

Catches from 1984 to 1992 were as follows:

Year	Catch (t)
1984	21.0
1985	26.6
1986	35.1
1987	48.5
1988	71.6
1989	72.0
1990	66.3
1991	261.9
1992	263.0

Since the 1992–93 fishing season (1 April to 31 March), the fishery has had restricted limited entry. To qualify for a sea cucumber permit a fisherman must have landed 50 lb of sea cucumber between 1 January 1988 and 30 June 1991. There were 86 permit-holders in 1993.

In 1993, 293 t of sea cucumber were landed in California. The catch was mainly composed of 12 t of warty sea cucumber and 279 t of California or giant red sea cucumber.

Most sea cucumbers were landed at the ports of Los Angeles and Santa Barbara. The main fishing grounds for *P. californicus* were the Santa Catalina Channel and the Santa Barbara Channel, at depths of 30 to 90 fathoms. *P. parvimensis* was harvested as far south as San Diego, but most of the catch was taken from waters off the northern Channel Islands.

Cucumber landings for the first nine months of 1994 were 259 t. The average price for warty sea cucumbers was \$0.66/lb; it ranged from \$0.30 to \$0.90/lb; the average price for California sea cucumbers was \$0.62/lb; it ranged from \$0.20 to \$0.70/lb.

However, divers are frequently paid a higher price per pound for the cucumbers they harvest. The warty variety is supposed to have a thicker, meatier body wall, which could result in a higher price for the diver.

Most of the sea cucumbers landed are dried and exported to Hong Kong and Taiwan. A small portion of the harvest is sold in the United States.

Problems of the Galapagos sea cucumber fishery

Communicated by C. Conand

Background information

Based on information and correspondence from G. Coppo, Charles Darwin Foundation

Ninety-five per cent of the Galapagos Islands Territory is a national park, with the remaining five per cent occupied by 'Ecuadorean settlers'. Unemployment on the mainland has caused many Ecuadoreans to move to this region over the last decade. The Marine Resources Reserve was created in 1986.

Traditional subsistence fishing in the Galapagos Islands is relatively undeveloped and there has never been any traditional fishing of sea cucumbers. Sea cucumber fishing appeared after the decline of the rock lobster fishery which was prohibited at the end of the 1980s. This venture was brought in from abroad and is controlled by entrepreneurs on the mainland. Local fishermen quickly turned to this type of fishing and currently account for 100 out of the 250 people involved. Processing camps have been set up on land in national park areas, leading to clearing of the land, fires, etc.

In 1992, a decree from the President of the Republic of Ecuador prohibited the harvesting of sea cucumbers, but social tensions have been very high (summer, 1994) and it has been very hard for the authorities to enforce this decree. In September 1994, an attempt was made to regulate the conflict through trial authorisation of 'artisanal' fishing in park waters, but this experiment does not take into consideration long-term conservation efforts. Negotiations are currently in progress. The Darwin Foundation, the Darwin Research Station and the National Park are continuing their efforts so that the Galapagos Islands, which have been declared a 'World Heritage' site by the United Nations, will safeguard their ecological resources for future generations.



Fishermen threaten Galapagos

by Richard Stone (source: *SCIENCE*, vol. 267, 3 February 1995)

Early in the afternoon on 3 January, several fishermen armed with clubs and machetes took researchers and their families hostage at Darwin Research Station, a small laboratory on Santa Cruz in the Galapagos. The pepineros—who fish for sea cucumber, or pepinos, that lie in beds off the Ecuadoran coast—said they were desperate.

The Government of Ecuador had just prohibited them from fishing off the Galapagos, in response to protests from scientists and tour operators who claimed the pepineros were harming one of the world's most fragile, and famous, ecosystems. Carmen Angermeyer, a resident of Santa Cruz, the main Galapagos island, recalls that Ecuadoran TV broadcast a chilling interview with a man in a mask, who 'said if they did not get what they wanted, blood would flow'.

Bloodletting, at least from humans, was avoided when troops arrived to free the hostages and remove the pepineros from the area. But sea cucumber beds are dangerously overfished, scientists say. And several Galapagos tortoises and sea lions were reported killed or mutilated prior to the occupation, according to Macarena Green, a biologist based in Quito, Ecuador, whose account of the events was forwarded to scientists over the Internet last week.

Many researchers reading the dispatch now worry that the flotilla of fishermen anchored off the islands may have introduced mainland rats and other species to some Galapagos islands, endangering the unique species that flourish there. 'Galapagos is facing an ecological crisis', warns Matt James, the Sonoma State University marine paleontologist who posted Green's distress signal.

The troubles began early last year, when biologists began finding slaughtered tortoises, some 'hung from trees'. Green told *Science* locals blamed the pepineros, who, Green says, were trying to force the Government to allow them to harvest the rich sea cucumber beds of the Galapagos, most of which is a national park.

The sea cucumbers, sushi delicacies, fetch a nice price upon export. The Government bowed to the demands, opening Galapagos waters to harvesting on 15 October for a three-month trial period.

It set total catch limit at 550,000 sea cucumbers, but 'no effective controls and enforcement were ever applied', claims Johannah Barry, an official of the Charles Darwin Foundation Inc., which raises funds for Darwin Station. The Foundation estimates the pepineros took at least six million sea cucumbers in just two months.

The Ecuadoran press began airing concerns about overharvesting and as public criticism mounted, the Government halted the sea cucumber season on 15 December, a month early, say Green and other scientists who work in the Galapagos.

According to the Darwin Foundation, which got its reports from stations personnel, three weeks later several armed pepineros stormed the park service office and the research station; Ecuador sent troops and Government officials to negotiate, and initially agreed to reopen the waters to fishing; the pepineros released their hostages and left.

But under pressure from environmental activists and from its own Ministry of Information and Tourism, which feared the loss of tourist dollars, the Government reversed its decision on 12 January and said it would prohibit sea cucumber harvesting until October 1995.

All is quiet on the Galapagos at the moment. But researchers were worried that the government was considering opening a four-month lobster season on 1 February.

San Francisco State University biologist Robert Bowman, a long-time Galapagos researcher, argues that such an action would effectively declare open season on sea cucumber again because, he says, the lobster fishers could just as easily take sea cucumbers.

Ecuador's National Fisheries Institute, with the Darwin Foundation, is currently undertaking a survey of the beds. The Fisheries Institute favours lifting the harvesting ban, at least for local fishermen. But any final decision on fishing rights rests with the Office of Ecuador President Sixto Duran Ballen, who will balance the economics of fishing against tourism and the well-being of flora and fauna.

Update on the illegal fishing activities in the Galapagos Islands, 24 March 1995

by J. R. Green

In mid-February 1995 a check was made by me personally of a previously established sea cucumber processing camp, situated in the mangroves at the northern end of the beach of a visitor site known as Punta Tortuga, on the western coast of Isabela Island. A 50 gallon drum, for cooking the cucumbers had been set up and dead mangrove wood lay chopped and strewn around the drum for firewood. There was no sign of anyone around the camp, but some of the mangroves appeared freshly cut.

On Monday 13 March I returned to the site to find brand new 'cooking' equipment. A rectangular steel tub, approximately 8 feet long, 2 feet wide and 2 feet deep had been set up alongside the drum. Judging by the piles of ash under the tub, this equipment had already been used several times. More mangroves had been cut around the clearing and along the beach. The area was strewn with

plastic rubbish and introduced tomato seedlings were growing around the edges of the clearing (presumably the area used by the cucumber fishermen as a bathroom!)

What this 'camp' clearly indicates is that:

1. Quantities of sea cucumbers are continuously being harvested and processed, despite the ban on this form of 'fishing'.
2. New species are being introduced into this almost pristine environment.
3. This small stand of mangroves which represents one of the most important habitats for the extremely rare and endemic mangrove finch, *Camarhynchus heliobates*, is being destroyed.



Galapagos Action Alert

J. E. Barry from the Charles Darwin Foundation, comments on the recent events in the Galapagos as follows:

1. The events of 3–6 January are worrisome. They are symptomatic of the collision of certain interest groups, biodiversity conservation and resource use, and the lack of definitive implementation of management and authority. In taking strong action, Ecuador has demonstrated its willingness to establish a framework for conservation decision-making that may well stand as a model for the rest of the world.
2. The evaluation of the 'experimental' sea cucumber fishery is critical and must be done with the utmost rigour. It will be extremely important to include information on sea cucumber biology and ecology, and experience gained from sea cucumber fisheries from all over the world as to their sustainability, efficacy, real costs and benefits, and ecological, social, economic and cultural impacts. The experience in Galapagos should be compared with information throughout the world in order to

project appropriate scenarios for Galapagos (both for the sea cucumbers and the entire marine environment) if the fishery were to be allowed to resume. The evaluation will be conducted by the National Fisheries Institute in Ecuador and the fisheries authorities have invited the Charles Darwin Foundation to participate. The CDF will be collaborating. In this matter, anyone who could offer their own technical expertise in gathering data, interpreting data, or providing other information to assist the evaluation team would be most welcome.

Editor's note:

A letter asking for international concern is circulating on 'eternet' and anyone interested in the problems of beche-de-mer fishing in Galapagos, is invited to contact J. E. Barry at the following address: Charles Darwin Foundation, Isla Santa Cruz, Galapagos, Ecuador.