small school of little blue fish swimming around the reef, circling over the octopus. Suddenly, the octopus shot out an arm, and caught one of the blue fish! It immediately brought the struggling, little fish to its mouth and bit it, then proceeded to have its lunch while we sat in the sub, eating our lunch.

Ricky: How fast does the submersible travel?

Colin Wollerman, Submersible Support Technician, Hawaii Undersea Research Lab

The *Pisces* submersibles (subs) travel between one and two knots (1.2 – 2.3 mph) during normal operations, with a top speed of about 3 knots under favorable conditions. Two important factors must be considered when piloting the subs on the seafloor at any rate of speed: 1) Visibility: The *Pisces* subs, mostly dive at depths that sunlight does not reach, thus limiting range of visibility to the penetration of the sub's underwater lights. This can be as much as twenty meters (66 feet). If there is any silt or sediment in the water, this range is greatly reduced. 2) Weight: The subs have been engineered to be neutrally buoyant while diving, but because of their weight (12 tons) and subsequent mass, a substantial inertia makes stopping quickly somewhat difficult. So when piloting a 27,000 pound submersible in rough terrain with low visibility and a strong current...two knots is pretty fast!

Maluhia: What kind of big game fish do you see at night?

Ken Longenecker, Invertebrate Zoologist/ Ichthyologist, Bishop Museum

At night, we use the ROV (remotely operated vehicle) to do surveys. I haven't seen many big fish in the night-time video. So far, there have been lai and opelu. Sometimes, the same fishes keep circling the ROV, so you're not sure if you're seeing lots of fish, or just the same fish again and again.

Evie: Can you talk to each other underwater?

Rich Pyle, Ichthyologist/Database Manager, Bishop Museum

Yes! In fact, there are several ways we can talk to each other underwater. Inside the submarine, we can talk to the ship, and to another submarine, using electronic devices similar to hand-held radios. These "radios" actually use "acoustic" (sound) waves to transmit the signals. Sound travels much better through water than it does through air. This system is not only used by the submarines and the ship, but can also be used by individual scuba divers, so they can talk to each other, and to people at the surface on a boat. When divers use this sort of underwater communications gear, they need to wear what's called a "full face mask", which is a special diver's mask that covers not only the eyes and nose, but the mouth as well. Divers who use closed-circuit rebreathers have another solution. Unlike regular scuba, the exhaled breath from a rebreather does not come out and make bubbles (and associated noise). Instead the exhaled breath is trapped in a hose, and recirculated back to the diver (which is why it's called a "rebreather"). In fact, when we dive with rebreathers, we can talk to each other very clearly even when we're 20 or 30 feet apart.

Maizie: How good is your food? What do you eat?

Ken Longenecker, Invertebrate Zoologist/ Ichthyologist, Bishop Museum

Very good, and lots of it! Breakfast had eggs, breakfast sandwiches/burritos, French toast, pancakes, bacon, sausage, fruit and yogurt. Lunch is sandwiches, salmon burgers, veggie burgers, cheese burgers, French dip, chili dogs, French fries, soups, and salad bar. Dinner so far has been green chicken curry, huli huli game hens, fish & tofu curry, roast beef, rice, potatoes, vegetables, salad bar (but not all at the same time!). We always have dessert. Plus, snacks are always available: ice cream, cookies, candy, jerky, a rare. When diving in the sub., we're a bit careful about what we eat. If you've ever seen games where people are racing in "hamster balls", imagine taking a 7 foot diameter ball and stuffing 3 people in it, along with computers, sonar displays, oxygen tanks, air purifiers, and the controls for the sub and its arms and cameras. Now imagine those 3 people stuck in the ball for 8 hours. This is not a place where you want to pee, poop, or fart. We're very careful about our diet the day before and morning of a sub. dive. No beans or cabbage, no coffee or coke, and very little water. No asparagus – just in case you have to pee.



A new species of fish collected with the submersible during our cruise. We didn't have it for dinner, though.