

**EMBARGOED until April 12<sup>th</sup>, 2016: 07.00 EST / 12.00 GMT**

## **PRESS RELEASE**



### **Swarming Red Crabs Documented on Video** ***Findings Represent New Southernmost Range for Species***

A research team studying biodiversity at the Hannibal Bank Seamount off the coast of Panama has captured unique video of thousands of red crabs swarming in low-oxygen waters just above the seafloor.

Jesús Pineda, a biologist at Woods Hole Oceanographic Institution (WHOI) and chief scientist on the cruise, called the encounter unexpected and mesmerizing. The researchers describe their findings in a paper published April 12, 2016, in the journal *PeerJ*.

The team, which included colleagues from Point Loma Nazarene University, San Francisco Estuary Institute, and Smithsonian Tropical Research Institute, was working aboard the *M/V Alucia*. They captured the video of the crab swarm during a dive in the manned submersible Deep Rover 2 on the last diving mission of the month-long expedition in April 2015.

"When we dove down in the submarine, we noticed the water became murkier as we got closer to the bottom," said Pineda, lead author of the paper. "There was this turbid layer, and you couldn't see a thing beyond it. We just saw this cloud but had no idea what was causing it."

"As we slowly moved down to the bottom of the seafloor, all of the sudden we saw these things," he continued. "At first, we thought they were biogenic rocks or structures. Once we saw them moving—swarming like insects—we couldn't believe it."

The crabs were later identified by DNA sequencing as *Pleuroncodes planipes*, a species abundant in Baja California and found in the waters off the west coast of Baja California, Gulf of California, and the California Current. This documentation represents a new southernmost range of distribution for the species.

"No one had ever found this species that far south," Pineda said. "To find a species at the extreme of their range and to be so abundant is very unusual."

The large aggregation of swarming red crabs was observed along the Northwest flank of the Hannibal Bank Seamount at depths of 355 to 385 meters (approximately 1,164 to 1,263 feet) in an area of "hypoxic" (low oxygen level) water.

"These crabs have been detected before in similar low oxygen conditions," Pineda said. "It could be that these low oxygen waters provide a refuge for this species from predators."

Also known as tuna crabs because they are favored prey for yellowfin tuna, *Pleuroncodes planipes* are an important food source for a variety of other fish, birds, and marine mammals. They migrate up and down in the water column, which also makes them vulnerable to changing currents.

A few months after the expedition, thousands of red crabs washed ashore onto Southern California beaches during a massive stranding associated with El Niño warming conditions. The researchers wondered if they were the same species as the Hannibal red crabs. After obtaining samples from a beach in San Diego in June 2015, DNA analysis revealed that the Panamanian and the Californian crabs are in fact the same species.

Seamounts are ecological "hotspots" that are home to thriving communities of unique species. Because less than one percent of these underwater mountains have been studied, the mechanisms that make them so biologically productive are not well understood.

The focus of the Panama expedition was to learn more about both the biological and physical processes that make Hannibal Seamount such a rich ecosystem. An interdisciplinary team onboard included physical oceanographers, biologists, software scientists, and robotics engineers. Two manned submersibles were utilized to obtain biological samples, while the autonomous underwater vehicle (AUV) Seabed and the autonomous surface vehicle Jetyak were used for mapping and imaging along the seamount, and for obtaining measurements of currents.

"This study is an example of how we can effectively use the multiple tools now available to study the deep-sea habitat," said Walter Cho, a biologist at Point Loma Nazarene University and coauthor of the paper. "The fact that we could combine the use of submersibles to explore, observe and sample, and then use an AUV to follow-up those observations of the crab aggregation and get quantitative data is really powerful."

The researchers plan to return to the Hannibal Seamount to further study why seamounts support such high levels of biodiversity. In addition, the deep-water areas of Hannibal Seamount, which lack dissolved oxygen and are acidic, give scientists an opportunity to investigate how communities might look in the future as the ocean responds to climate change.

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Additional coauthors are Rusty Holleman of San Francisco Estuary Institute, Héctor M. Guzman of Smithsonian Tropical Research Institute, and Victoria Starczak, Annette Govindarajan, Yogesh Girdhar, James Churchill, Hanumant Singh, and David Ralston of WHOI.

Funding for this project was provided by a grant to WHOI from the Dalio Ocean Initiative.

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**Media:** A zip file of the high resolution images, the video file, and a PDF of this press release: <http://static.peerj.com/pressReleases/2016/1770-media.zip>

**Video:**

A video has been produced by Woods Hole Oceanographic Institution – access it at: <https://vimeo.com/161655689> Password: WHOIPineda

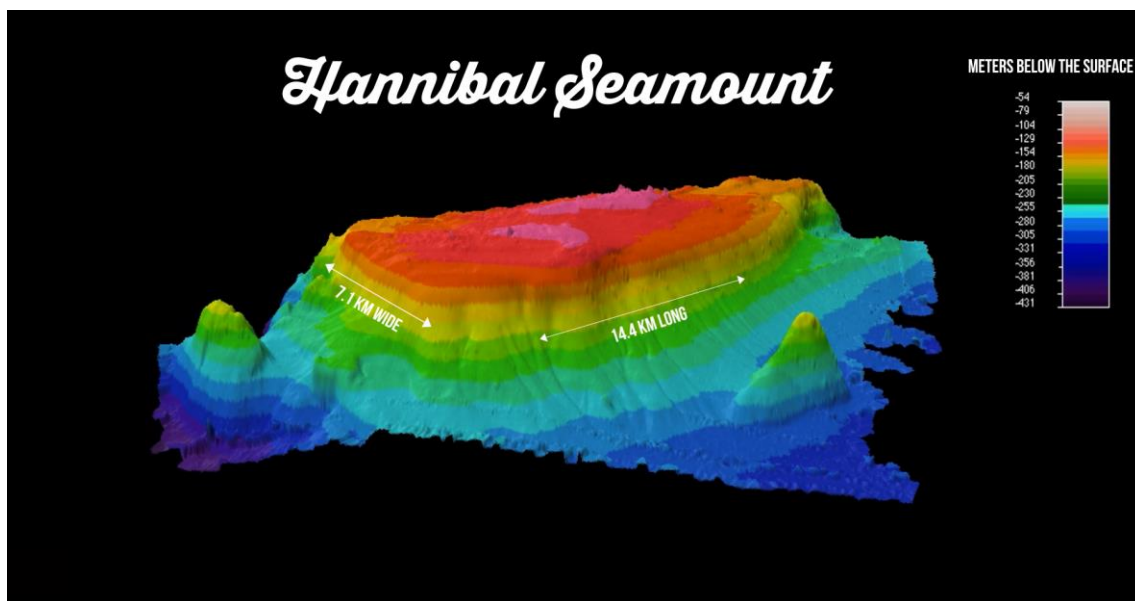
You should embed this video link into your article, and the password will be removed when the embargo lifts.

An additional video of the crab swarm (forming a supplemental file to the article) is also available in the Zip file <http://static.peerj.com/pressReleases/2016/1770-media.zip>

**Images:**



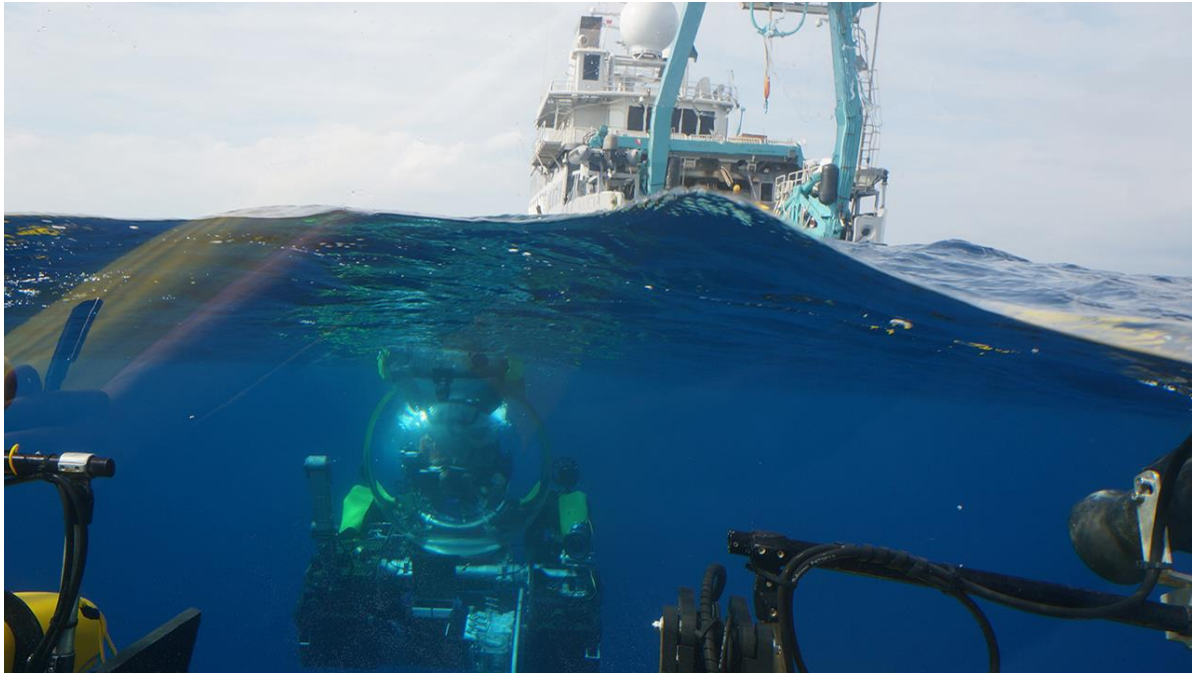
Caption: Photograph with the highest density of *Pleuroncodes planipes* (Fig 4 of the article)



**Caption:** The Hannibal Bank Seamount is located 20 kilometers (12.42 miles) west of Coiba Island, Panama. The focus of the April 2015 expedition was to learn more about both the biological and physical processes that make the seamount such a rich ecosystem.

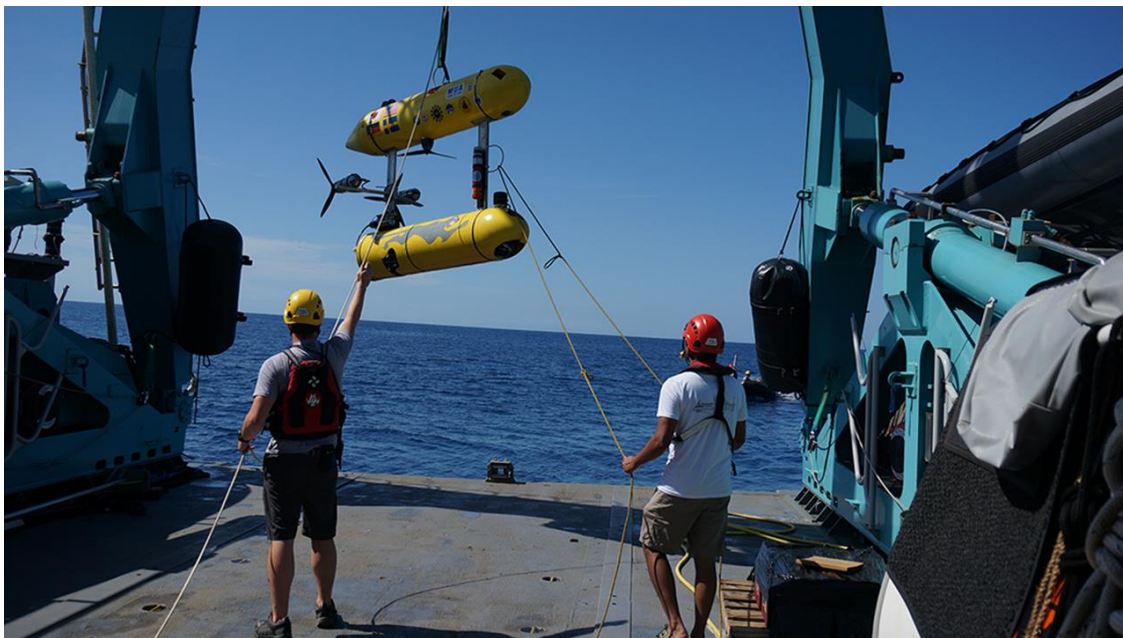
**Credit:** Image courtesy of Ocean Media Institute





**Caption:** A front-row view as deep-submergence vehicles Deep Rover 2 (pictured) and Nadir descended from the M/V *Alucia* on one of the dives to Hannibal Seamount in the Panamanian Pacific.

**Credit:** Photo by Jesús Pineda, Woods Hole Oceanographic Institution



**Caption:** Autonomous Underwater Vehicle (AUV) specialist Jeff Anderson and WHOI scientist Yogesh Girdhar (left to right) deployed the SeaBED-class vehicle Jaguar AUV from the stern of M/V *Alucia*.

**Credit:** Photo by Jesús Pineda, Woods Hole Oceanographic Institution



**Caption:** Members of the research team get ready to unload the MV *Alucia* at the end of the Panama expedition: (front row left to right) Héctor Guzman, Smithsonian Tropical Research Institute; Jesús Pineda, WHOI; Vicke Starczak, WHOI; Yogesh Girdhar, WHOI; (back row, left to right) James Churchill, WHOI; Rusty Holleman, San Francisco Estuary Institute; AUV specialist Jeff Anderson; and Walter Cho, Point Loma Nazarene University.

**Credit:** Photo courtesy of Ocean Media Institute

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**PDF of this Press Release:** <http://static.peerj.com/pressReleases/2016/Press-Release-Pineda.pdf>

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**Abstract** (from the article)

**A crab swarm at an ecological hotspot: patchiness and population density from AUV observations at a coastal, tropical Seamount**

A research cruise to Hannibal Bank, a seamount and an ecological hotspot in the coastal eastern tropical Pacific Ocean off Panama, explored the zonation, biodiversity, and the ecological processes that contribute to the seamount's elevated biomass. Here we describe the spatial structure of a benthic anomuran red crab population, using submarine video and autonomous underwater vehicle (AUV) photographs. High density aggregations and a swarm of red crabs were associated with a dense turbid layer 4-10 m above the bottom. The high density aggregations were constrained to 355-385 m water depth over the Northwest flank of the seamount, although the crabs also occurred at lower densities in shallower waters (~280 m) and in another location of the seamount. The crab aggregations occurred in hypoxic water, with oxygen levels of 0.04 ml/l. Barcoding of Hannibal red crabs, and pelagic red crabs sampled in a mass stranding event in 2015 at a beach in San Diego, California, USA, revealed that the Panamanian and the Californian crabs are likely the same species, *Pleuroncodes planipes*, and these findings represent an extension of the southern endrange of this species. Measurements along a 1.6 km transect revealed three high density aggregations, with the highest density up to 78 crabs/m<sup>2</sup>, and that the crabs were patchily distributed. Crab density peaked in the middle of the patch, a density structure similar to that of swarming insects.