

A surprise new butterflyfish is described from the Philippine 'twilight zone' and exhibit

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San Francisco. Deep-diving researchers from the California Academy of Sciences' Hope for Reefs team -- with genetic sequencing help from a parent-son team -- share their discovery of a fifth species of *Roa* this week in *ZooKeys*.
Credit: © 2017 Luiz Rocha and the California Academy of Sciences

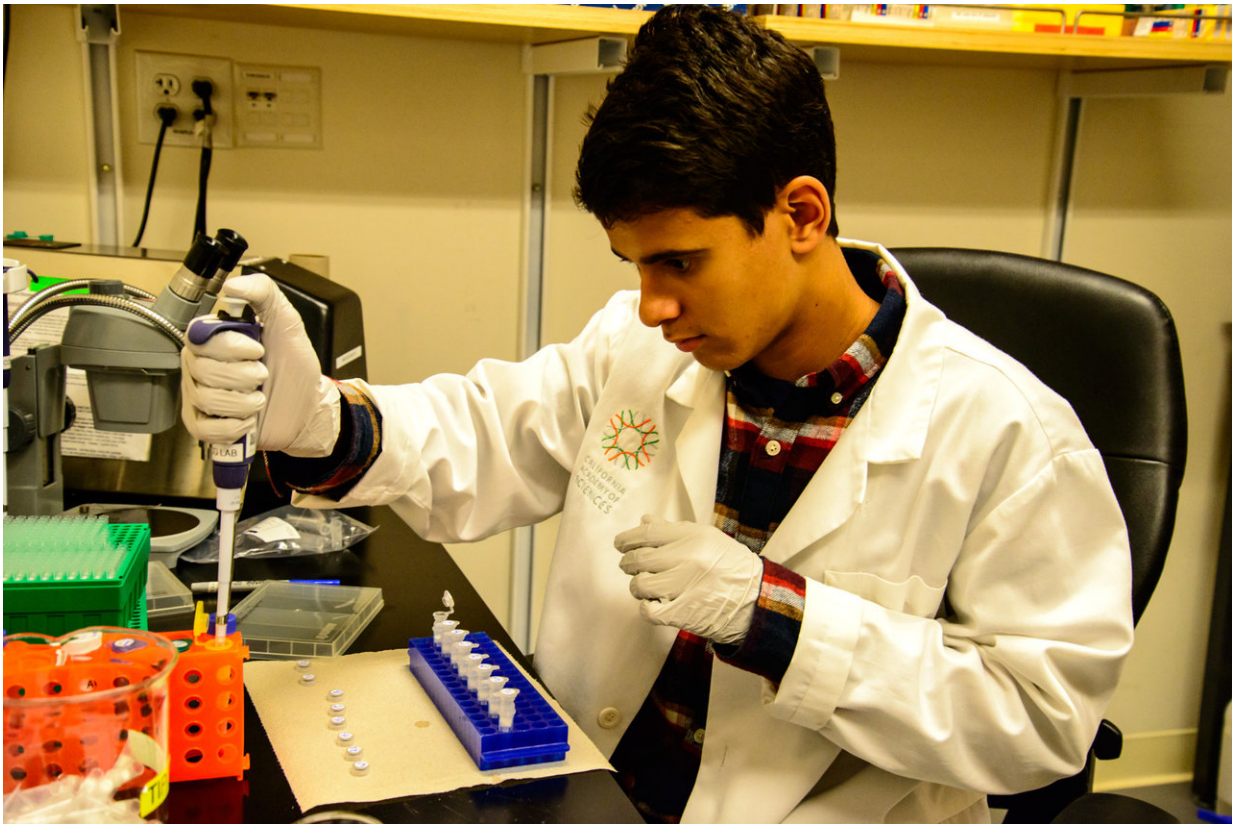
A newly described species of brown-and-white Philippine butterflyfish—the charismatic *Roa rumsfeldi*—made a fantastic, 7,000-mile journey before surprising scientists with its unknown status. Live specimens collected from 360 feet beneath the ocean's surface in the Philippine's Verde Island Passage escaped special notice until a single black fin spine tipped off aquarium biologists back in San Francisco. Deep-diving researchers from the California Academy of Sciences' Hope for Reefs team—with genetic sequencing help from a parent-son team—share their discovery of a fifth species of *Roa* this week in *ZooKeys*.

"We named this [reef](#) fish *Roa rumsfeldi* because, as Donald Rumsfeld once said, some things are truly 'unknown unknowns,'" says senior author Dr. Luiz Rocha, Academy curator of ichthyology and co-leader of its Hope for Reefs initiative to research, explore, and sustain global reefs. "This fish caught us completely off-guard. After traveling from the deep reefs of the Philippines to our aquarium in San Francisco, former Academy aquarium biologist and co-author Matt Wandell noticed a black fin spine that looked different from other known *Roa* we've collected in the past. It was a light bulb moment for all of us."

Butterflyfish—which sport bold patterns—are iconic coral reef species. Because this group's taxonomy is relatively well understood, scientists didn't expect to find an unknown species on a recent expedition.

Under pressure

Roa rumsfeldi and its close relatives are only known to live in mesophotic "twilight zone" reefs—a place where sunlight is scarce and divers with traditional scuba gear cannot safely visit. In the narrow band between the light-filled shallow reefs and the pitch-black deep sea, these little-known mesophotic reefs, located 200 to 500 feet beneath the ocean's surface, are home to fascinatingly diverse and previously-unknown marine life. As part of its Hope for Reefs initiative, specially trained Academy scientists are exploring these relatively unknown frontiers with the help of high-tech equipment like closed-circuit rebreathers, which take extensive training and allow them to extend their research time underwater.



"The team effort between our museum's scientists and aquarium biologists helped add a new fish to the tree of life," says Rocha, adding that the

collaboration isn't the only reason this fish discovery feels particularly special. "My teenage son Gabriel helped sequence its genes during a summer internship -- his mother and I helped show him how to use complicated genomic processes to take a closer look at the fish's DNA. This is part of how we prove a species is distinct, and it's always a pleasure to share that learning with young people." Gabriel Rocha, a high school sophomore at the time, helped sequence the mitochondrial DNA cytochrome oxidase I gene, also known as the "barcode" gene. The process from DNA extraction to amplification and sequencing takes just a few days -- an ideal project for short, in-depth internships. Credit: © 2016 Luiz Rocha and the California Academy of Sciences

As part of their expedition-driven research, Rocha and his Academy colleagues sometimes collect live fish they believe to be unknown species in order to study their behavior (making for more robust research) and inspire the public to connect with beautiful and unique reef life during aquarium visits.

"Our human bodies are not really compressible," says Bart Shepherd, Director of Steinhart Aquarium and co-leader of the Academy's Hope for Reefs initiative, "but fish have swim bladders for buoyancy that can't make the journey from twilight zone depths to the surface. We gently moved this Roa to a special lightweight [decompression chamber designed just for fish](#), brought it to the surface, and attentively cared for it through the flight back to San Francisco and into our aquarium."

A family affair

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Gabriel Rocha, a high school sophomore at the time, helped sequence the mitochondrial DNA cytochrome oxidase I gene, also known as the "barcode" gene. The process from DNA extraction to amplification and sequencing takes just a few days—an ideal project for short, in-depth internships. After the sequence is obtained, the work moves from the lab to the virtual world: Major online databases contain thousands of sequences of this gene for known species, and are a great comparison tool.



This new butterflyfish was collected by the Academy's deep-diving researchers

at 360 feet beneath the ocean's surface in the Philippine's Verde Island Passage.
Credit: © 2017 Luiz Rocha and the California Academy of Sciences

New discoveries and Hope for Reefs

Considered the "rainforests of the sea," [coral reefs](#) are some of the most biologically diverse, economically valuable, beautiful, and threatened ecosystems on Earth. They cover less than 0.1% of the ocean but contain more than 30% of marine species. Coral reefs provide critical habitat to vast marine communities—from the tiny coral polyps that make up the reef's foundation to the colorful fishes and sharks that live among them. Coral reefs are integral to the livelihoods and well-being of hundreds of millions of people worldwide, providing protection from erosion and generating income through ecotourism and fishing.

In response to coral reef threats, the Academy launched the Hope for Reefs initiative in 2016 to explore, explain, and sustain the world's coral reefs by making fundamental breakthroughs in coral reef biology; developing new conservation solutions and restoration techniques with partners like [SECORE International](#) and [The Nature Conservancy](#); and sharing what we know through innovative exhibits and educational programs.

Every Academy expedition yields new understanding and surprising discoveries, and the public can see new and rare species, many of which have never been displayed in a public aquarium, at Steinhart Aquarium. Explore the great unknown alongside our scientists as they uncover the secrets of our world's critically important reefs. Visitors to the Academy's [aquarium](#) can take a closer look at many mesophotic marine creatures from around the world—and discover why they deserve protection—in [Twilight Zone: Deep Reefs Revealed](#).

Provided by California Academy of Sciences

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