

## Save the sharks.

by Leigh Dayton

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A BLACK fin appears in a tropical bay. The pounding beat of the soundtrack quickens as the ruthless killer closes in. The fish strikes: cut to a close-up of jaws and slashing teeth. A cloud of blood and dismembered bather complete the image. This is the shark as movie star, the powerful fish that threatens humans.

In reality of course the reverse is true: sharks are being threatened by humans. Over the past 20 years human exploitation of sharks has increased dramatically worldwide, with the result that many populations are now believed to be endangered. Hard figures are scarce, but biologists think that of the undreds of known species (see Box 1), the 20 or so that are fished commercially are in most trouble. And although no one is predicting mass extinctions, there is growing concern over the possible effects of continued exploitation on marine food chains.

There are signs that governments, too, are beginning to take the problem seriously. In April, South Africa became the first country to ban the killing of great white sharks. And within the next few months, the US National Marine Fisheries Service is expected to announce a package of sweeping controls on shark fishing, both recreational and commercial. These will give varying degrees of protection to more than 30 species, according to Charles Manire, a shark researchers based at the University of Miami in Florida.

For the species thought to be at greatest risk in northern waters--the great white shark, tiger shark, hammerhead shark and lemon shark--all forms of killing will be banned in US waters. Other species, such as thresher sharks, will be protected by catch quotas, which will be based on current population estimates.

But introducing restrictions is one thing, enforcing them quite another. Past experience suggests that shark fishing, like whaling, can be difficult to control. According to David Pollard of the New South Wales Fisheries Institute in Australia, the number of the grey nurse sharks near central New South Wales declined fortyfold during the 1980s even though it gained legal protection in 1984. Exactly how the US controls will be enforced has not yet been worked out. The shark researchers who are reviewing the proposals envisage the involvement of both boat and port inspectors.

In persuading politicians of the need for truly effective protection, the main problem facing biologists is a lack of informaton on shark populations. Sharks are not

high-priority commercial fish, so the amount of research done is limited. Nor have sharks attracted the interests of international conservation groups, in the way that whales have. Nonetheless the figures that do exist paint a bleak picture.

For example, according to a group of shark researchers based at the University of Miami and the Bimini Biological Field Station in the Bahamas, one population of lemon sharks (*Negaprion brevirostris*) near Florida has declined about a hundredfold in the past 15 years. In the mid-1970s the researchers were able to catch and tag 2000 or so sharks each summer; that figure is now down to between 30 and 40. If other populations of lemon sharks in US coastal waters have declined to this extent, then the problem is serious, says Manire, one of the researchers involved in the study. "Bu the time we can put a number on the problem, it's normally too late."

Worrying figures also come from catch rates compiled by fisheries biologists in California and South Australia. Over the past 10 years, shark meat has appeared with growing frequency on the menus of fashionable American restaurants. To meet the demand, the commercial catch in the United States increased from roughly 500 tonnes in 1980 to more than 7000 tonnes in 1989. Yet in spite of continuing demand for shark meat, last year's catch was down an estimated 20 per cent. When the US restrictions on shark fishing come into force, anyone trading in shark meat is likely to require a government licence. In South Australia an average of 5000 tonnes of school shark (*Galeorhinus galeus*) and gummy shark (*Mustelus antarcticus*) were landed each year in the 1970s. But since 1980 the yearly catch has declined to less than 1000 tonnes.

Of even greater concern to researchers is the fact that fishermen are working ever harder to catch fewer sharks. In Australia a group of government researchers has been monitoring what is termed the "catch per unit effort" (CPUE)--the amount of fish caught using a 1-kilometre gill net for 1 hour. Since 1973 the CPUE for school and gummy shark has fallen by about a half. Moreover, the group leader, Tery Walker, fears the figures are too optimistic. For one thing, says Walker, they do not take into account increased efficiency gained from better boats and equipment.

However, estimating worldwide population trends from such figures is far from easy. Most shark species are threatened to different extents in different parts of the world. Also, the migratory habits of some species make it difficult for researchers to keep track of individual

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populations. While in Florida the large coastal sharks such as the lemon shark and tiger shark (*Galeocerdo cuvier*) are under the most pressure, near Australia grey nurse, gummy and school shark have borne the brunt of human predation. The reasons for the pressure vary too, depending on both the species and the location. The plight of Florida's lemon shark, for instance, largely reflects the loss of a key habitat, the local mangroves which serve as nursery grounds for lemon shark pups.

For the vast majority of sharks it is not targeted fishing, either commercial or game, that poses the main threat but "incidental mortality". Information is limited but estimates based on observer programmes in the north Pacific suggest millions of sharks are killed by accident each year in drift nets. Greenpeace Australia calculates that in 1988 alone Taiwanese and Korean fleets killed over 2.25 million blue sharks (*Prionace glauca*) in the north Pacific as they fished for squid. The actual impact on the region's blue sharks is difficult to assess, however, because researchers have no idea how many live in the area.

Shark researchers in the United States also consider incidental mortality to be the biggest threat to many species. Manire puts the problem in perspective: "Over 90 per cent of all sharks caught commercially are killed and then thrown back into the ocean to rot." One of the aims of the proposed US controls, he says, is to make fishermen release sharks they catch accidentally, rather than killing them. Fishermen have long viewed sharks as a threat to the species they really want, and so are quick to bludgeon them when they appear in the catch. In reality, says Manire, the opposite is true: sharks help to maintain the quality of the catch by taking prey that are of no commercial value, such as old and sick fish.

Though not as significant as incidental mortality, targeted fishing of sharks, especially "finning", has increased sharply in recent years. Finning is the practice of catching sharks, cutting off their fins, and dumping the animals (often still alive) back into the water. Many species of shark are exploited in this way.

Although the main market for the fins is Asia, where they are made into shark fin soup, the demand for fins is on the increase elsewhere: on international markets shark fins currently fetch \$117 per kilogram. Finning is especially attractive because the fins can be dried easily, and stored without expensive on-board preparation and refrigeration equipment. Poor fishermen can get into the game, and large fleets can increase their profits with little effort.

As large-scale finning is a relatively new and largely unregulated activity, researchers can only guess at the price it exacts on shark populations. Circumstantial

evidence suggests it is high. For example, in the Cocos Islands off Florida fishermen began finning hammerhead sharks (*Sphyrnidae*) seven years ago. The population dropped to steeply that a sanctuary was created. Now, though, there are reports that some fishermen bribe guards to allow them to continue the practice.

Sport fishing, too, has taken a toll on some shark stocks, particularly off the coast of Florida, where sharks became a prized "glory fish" after the movie *Jaws* was released. Researchers are just beginning to carry out detailed studies of sport fishing; their hunch is that it is a serious problem for species living near certain resort areas. For example, the recreational catch of leopard sharks (*Triakis semifasciata*) off the California coast is estimated to be six times greater than the commercial catch.

In Florida, dozens of "shark kill" tournaments, with up to 200 anglers taking part in each, sprang up during the late 1970s and 1980s. The winning catches were frequently large tiger sharks weighing 350 kilograms or more. While the events were highly profitable for the organisers, they were disastrous for the sharks, says Robert Heuter of the Mote Marine laboratory in Sarasota, Florida, who has just completed a study of Florida tournaments. He notes: "The trend is clear. You see a gross decline in the number and size of sharks entered [caught] in the tournaments." To illustrate, Heuter points out that the trophy-winning fish in a large tournament last year was a comparatively puny grey nurse shark of about 40 kilograms. He believes that the drop in size is a direct result of overfishing by sportsmen.

All these pressures would be less worrying if sharks reproduced as prolifically as other fish. Typical bony fish produce thousands, and in some cases millions, of eggs annually. In contrast, most sharks produce between 2 and 50 young per year, take a long time to reach reproductive age and live long lives--between 12 and 70 years depending on the species. The inevitable result is that there are not enough young "recruits" to replace adults lost to human predation.

What will happen if shark exploitation goes unchecked? Most shark species are top-level predators, so a sharp drop in their numbers could, at least in theory, have a marked effect on marine food chains. Biologists such as John Stevens of the CSIRO, the Australian national research organisation, warn that if the downward slide continues, the equilibrium between predators and prey throughout the oceans could be thrown out of kilter. But exactly what that will mean cannot be predicted with confidence. "We just don't have enough understanding of the food web to know precisely what will happen," says Stevens.

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The Antarctic blue whale, which was heavily hunted until the 1960s, provides one model. When its population plummeted, the number of krill (the whale's main food) was prevented from exploding by an expansion in the populations of other krill feeders, principally seals. A similar thing could happen in the case of sharks, but most researchers think it unlikely. Most species of shark are at the top of a longer and more complex food chain than that of the blue whale and there are no obvious predators that could replace sharks.

The effect of killing off top predators are better understood on land. Samuel Gruber, a biologist at the University of Miami and Bimini Biological Field Station in the Bahamas, likens the shark to the American mountain lion. Until recently, farmers in the southwestern United States deliberately destroyed mountain lions to "protect" sheep, cattle and big-game species. The result was an explosion in the population of antelope, one of the mountain lion's former prey, into vast herds which, in the words of Gruber, "ate themselves out of the environment."

If some populations of sharks have been in trouble for so long, why is widespread concern only now emerging? Many researchers think that the shark's image is partly to blame. The lurid portrait of sharks given in films does a grave injustice to the animal we love to hate, says Gruber. At the world's first conference on shark conservation, held recently in Sydney, Australia, he issued a blunt statement: "The message is that sharks are not the death fish from hell."

A key question is whether the shark's reputation will prove a stumbling block to the development of conservation policies. "Marine mammals have a friendly image, and that tends to attract a lot of attention from the media, wildlife organisations and funding agencies," says Stevens. "Sharks have a negative image, and that definitely work against them." Peter Gill, a biologist with Greenpeace Australia, agrees. Have any of the world's conservation organisations ever funded a shark campaign? His reply: "No. The answer is no."

To help to win support, several researchers have taken on the role of public relations officers for sharks. Gruber decided that it was time for action a few years ago when his group's long-term study of the Florida lemon shark ground to a halt because all the animals being studied had been killed by divers. He now heads a newly established shark survival group for the IUCN, the World Conservation Union. Gruber sees education as a top priority. "We have to get across the message that their press has been unduly bad for emotional reasons," he says.

Gruber's opinion is shared by George Burgess, a biologist

at the University of Florida, Gainesville, and director of the International Shark Attack File. Burgess estimates that, worldwide, only 30 to 100 people are attacked by sharks each year. An average of 30 per cent of those attacks are fatal. Pakistan's Bengal Tigers, by contrast, attack approximately 600 people each year, killing 200. John West, who runs the Australian Shark Attack File at the Tarong Zoo, Sydney, adds that the probability of being killed by a shark is infinitesimal compared with the chance of drowning or dying from a bee sting.

So why the bad image? Films such as *Jaws* undoubtedly have a lot to answer for. But there is another reason: until recently, even biologists knew surprisingly little about most species, and knowledge is still "fragmentary", says Stevens. Shark life histories are a particular mystery. There are vast gaps in our understanding of the development and reproductive cycles of most species.

Much of the information that is available about shark biology and behaviour has come from fish caught in beach nets. To remove sharks from areas near public beaches, countries such as Australia and South Africa maintain extensive netting programmes. But researchers can glean only sparse biological information from these programmes, as the relatively few fish that are caught are often not representative of the population at large. And ocean-going studies are inherently difficult.

John Paxton, a shark researcher at the Australian Museum in Sydney, sums up the problem: "We can't get down there [into the ocean] and be with them all the time. You can't put a tag on individuals and follow them through life." Similarly, obtaining representative samples of sharks for study in the laboratory can be laborious, and therefore expensive.

To halt the decline in shark populations, researchers are calling for controlled fisheries, protected nursery areas for young sharks, shark reserves and an international ban on finning. They also want more research to enable experts to develop detailed conservation and management strategies. But the researchers stress that they cannot act alone: they need financial, legal and political help, as well as cooperation from the public. Otherwise, they fear, future conservation programmes--perhaps even the forthcoming US controls--will fail as badly as Australia's attempt to protect the grey nurse shark.

Meanwhile, Australians and South Africans continue to demand extensive beach netting of sharks. Australians net between 1000 and 1500 sharks each year and, according to Jeremy Cliff, a biologist on the Natal Shark Board, South Africans net an average of 1400 sharks annually. Convincing people of the need to curb such activities may

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prove a tall order for shark researchers, some of whom worry that even if the public's attitude does shift, the change may prove too little, too late. Robert Heuter summed up their concern at the Sydney meeting. He showed a slide of an American roadside billboard. The sign was intended for a sports club, but the sentiment was applauded by the gathered scientists. The message: "Good luck, sharks!".