

# NET LOSS

AS THE OCEANS  
RUN OUT OF  
STOCKS, THE  
WORLD'S FISHING  
FLEETS ARE  
MOVING INTO  
SOUTHERN  
WATERS, WHERE  
THE BATTLE TO  
SAVE UNEXPLOITED  
FISHERIES  
IS RAGING

**W**HEN THE English author John Bunyan wrote his masterpiece in the 17th century, the oceans represented the boundless, the untameable. Even in the 19th century, Thomas Henry Huxley, the English biologist and most prominent exponent of Darwin's

theory of evolution, believed fisheries were so vast as to be inexhaustible. But only a century after Huxley's death, the unthinkable is finally happening: we are running out of fish.

The global catch reached its peak in 1989. Every year another decline is recorded and vessels must ply the seas ever longer and cast their lines ever deeper. They have to go into new territories and catch unfamiliar species just to keep tonnages up. The world's scientists are in accord and only recently have nation states reluctantly agreed: the oceans have reached their limit.

Only 20 years ago, the United Nations believed that the ocean would be the food saviour of a growing population, predicting that by the end of this century some 500 million tonnes of seafood could be extracted from the sea. But then, off the coast of Canada, the world's richest fishing grounds collapsed and everyone got the fright of their lives.

The Grand Banks is an underwater plateau with an extensive sweep of shoals in the western Atlantic Ocean, off the south-east coast of Newfoundland, Canada. Here, the cold Labrador Current and the warm Gulf Stream mingle. Shallow and frequently fog-bound, the waters are rich in cod, halibut and haddock. Or, at least, they were.

These days, Canadian research vessels sweep the seas in vain, finding not a single school of cod – fish once so bountiful they could be caught by lowering baskets into the sea from the sides of ships. After centuries of booming commercial exploitation, the haddock, cod and flounder have all but disappeared. Canadian governments, after years of setting quotas at the upper limits of scientific recommendations (and sometimes above) were forced to close the fisheries in 1992, and a ban is likely to remain into the next century. Thirty thousand fishermen are idle and hundreds of fish processing workers have been laid off. St John's in Newfoundland, North America's oldest city, has been in a slump ever since.

Some scientists suggest that 15 years may pass before there are enough old spawners to restore fish populations. But others believe that the cod and some other bottom-feeding species may never return; that their ecological niche, now vacated, will be filled by other less edible species. In the Grand Banks, even five years after the ban was first imposed, cod numbers were still less than two per cent of what they had been in the mid-1980s.

Every morning, an abundant array of fresh catch arrives at the Sydney Fish Markets. Men in vinyl aprons unload crate after blue crate filled with whole tuna, marlin, mahi mahi and swordfish. The best and largest are picked out by restaurant buyers, or packed up and sent off to the finest eateries. In the midst of such industry and plenty, it's hard to believe there is a crisis in the oceans. But this is an illusion.

Seafood is popular and fish is still affordable. Although

"You see the ways  
the fisherman doth take  
To catch the fish;  
what engines doth he make?  
Behold how he  
engageth all his wits;  
Also his snares, lines,  
angles, hooks, and nets;  
Yet fish there be,  
that neither hook, nor line,  
Nor snare, nor net,  
nor engine can make thine."

— John Bunyan,  
*The Pilgrim's Progress*

■ BY WILSON DA SILVA ■ ILLUSTRATION BY NIGEL BUCHANAN





intensive and more efficient farming practices on land have contained price increases in the fishing sector, seafood prices worldwide have risen faster than those for chicken, pork or beef, and returns are good.

As prices go up, fishermen become bounty hunters. Take the bluefin tuna: it can grow to three metres long, weigh more than 600 kg and travel at speeds of 80 kph. Its red, oily flesh is prized in the most affluent markets, particularly in Japan, where it is de rigueur for gourmet sushi and sashimi. Thanks to a burgeoning seafood air-freight business, bluefin can be purchased by brokers at the dock and sent to the Tokyo market overnight, where a single fish can fetch \$US80,000 at auction.

And yet fishing is one of the world's most subsidised and wasteful industries. According to the United Nations Food and Agriculture Organisation (FAO), almost \$US\$4 billion is paid by governments in subsidies to their fishing



GREENPEACE/GRACE

industries. This includes fuel tax exemptions, price controls and low-interest loans, as well as outright grants for gear and infrastructure. All of this to an industry that only catches \$US70 billion worth of fish.

**Killer nets...** Thousands of ocean creatures and seabirds, such as this drowned sooty shearwater, get caught in driftnets every year.

The European Union alone has 40 per cent more vessels at sea than are needed to catch fish on a sustainable basis. In 1996, the EU spent \$US252 million – one-third of its annual fisheries budget – on access agreements for its distant water fleets, much of it in Third World countries with large maritime exclusive economic zones and little hard currency. According to a World Wide Fund for Nature report released last year, 90 per cent of subsidies to the fishing industry are in violation of international trade agreements.

Since the end of World War II, fishing has placed unprecedented pressure on the oceans: between 1950 and 1970, world catches tripled to 60 million tonnes a year. In the 20 years to 1990, the annual catch has only risen by 54 per cent; yet the number of fishing vessels has doubled.

## THE GREAT COLLAPSE

**T**HE GRAND Banks off the eastern coast of Canada were the greatest fishing grounds ever known. They had been fished at least since 1000 AD, mostly in secret, by Basque fishermen who dominated the market for that most favoured of European fish species, the Atlantic cod, *Gadus morhua*.

The source of Basque plenty remained a mystery until 1534, when Jacques Cartier arrived at the mouth of the St Lawrence River in what is today eastern Quebec. As Mark Kurlansky writes in his history of the fish, *Cod* (Vintage, \$19.95) Cartier noted that he had been preceded by a flotilla of 1,000 Basque fishing vessels: "But the Basque, wanting to keep a good secret, had never claimed it for anyone."

Europeans marvelled at the tales of plenty brought back by early explorers. Milan's envoy to London wrote to his duke about the British expedition led by John Cabot, which reported that "the sea is swarming with fish that can be taken not only with the net, but in baskets let down with a stone". The Grand Banks fisheries – which also included mackerel, herring, haddock and flounder – seemed inexhaustible, a view that prevailed in the centuries that followed.

After World War II, the global fishing effort went into overdrive and the number of vessels trawling the seas exploded. Canadian officials, keen to protect their grounds and the large Canadian fishing industry, conceded the fisheries might be affected without some management. Scientists were employed to set "safe" quotas for both Canadian and foreign fleets. The quotas were high, and their scientific basis rudimentary, but the catch continued to grow and there seemed no end to what the sea would yield.

In 1960, the annual catch of codfish occasionally hit 250,000 tonnes. But eight years later, it had reached an impressive 810,000 tonnes. In the years that followed, this began to drop off. Few were concerned, as fish populations are known to fluctuate and even the Grand Banks had seen sporadic disappearances from certain grounds that would last years.

By 1977, the cod catch had fallen to 150,000 tonnes. Canada blamed massive quota violations by foreign fleets,

extended its jurisdiction to 200 nautical miles offshore and sent in the navy to evict foreign vessels. Scientists at the Canadian Department of Fisheries and Oceans analysed populations and set a "total allowable catch", pegged at 16 per cent of the estimated fish population, which would in theory allow stocks to slowly increase. These mathematical models assumed that the size of fish populations was dominated by the survival rate of young fish, a number hard to determine accurately and which can vary unpredictably. And most of the data came from catch figures reported by the commercial fishing fleets. They also assumed that a slow recovery rate would only last a few years, allowing cod populations to pick up by 1990 and permitting annual catches of 400,000 tonnes by then.



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**Greenpeace activists in 1997 intercept a Dutch beam trawler believed to use heavy chains that plough up the seabed.**

In anticipation, the Canadian government offered incentives to buy new boats and build fish processing factories. Fishermen invested in bigger vessels with accurate sonar and other equipment designed to increase the catch per unit. No account of this new technology was taken when calculating the new cod quotas.

The recovery never did come: even with the closing of Canadian ports to foreign fleets in 1986, the cod quota peaked at only 266,000 tonnes in 1988 and again began to be wound back. By 1989, the scientists were becoming

uneasy. Research vessels cruising a random course across the Grand Banks found an ocean almost devoid of fish.

But catch data from commercial fishing vessels pointed the other way; when schools of cod were found, catches were plentiful and the data suggested twice as many fish as the models indicated. The scientists were reluctant to cry wolf based on a single research cruise. And to do so would mean questioning the whole theoretical basis for their modelling. So they compromised, setting a quota midway between the survey and the commercial data.

The fishing industry rebelled, saying scientists thought cod stocks were low because they didn't "go where the fish are". Canadian fisheries minister John Crosbie agreed, setting a higher quota. At an inquiry in 1990, the scientists – their confidence in their models now ebbing away – declined to make firm statements. Their uncertainty was exploited by the industry and the government to set quotas as high as possible.

The fisheries scientists finally rang alarm bells in 1992. Survey after survey was showing depletions and they had, too late, come to understand the nature of their quarry. Fish such as cod and haddock, they said, huddle together as they deplete. Fishermen reporting the best ever catches were getting a false impression because they were fishing only the areas where the fish congregated. "You see some cod and you assume that this is the tip of the iceberg," says Ralph Mayo, a marine biologist for the Woods Hole Oceanographic Institution in Massachusetts at the time. "But it could be the whole iceberg."

In January that year, the Canadian scientists recommended a quota of 185,000 tonnes, then trimmed this to 120,000 following another barren cruise. By June, no cod old enough to spawn could be found. Fishermen, too, were experiencing a rapid decline in catches. The scientists recommended a moratorium in the Grand Banks and adjacent fisheries and the fisheries minister agreed. Stricter quotas were placed on other bottom-feeding fish, such as haddock and flounder, numbers of which were also showing a massive decline.

In January 1994, the moratorium was extended indefinitely.



GREENPEACE/GAVIN NEWMAN/REUTERS X2



But it is not just the sheer numbers of boats that are depleting the world's oceans: it is also their scale. Worldwide, there are more than 38,000 "factory" ships: large super-trawlers that use radar to sail through all weather, sonar to find fish schools, geopositioning satellites to track them, and lines stretching kilometres behind them with up to 10,000 baited hooks that can drop more than 1,000 metres below. Some trail longlines stretching 129 km, or trawls that could engulf 12 jumbo jets and seize 10 tonnes of fish an hour. These hulking predators can stay out for months and process millions of fish, storing them in shipboard freezers. They represent one per cent of the total commercial fleet, but account for more than half of the world's fishing capacity.

A quarter of all the fish caught never makes it to market: an average 27 million tonnes of unwanted fish, known as bycatch, is thrown back each year, and most does not survive, according to the UN. This does not include the thousands of seabirds, sea turtles and other ocean creatures that get accidentally entangled on hooks. Take the case of trawlers in the Bering Sea and the Gulf of Alaska, analysed in a 1994 study by Alaska's Department of Fish and Game. Factory trawlers caught 341,000 tonnes of edible fish. But they also dumped 7,700 tonnes of halibut, 1,800 tonnes of herring, 200,000 salmon, 360,000 king crabs and 15 million tanner crabs, as well as cod, pollock and other

bottom-feeding fish. The study found that the fish discarded by the trawlers could have generated 50 million meals.

"The fishing industry is over-capitalised," says Dr Tony Koslow, a fisheries scientist at the CSIRO Marine Research in Hobart. "There are a lot more vessels out there than are necessary to catch the number of fish that can be caught. It is an economic and ecological crisis. What will these boats do? In the end, if they can't find new grounds, they will just end up going belly up."

And many have. The unrelenting pressure of mass-scale fishing has finally come up against the limits of the oceans. The global catch of fish peaked a decade ago and has been declining ever since. The UN estimates that 66 per cent of the world's commercially important marine fish stocks are either fully exploited or so depleted as to be commercially extinct. The FAO estimates that the total amount of fish that can be taken from the world's oceans sustainably is 82 million tonnes a year. This figure was reached five years ago – the world catch is now estimated at 110 million tonnes.

This depletion has set off three trends, each compounding the problem: fishermen are upgrading technologies to allow them to catch fish in deeper waters; they are fishing lower down the food chain; and as each fishery is depleted, they are moving to new grounds, where the cycle begins again. This has staved off a wholesale collapse of fisheries, but each

**Fish chase...** a Greenpeace raft (left) pursues an illegal fishing vessel near Kerguelen Island; the crew wear hooded masks (middle). Keith Brady (top right) wrestles with a Patagonian toothfish (right), legally caught.



## HUNTING TO EXTINCTION

**F**ISHERMEN ARE hunters and fish are their wild prey. When trawlers descend on a fishery, they make no provision for next year's take; nor do they leave behind enough fish to breed the next generation. They fill their holds with what they can take and return to port. Fishermen take from the sea, but return nothing.

Throughout history, the arrival of humans has always precipitated large-scale depletions of animal species and eventually extinctions. This is not just a product of Western capitalism or the Judeo-Christian ethos. It seems to be a by-product of human expansion, whether by Europeans in the New World or ancient tribesmen at the dawn of human history. Take the Americas, once home to elephants, mastodons, giant sloths, and lumbering glyptodonts, horses and camels. We know that humans arrived in North America 11,500 years ago, crossing the Bering Strait from Asia into Alaska and migrating south, reaching Tierra del Fuego, at the tip of South America, only a thousand years later. By the end of this rapid expansion, 57 large mammalian species in North America had ceased to exist. It's estimated that the human population of the Americas quickly jumped to several million. "This explosive expansion was facilitated by unlimited resources – land and prey – opening up before an inexorable advance," says palaeontologist Richard Leakey. "[It] left a trail of



GREENPEACE/GRACE

**Plenty more fish in the sea... if only. A catch of the prized bluefin tuna trapped in a tow cage in the Southern Ocean, Australia.**

destruction, as hunters were easily able to kill large, lumbering prey unused to a new kind of predator."

The animals had no innate fear of humans and no strategies to deal with such a new and efficient super-predator. Soon, American lions and sabre-tooth tigers also passed into history as numbers of their prey dwindled dramatically as a result of human predation.

History is littered with similar examples: in Europe (where elephants once roamed); in Papua New Guinea

(where seven species of giant marsupials disappeared shortly after humans arrived); in Australia, with the arrival of Aborigines; and most recently in New Zealand.

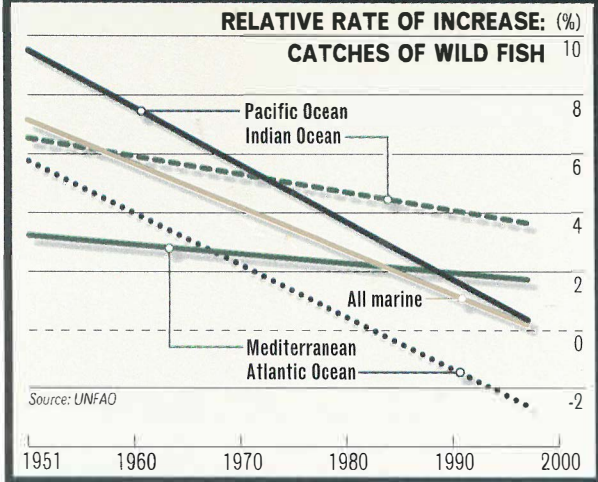
None has been better documented than the extinction of the moa. Weighing between 20 and 250 kg, these large, flightless birds dominated New Zealand until the Maoris arrived about 1100 AD. By 1400, moa were extinct. Analysis of ancient earth ovens reveal a wastage of meat that was enormous, "which indicates that protein was available in surplus at the time", writes Tim Flannery in his seminal book, *The Future Eaters*. At least, it was for a while. Possessed of a tropical agriculture that failed them in temperate latitudes, food sources became scarce. By the time Europeans began arriving in the 17th century, cannibalism was not uncommon and "certainly by the late 18th century, the bodies of those killed in war were a prized source of food", Flannery writes.

It is not therefore surprising that this grand human narrative of the past 60,000 or so years is now finally being played out in the oceans. It seems the only reason it had not occurred before was that humans didn't have the technology. Now we do. And there are so many more humans: the six billion people alive today represent the greatest proportion of living protoplasm to ever exist on the Earth. And it needs to be fed every day.





## STEEP TROUBLE



As marine stocks decline around the world, fishing fleets have headed south, to the waters around Antarctica and Australia's southern possessions. The freezing temperatures, wild seas and distance from port had limited the amount of fishing in the region, but now there is a gold-rush. What may be the last act in the global drama of overfishing is being played out in our neighbourhood. The world's fleets have come to the last undeveloped fisheries. And they have found a prey that is large, fleshy and easy to catch, which fetches a high price in premium markets: the Patagonian toothfish.

These deep-water creatures, swimming between one and two kilometres beneath the icy seas, can grow to two metres in length and weigh 100 kg. They are thought to live for between 20 and 40 years, but no-one knows at what point they reach sexual maturity and spawn. A decade ago, hardly

anyone fished them. Now, as other major species decline, the toothfish has become a prime commercial target. Still a mystery to science, it is already worth an estimated \$US270 million annually and can fetch \$US11 a kilo in Japan.

"When I was a graduate student, the idea that there would be fisheries at a thousand metres – it just wasn't taken seriously," says the CSIRO's Tony Koslow, who grew up on the Pacific coast of Canada. "Most life in the sea declines pretty much exponentially with depth – life just becomes sparser and sparser. But within the last 10 or 20 years, fishing fleets have been moving out into non-traditional grounds. And they've been going much, much deeper."

But, as Koslow points out, the fishing grounds around Australia and Antarctica are different from others. For reasons no-one quite understands, the southern hemisphere is less populated with fish per square kilometre of ocean than the northern hemisphere. And the stock is much less diverse: of the 20,000 known species of fish, only 120 inhabit waters around the Antarctic.

The region is also a global commons and patrolling is a scarce activity. Catches are governed by a 23-nation treaty organisation known as CCAMLR, the Commission for the Conservation of Antarctic Marine Living Resources. It sets quotas annually, based on limited survey data collected by British and Australian scientists around three Antarctic islands some years ago. Ecologists use computer models to extrapolate populations for similar submarine terrain in Antarctic waters from this data. They then estimate total populations and come up with a figure for the amount that can be fished without destroying the stock.

Aboard every legal vessel operating in the region is a scientific observer who logs tonnages and rate of catch. In this way, each year a picture builds of how the stocks are

reacting to fishing. In addition, scientific surveys take place every few years, outside the areas where the fish congregate.

But even these measures are considered minimal by scientists seeking to truly understand a fishery, particularly a new one. "It's a bit like trying to survey a population on a mountain by flying over in a helicopter and dangling a camera," says Koslow, who led a survey to Antarctic waters earlier this year. "Each of the various techniques we use has biases and problems. In fact, in this survey we didn't find a major aggregation toothfish around Macquarie Island. But there was one recorded two years ago by the fishing fleet that was estimated at maybe several tens of thousands of tonnes." This doesn't mean the toothfish is gone, he explains: it could just mean that the populations fluctuate in ways we don't understand. It's this lack of complete understanding that makes the setting of quotas so fraught. And who will fund the annual equipment-laden trawls filled with the kind of PhD-wielding crew needed to build a more-than-cursory picture of a fishing ground, particularly one shared by so many nations?

Nevertheless, the scientific effort that goes into producing the CCAMLR quotas is highly regarded and considered some of the best sustainable fishing ecology work in the business. Many point to it as a sign of how fisheries could be managed in the future.

And yet, it is a sham. Illegal fishing is rampant in these waters, and pirate vessels care little about the quotas. While CCAMLR sets an annual sustainable quota of 28,000 tonnes for the toothfish, more than 100,000 tonnes is landed in ports around the world. "There's a vast difference between the amount of toothfish which has been traded and that which has been calculated to be sustainable," says Dr Andrew Constable, an ecologist at the Australian

## CAN AQUACULTURE SAVE US?

**I**N a world rapidly running out of fish, aquaculture would seem a godsend. And it certainly is booming. In 1984, fish and shellfish farming generated 6.9 million tonnes worldwide; a decade later, this had almost tripled to 18.5 million tonnes. In fact, had it not been for the dramatic rise in aquaculture, the total tonnage of fish would have been declining (see graph).

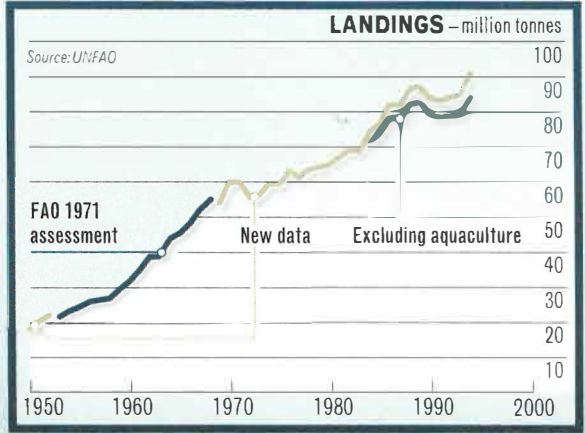
Global aquaculture now accounts for one-quarter of all fish eaten; almost half of the salmon and a fourth of the shrimp consumed come from fish farms. In all, the industry is estimated to be worth \$US36 billion a year and is growing at between five and 10 per cent a year.

In Australia, the industry is largely made up of oyster, tuna, salmon and prawn farms, generating \$491 million in revenue and accounting for 25 per cent of the country's fisheries production by value. The fastest-growing sub-group of this sector is southern bluefin tuna culturing, which began in 1991 and is now worth \$130 million.

But as is the case with most aquaculture, the fish are not farmed from cradle to plate: the tuna are captured in the wild, fattened and then "harvested" six months later, largely for the profitable sashimi market in Japan. The pressure on ocean fisheries is still present: the tuna have to be fed large amounts of wild fish, such as pilchards, before

they are ready for market. Source stocks of bluefin are already overfished, and the quota is unlikely to be lifted from the present 5,265 tonnes a year if the fishery is to last.

Most farmed fish require a great deal more seafood to eat than the process creates. The quantity of wild-caught fish fed to aquacultured shrimp and salmon is almost triple the amount of final product. These species are also considered by scientists to be the most environmentally pernicious, accused not only of depleting fisheries, but



Antarctic Division, who helps set the quotas for CCAMLR. "It's clear that the total catch is not sustainable."

At this rate of intensive fishing, even CCAMLR scientists agree that the toothfish could be commercially extinct in the next three years. Nations with territories with a CCAMLR

treaty area, such as Australia, France and New Zealand, have sent warships to chase the pirates and have in a few cases seized cargo and impounded vessels. In one case, two vessels – one registered in Panama, the other in Belize – were charged and their captains fined hundreds of thousands of

also of disrupting coastal ecosystems and polluting oceans with an abundance of nutrients and pesticides.

"Aquaculture is often seen as a panacea, the solution to relieving fishing pressure on the oceans and feeding the world," says Professor Jane Lubchenco, a zoologist at Oregon State University and the co-author of a major report into aquaculture published in the journal *Science* last year. "But it's a losing proposition if what you are trying to do is decrease the pressure on wild-caught fish."

Lubchenco says that some species, such as carp, oysters and mussels, can be sustainable and have a low impact on surrounding marine environments. Sturgeon is another, says Dr Serge Doroshov of the University of California at Davis: "The fish is a very efficient converter of food."

But scientists say there is no incentive to raise fish in a way that is sustainable, or to encourage diversity in aquaculture rather than a monoculture that has to be maintained with pesticides and drugs, such as antibiotics. In Asia, shrimp farming grounds are often abandoned after five years as the discharge of waste and pesticides from farm ponds into the open ocean damages the habitats.

"Unless it is done right, some aquaculture is causing more problems than it solves, and doing nothing to increase the world's overall food supply," Lubchenco says.

dollars in 1997. But the trade is so profitable that one of the ships, now known to be Spanish-owned, was sighted again this year poaching toothfish in Antarctic waters.

"One of the difficulties in the Antarctic is being able to enforce the regulations," says Constable. "It's far away and

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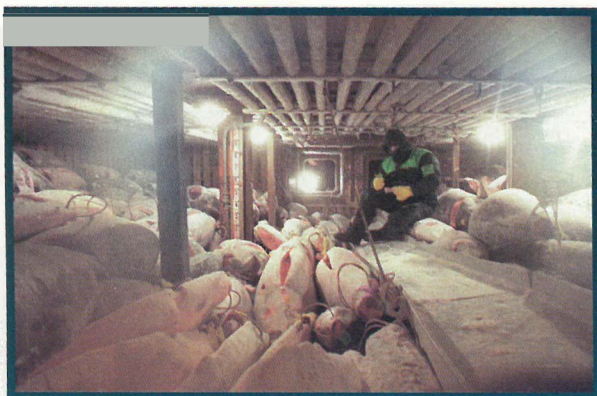
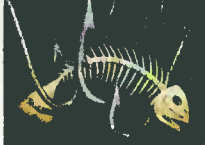
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NICK MOIR

**Cold fish...** The tuna-filled freezer room of a Japanese vessel docked at Darling Harbour, Sydney, is inspected for evidence of overfishing.

an expensive area to have a ship in. It's easy for illegal vessels to get into the area, poach the fish and get out again."

Even if the seas are better patrolled, as they have been on a sporadic basis since 1997, CCAMLR nations are powerless to seize pirates outside the 200 nautical mile

exclusive economic zones (EEZ) of Antarctic territories such as Australia's Heard Island. "Obviously these guys are thinking twice about whether they target the Australian EEZ or the French EEZ, which are now more regularly patrolled," says Frank Meere, acting managing director of the Australian Fisheries Management Authority (AFMA). "But in some places it's already too late, because they have been in there and done enormous damage already."

Most of the poachers are from countries that are party to the CCAMLR treaty, the major culprits being fishing conglomerates in Spain, Norway and Korea. But the vessels are always registered in countries such as Belize or Panama and their ownership is difficult to trace. However, patience is running out. Australia has been leading a push in CCAMLR to introduce a system of catch certification, whereby only vessels that can certify their catch of toothfish was obtained legally would be able to unload their cargo and the 23 CCAMLR nations – which are also the fish's biggest consumers – would ban the importation of uncertified catches. The measure could be introduced next year.

Developments such as these may well slow the seemingly inexorable grind toward commercial extinction, but they

## DEEP DECLINE

**PERCENTAGE DECLINE IN ANNUAL FISH CATCHES FROM THEIR PEAKS, REACHED BETWEEN SEVEN AND 25 YEARS AGO:**

### NORTH ATLANTIC

■ Off the US east coast – 42 %

■ Off Europe's west coast – 16 %

### SOUTH ATLANTIC

■ Off Brazil's east coast – 36 %

■ Off Argentina's east coast – 11 %

■ Off Africa's west coast – 20 %

■ Off South Africa's west coast – 53 %

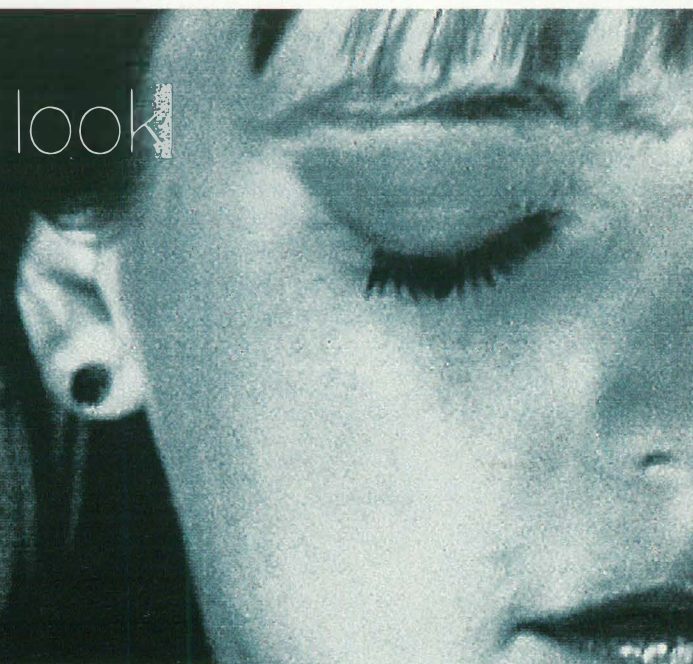
### NORTH PACIFIC

■ Off the North American west coast – 9 %

■ Off the Central American west coast – 31 %

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do not address the core problem of overfishing. "How do you control high seas fishing fleets? How do you stop them moving from one ground to another, essentially sending all of those grounds into commercial extinction in their wake?" Constable asks. "Until we stop just trying to simply regulate where fishing can be undertaken and get to the nub of the problem, which is to control the number of vessels, I don't think that there will be much progress."

The nations of the world seem to have reached the same conclusion. Earlier this year, member nations of the UN's Food and Agriculture Organisation agreed to address fleet capacity in their countries and control the size of distant-water fishing fleets. A target date of 2005 was set, with the possibility of introducing the measure by 2003. It is the first time an international agreement has committed nations to review the size of their fishing fleets and develop plans for reducing them.

Some nations have already bitten the bullet: Japan has scrapped 130 vessels in the last six months. Large sums were paid in compensation to the communities affected and the vessels were turned into scrap metal. Despite this, the Japanese fishing effort remains over-capitalised.

"By and large, Australian fisheries are nowhere near as over-capitalised as elsewhere in the world," Meere says. "But we do have our problems. We could probably harvest fish in all our fisheries with fewer boats than we currently have. And that's the dilemma with fisheries management – we have not sent operators the right signals." The AFMA has also been whittling down capacity, buying out 27 fishing permits in the crowded south-east fishery (off NSW and Victoria) and compensating the operators. More may be needed. Meere says that the AFMA's system of individual transferable quotas – in which total sustainable catch is set for a fishery, then divided into licences – is the way fisheries management has to go. "Fishing operators don't have to catch their share tomorrow. They are not in a race to fish."

While the oceans may be too vast for humans to cause a wholesale extinction of a fish species, we certainly have the power to hunt a species down to such a remnant population that it never returns in enough numbers to sustain a commercial fishery, its ecological niche swallowed up by a competitor species. And as the demand for seafood grows and our technology improves, we could go on down the food chain, catching all that can be caught, until eventually all the big fish are so few in number they are essentially gone. Already, some scientists suspect that within a generation this forecast will prove true: most of the world's fishing grounds will have become commercially extinct.

"If things go unchecked, we might end up with a marine junkyard dominated by plankton," says Daniel Pauly. He could be right. ■