

# New study on "Burnt Hot Dog" sea cucumbers raises red flags for threatened global fisheries

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Healthy marine ecosystems rely on animals that provide these types of frequent cleaning services; without them, an abundance of detritus can impact plant and animal health, which in turn decreases the health of the ecosystem as a whole.

Credit: © Keoki Stender

Sea cucumbers—the floppy cousins of starfish and sea urchins—are particularly vulnerable to pollution and overfishing; scientists say this is bad news for ocean ecosystems worldwide.

*Holothuria edulis*—a type of slow-moving sea cucumber about the size of a classroom ruler—boasts an important ocean role despite its uncanny resemblance to an overcooked sausage. This "Burnt Hot Dog" sea cucumber takes center stage in a new genetic study that digs into the animal's valued spot in [marine ecosystems](#) across Japan's Okinawa Island as well as its extreme vulnerability to environmental stress and overfishing. A team of researchers, including an expert from the California Academy of Sciences, says their study's findings are an urgent call for increased fisheries management and protections for ecologically important sea cucumbers, sometimes called the "vacuum cleaners of the ocean," worldwide. The study was recently published in the journal *Conservation Genetics*.

Sea cucumbers, the often-overlooked cousins of starfish and sea urchins, are soft-bodied marine invertebrates that appear in myriad sizes, shapes, and thrilling colors in every ocean on Earth. More than 1,500 species—including pleasingly-named "Sea Apples," "Strawberries," and "Sea Pigs"—inhabit global oceans from the shallows to the mysterious deep seafloor. Despite their wide-reaching range and diversity of species, one Academy researcher says scientists need to know more about sea cucumbers' biology, natural histories, and ability to adapt to the modern threats of pollution, overfishing for food and medicine, and

changing ocean climate.



A rapid rise in East Asia's consumer demand for sea cucumbers for both food and medicine has increased fishing pressures in many parts of the world. Overfishing can spell extinction for species of sea cucumber that already face serious pollution and habitat destruction threats worldwide. For example, populations of *Holothuria whitmaei* and *H. scabra* -- once common in the entire Indian and Pacific oceans -- have recently declined 60 to 90 percent in most of their traditional ranges. Today, at least 16 species of sea cucumber are considered threatened with extinction by the International Union for Conservation of Nature (IUCN) Red List, a global authority on the conservation status of plants and animals. The above image depicts dried *Holothuria* sea cucumbers for sale in Hong Kong. Credit: © Steve Taylor

"It's easy to underestimate the sea cucumber," says Dr. Iria Fernandez-Silva, an Academy postdoctoral research fellow. "Sea cucumbers look goofy, move slowly, and barf up their guts when startled, but these invertebrates are superstar ocean cleaners that are hugely important to marine ecosystems. Our study looks into the genetics behind the economically-important species *Holothuria edulis* so we can understand the pressures they face and help protect threatened sea cucumbers globally."

Like other sea cucumbers, nocturnal *H. edulis* use their guts to help clean seafloors and coral reefs. These Burnt Hot Dog invertebrates take shelter during daylight hours before emerging at night to inch along the sandy seafloor in search of food. Feeding tentacles help the animal shove sand and rubble through its digestive system as it moves, absorbing nutrients from detritus (dead plant and animal matter) and expelling cleaner, oxygenated sand in its wake. Healthy marine ecosystems rely on animals that provide these types of frequent cleaning services; without them, an abundance of detritus can impact plant and animal health, which in turn decreases the health of the ecosystem as a whole.

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Fernandez-Silva and two colleagues—Drs. Taha Soliman and James Reimer from the University of the Ryukyus—are filling in a blurry

picture of exactly why sea cucumber populations have trouble rebounding from overfishing and environmental stress. The team traveled around Okinawa Island to explore the genetic exchange between different populations of Burnt Hot Dog sea cucumbers, an overexploited species found along the island's varied coastline. When caught in Okinawa, Japan, *H. edulis* is prepared and dried for food, medicine, or export overseas. A recent uptick in commercial demand for *H. edulis*—a species that hasn't historically been targeted by fishing interests—could be an indicator that more desirable sea cucumber species are becoming difficult to find in oceans worldwide.

In Okinawa, the scientists were interested in comparing *H. edulis* population genetic diversity—an extremely important factor in determining whether a population can safely survive in the face of stress—along a range of coastal habitats. A population of organisms that lacks diversity is more vulnerable to threats including disease, which can easily wipe out a population that is too genetically similar (and vulnerable to a particular pathogen). In the case of *H. edulis*, which has been known to reproduce both sexually and asexually, the researchers wondered what genetic diversity looked like in marine habitats ranging from relatively pristine to heavily developed and polluted.

"The data tell a story," says Fernandez-Silva. "We saw low genetic diversity in some sea cucumber populations along Okinawa's eastern coastline, where water is polluted by nearby industry, runoff, and coastal development. In contrast, populations in more pristine sites on the island's west coast were more genetically diverse. Since populations appeared disconnected from one another, we can predict that overfishing might be the last straw for vulnerable sea cucumber populations ill-equipped for a comeback."

The researchers say these genetic findings are red flags for stressed marine fisheries, and urge Okinawan officials to help study, monitor,

and protect [sea cucumbers](#) as valued marine ecosystem-cleaners. Fernandez-Silva and colleagues are currently researching different species of sea cucumber in southern Japan, and say preliminary findings are showing similar connections between polluted environments and low population diversity.

"Japan has the opportunity to become a leader in protecting ocean health," says Fernandez-Silva. "Urging other countries to tighten restrictions on sea cucumber fishing will help ensure the future of countless vulnerable species that help keep marine ecosystems clean and healthy. First, both Japan and Okinawa must act at home."

Hawaii provides a heartening example of environmental stewardship in the South Pacific. In June of 2015, Hawaii's State Board of Land and Natural Resources passed an emergency ban on the taking and selling of sea cucumber species in state waters, which appeared to be experiencing "imminent peril" due to overfishing for export overseas. Earlier this year, Governor David Ige signed a more detailed, large-scale ban on commercial sea cucumber take that outlined a preliminary plan for more sustainable fisheries along Hawaii's shores. Fernandez-Silva and her colleagues hope that Japan and other global entities will follow suit, protecting ecologically important—and threatened—marine species before they are lost forever.

"Where ocean life is concerned, looks aren't everything," says Fernandez-Silva. "We urge global communities to speak up in defense of important marine species, even those that look like burned hot dogs. Our team will continue to explore and explain why these critical species are worthy of protection."

**More information:** Taha Soliman et al. Genetic population structure and low genetic diversity in the over-exploited sea cucumber *Holothuria edulis* Lesson, 1830 (Echinodermata: Holothuroidea) in Okinawa Island,

*Conservation Genetics* (2016). [DOI: 10.1007/s10592-016-0823-8](https://doi.org/10.1007/s10592-016-0823-8)

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