The most remote fishery on earth

Over-fishing worldwide has driven fishers to the unique Ross Sea in Antarctica in pursuit of toothfish, a fish previously only deemed worthy by a handful of polar scientists, writes marine scientist CASSANDRA BROOKS. Should we be fishing in Antarctica which is designated a place of peace, to be protected from exploitation?

For decades Antarctic fish have drawn scientists from around the world to study their strange polar adaptations. Few people would have seen any potential for eating or harvesting these bizarre fish. I had studied fish for years, but seen nothing like Antarctic dragonfish (Family Bathydraconidae). Some have leopard print, thick leather-like skin and blunt triangle heads, culminating in a jagged underbite. Nor had I ever seen a fish as clean as Icefish (Family Channichthyidae), which lack hemoglobin, a peculiar polar adaptation that gives them clear white blood. In one trawl we found a small speckled purple fish with a long fleshy barbell snaking off its chin. We coined it "species A."

Our nets were also full of fish from the family Nototheniidae, the most diverse family of fishes in the Southern Ocean. While most of the notothenoids don't look particularly strange, their physiological adaptations are extraordinary. These fish proliferate in the frigid Antarctic waters by producing anti-freeze proteins that keeps their blood from crystallizing. Most of the fish were small and slender, usually 10 to 30 centimeters, until we caught an Antarctic toothfish (*Dissostichus mawsoni*), a fish that grows to more than two meters in length, making them the largest and most dominant fish in the Southern Ocean. The toothfish, is heavy and dense outside its water world. But once placed in a tub of water for a quick buoyancy test, it floated perfectly neutral in the water. Most fish use a swim bladder (filling it with air to stay aloft in the water column) but toothfish use lipids (or fats) to achieve perfect buoyancy with zero effort.

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But I wasn't here to study any amazing Antarctic piscine adaptations. I was a graduate student studying the life history of toothfish (also known as "Chilean sea bass"), heeding a request made by the Southern Ocean management body, CCAMLR (the Convention of the Conservation of Antarctic Marine Living Resources) in an effort to manage the growing fishery.

Harvesting the Southern Ocean

It may come as a surprise to know that some fish in our local grocery stores in the US, and some EU and Asian countries, come all the way from Antarctica. Indeed it makes little sense to use so much valuable energy resources, and time travelling to the most remote corner of the earth in pursuit of fish. But fisheries closest to home have been over-exploited and can no longer meet the needs of a growing world population, hungry for fish.[1] Recent United Nations Food and Agriculture Organization statistics show that 80 percent of global fisheries are fully exploited, over-fished, or collapsed while another 18 percent are moderately exploited.[2] This leaves only two percent of the world fisheries undeveloped, including some stocks of Antarctic toothfish. Fishermen are constantly forced into deeper, more remote waters to keep up with world demands and continue fishing, with or without a license to do so.

In the 1960s, fisherman began trawling around the sub-Antarctic islands, mostly for *Notothenia rossi* (the marbled rock cod) and some species of Icefish. Catches rose steadily, and by 1990, marbled rock cod populations plummeted to five percent of their pre-exploitation level.[3] With these shallow water species exhausted, fishermen began targeting the deep-water Patagonian toothfish, the northern cousin of the Ant-

Toothfish.
VALERIE LOEB

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arctic toothfish. Equal in length and full of the same fatty lipids for buoyancy, the fish was marketed as Chilean sea bass, and quickly became a popular menu item in up-scale restaurants. But legal commercial fishermen weren't the only ones interested in tapping this new gold mine; pirate fishermen also wanted their share. Within ten years local populations of Patagonian toothfish declined and stock closures ensued.[4] To keep up with market demands, fishing boats pressed into the southern-most reaches of Antarctic waters in pursuit of the Antarctic toothfish. With retail prices at over $20 per pound (USD, about $70 kilo NZD), the fishery plunders on despite stock depletions and the potential vulnerability of both species of toothfish.

Deep-sea fisheries problems

As a graduate student in 2007, I attended a symposium on deep-sea fisheries in San Francisco.[5] I listened in earnest, taking notes as all the fishery biologists on the panel, including world-renowned fishery experts like Daniel Pauly, stood up and talked about the vulnerability of deep-sea fisheries. Deepwater fish tend to grow slowly, live a long time, mature later in life and have low fecundity (reproductive capability). The symposium led to a clear conclusion: deep-sea fisheries are not resilient to heavy commercial exploitation. In the past we've realized this far too late, long after the deepwater fishes were over-harvested.

Toothfish, which occupy the deep waters of the Southern Ocean are among these slow-growing and long-lived fish, 50 years for the Patagonian species and about 40 for the Antarctic species, the latter confirmed by my graduate work.[6] We still don't know at precisely what age toothfish mature, but it's likely to be well into their teen years. Because many are caught long before this, they will never have a chance to reproduce and propagate the population. We also still know very little about where and when exactly they spawn. Incredibly, to date no one has found a larval Antarctic toothfish.


Species "A"
KIM DIETRICH

Given the trends of Antarctic and deep-sea fisheries, the chances that toothfish could withstand heavy fishing pressure seem slight. Toothfish are the largest fish in the Southern Ocean; decimating their population could damage the entire Antarctic ecosystem. Ross Sea scientists, the primary region for the Antarctic toothfish fishery, have formally pleaded to the Antarctic managing body to stop the fishery.[7] In recent years they've no longer been able to catch enough toothfish to continue the research they've been doing for decades.[8]

Under the Antarctic Treaty, the Antarctic continent is fully protected as a place for international peace and science. Exploitation is strictly forbidden. 9 Yet the treaty only applies to the land, leaving the waters around the continent part of the global commons. Don't these waters, teeming with animals found nowhere else on the planet, deserve the same protection? Do we really have any business to be commercially harvesting fish that come all the way from Antarctica?

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