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THE FISHER KING

His life has been an odyssey: after being kidnapped as a child, he went on to sail the world's oceans and develop powerful theories about the world's fisheries.

STORY *Peter Calamai*
PHOTOGRAPHS *Dina Goldstein*

>> **THE SCENE IS A RECEPTION** at the annual meeting of the American Association for the Advancement of Science in St Louis, Missouri. Journalists, scientists, activists, publicists, officials and party-crashers are crammed into a cordoned-off rectangle, like so many fish in a net.

And gazing placidly above the thrashing crowd from his height of 195 cm is the master nose-counter of all the world's fish himself, Daniel Marc Pauly.

For a quarter of a century, the polyglot Pauly has been rising above the crowd in the cosseted world of fish management — initially by devoting his prodigious talents and energies to understanding the fisheries of poor developing countries while most of his colleagues were occupied with the rich industrialised world. And then, during the last dozen years, by coming up with credible numbers for the total world fishery — that is, every tonne of every wiggling marine creature that's netted, speared, hooked, trawled or otherwise scooped from every square centimetre of the world's seven seas. By his calculations, that works out to somewhere around 90 million tonnes annually.

tactic with a man who has published more than 500 articles and who — without any advance notice of the question from a reporter — demolished just such an attack on his research in a paper published just two days previously.

Yet even though population estimates for some species are little better than guesses, Pauly contends that the world's fisheries can still be put on a sustainable footing.

"Paradoxically, we can manage the fisheries. We know from the state of the stocks that the rate of extraction is in excess of what would maintain the balance. So we can intervene in the right direction, even if we don't know the exact input and output."

But to get such intervention started, there has to be a high-profile champion for fish. So imperilled are the world's fisheries, Pauly told the St Louis meeting in February 2006, that only someone with the public stature and activist commitment of a Nelson Mandela or a Bono would be able to save many fish populations from following the North Atlantic cod to the brink of extinction.

Expanding on this point over the din of the reception, Pauly explains why such charisma is an essential element in any salvage plan.

(Swahili and Russian) and the one he never mastered (Indonesian).

Also entangled with those languages is a peripatetic life's journey of 60 years that has taken the offspring of a white French mother and a black American father around most of the world: from a near-Dickensian boyhood in Europe to worldwide acclaim in his current position as director of the Fisheries Centre at the University of British Columbia in Vancouver, Canada.

For his pioneering research in estimating the number of fish on a global scale, Pauly has been smothered in recognition and honours. There have been flattering profiles in *Science* and *Nature*, the world's pre-eminent scientific journals, and in leading newspapers. Last year he won Japan's substantial Cosmos Prize for research excellence, which promotes the concept of the "harmonious co-existence of nature and mankind", worth A$450,000 (US$335,000). This year he is one of three pioneers in marine ecosystems sharing Sweden's Volvo Environment Prize, worth a total of A$275,000 (US$210,000).

The Volvo announcement pointed to Pauly's ground-breaking efforts in popularising

"He's undoubtedly the foremost fisheries biologist in the world. He has been almost single-handedly responsible for changing the way that people in his profession look at the responsibilities of their profession."

In Pauly's view, the trends over time in these numbers clearly show two things. First, the total haul from all world fisheries — legal and illegal, industrial and artisanal — has been in decline since the late 1980s because fish stocks have shrunk to the point where fishing fleets can no longer catch their quotas.

Second, a rising percentage of the declining catch is made up of ever smaller fish that occupy increasingly low levels on the food chain, because so many of the bigger predator species have been caught. Terming this phenomenon "fishing down the food web", Pauly often talks about future generations of humans being reduced to dining on plankton stew or jellyfish.

Other fish biologists have challenged both statements, usually zeroing in on estimates for just one or two species of fish. This is a risky

"Essentially people perceive fisheries as boring, as a minor activity which is conducted by romantic characters, fishermen, who are doing their own thing and are stewards of the resources," he said. "It is really a monstrous industrial might that has been unleashed on the ocean, which has become a force that is changing all ecosystems.

"Fishing is not only getting fish for us to eat. It is really changing the way that the world under the sea is organised, and changing it for the worse. And to understand that, you need some sort of vision that people 'paint' for you."

Pauly ensnares his listeners with a soft, lilting accent that's simultaneously from nowhere and everywhere — a bouillabaisse composed of hints from the four languages he speaks fluently (English, French, German and Spanish), the two he once spoke almost as well

ecosystem modelling, incorporated in the widely used Ecopath software; the development of FishBase, an online encyclopaedia of 25,000 fish species (see www.fishbase.org); and "his tireless communication with the broad realm of managers, fishers, politicians and the general public".

"He's undoubtedly the foremost fisheries biologist in the world," says Josh Reichert, a senior official of the Pew Charitable Trusts in Philadelphia. "He has been almost single-handedly responsible for changing the way that people in his profession look at the responsibilities of their profession."

Pew is a major financial backer of Pauly's current research focus, The Sea Around Us, a project that aims to display global fisheries trends in easy-to-grasp dynamic maps. Reichert's mention of responsibilities is an

Daniel Pauly at False Creek Fisherman's Wharf in Vancouver.

allusion to Pauly's repeated complaints that fisheries biologists have focussed for too long on how to take the maximum amount of fish out of the sea rather than on conservation of the marine resources. Which is oddly self-defeating: if you don't conserve some fish stocks now, there won't be any to take later.

Colleagues variously describe Pauly as brilliant, inspiring or arrogant — sometimes all three simultaneously. He's been called "the prophet Daniel" and criticised as "the lead instrument in the Pew Trusts symphony".

Respected fish scientists like Ray Hilborn also complain that Pauly has become a broken record with his constant piscine jeremiads.

"He's a smart guy. I can't believe he's going to spend another 10 years telling us how bad the world's fisheries are without talking about ways to move forward," says Hilborn, professor at the University of Washington in Seattle, acquaintance of Pauly's for almost two decades and one of the trio of Volvo Prize winners.

Hilborn is especially caustic about Pauly's championing of a proposal to designate by 2020 one-fifth of the world's oceans as marine protected areas — effectively no-fish zones.

"If you have to use protected areas as your main fisheries management tool, it means you've abandoned all hope. You need to change the incentive structure so it is in the individual interest of the person who is fishing to reduce their fishing," says Hilborn.

Although the source of this criticism isn't revealed during our interview, Pauly instantly assumes it was Hilborn, suggesting that the continuing battles over fishery management resemble hand-to-hand combat much more than artillery barrages.

Protected areas needn't be a last resort, says Pauly. "Our studies show that if only five to 10 per cent of the North Atlantic cod's range had been protected in the 1970s, that would have been enough. Then the protected figure went up to 30 to 40 per cent. Now to rescue the cod, we need a total ban on the fishery. And nobody knows if that will work."

Only about 0.6 per cent of the world's oceans are currently marine protected areas, and barely half of that is effectively policed. "So 99.7 per cent of the ocean is fishable. If you look at agriculture on land, it's far less than that. As well, many countries have set aside between 10 and 15 per cent of their territory as protected national parks."

Another criticism that other fish scientists level at Pauly is that it's often difficult to distinguish between when he is speaking in a >

>> strictly scientific role and when he is speaking as an advocate for marine conservation.

"The science gets distorted in the advocacy," says Mike Sissenwine, current president of the International Council for the Exploration of the Sea and former chief scientist for the U.S. National Marine Fisheries Service.

In Pauly's life, passionate advocacy has always been bubbling up to the surface. The concern for social justice that runs throughout the scientist's career obviously stems from his own personal experiences.

The Pew Trust's Reichert calls Pauly's upbringing "a Horatio Alger story". Yet that American writer's dime novels about boys from poor families triumphing over adversity pale in comparison with this real-life story. "My father was essentially an American soldier on the make," Pauly says. With his French mother pregnant in Paris in 1945, the American father disappeared and Pauly did not meet him until 1969 when he visited the United States for the first time.

"He became a good grandfather for my children," says Pauly, speaking of his son Ilya, now 29, and daughter Angela, 25.

Pauly also met his wife Sandra on those filial visits. A teacher and now education administrator, she was one of three daughters of a friend of Pauly's father.

Before reaching those happy days, however, Pauly lived out his Horatio Alger story. At the age of two, he was spotted on a Paris street by a family visiting from Chauxdefonds, then a centre of the traditional Swiss watch industry. "They had lost a son. They somehow convinced my mother that I would be treated well in Switzerland for a visit."

He wasn't. Even today, Pauly's voice has an edge to it as he recalls being treated "more like a pet" than a child, and being forced to work as an unpaid domestic servant. "I didn't return to Paris. These people sent my mother threatening letters, which I later read. She was poor and could not imagine anyone helping her to recover her son."

The year after Pauly was, in effect, kidnapped, his mother married. Seven brothers and sisters followed. "They grew up in the shadow of a bigger brother who would come at any time. My birthday was celebrated every year, even though I was never there." (His siblings and mother all still live in France. Pauly goes there at least once a year.)

In Chauxdefonds, Pauly's Swiss family dissolved, leaving him alone and homeless at the age of 16. He ran away to Germany, working briefly in a factory before putting himself through high school and gaining entrance to the University of Kiel, where he earned a >>

All the fish in the sea

EARLY IN HIS CAREER, Pauly established new methods for estimating fish populations, and helped develop FishBase — a comprehensive online encyclopaedia of more than 29,000 fish species and their 222,300 common names in hundreds of languages.

Along the way, he developed the concept of ecosystem modelling of fisheries that is now incorporated into a sustainable fisheries management program known as Ecopath. Managing a sustainable fishery is a bit like putting all your money into a savings account and living off the interest: in other words, harvest only the amount of fish that can be replaced every year via reproduction in that area.

In theory, this should be straightforward; if you know how many fish are in a population, and how quickly those fish reproduce, it should be easy to figure out how many fish can be sustainably harvested. Unfortunately, it's not.

In fisheries, population sizes are generally extrapolated from past catch data, and these are in turn used to set harvest quotas. But catch data is not a reliable indicator of maximum sustainable harvest — so fisheries managers often make a best guess.

In light of this, some scientists, including Pauly, advocate protecting a proportion of the fish's range. Inside these 'marine protected areas' — ideally rich feeding grounds such as reefs or seamounts — fish are not harvested at all. Here they breed, and some then spread out into other parts of the ocean where they can be caught. Marine refuges also protect an entire ecosystem, not just a single fish species.

The difficulty with refuges is that every type of fish has a different population size and growth rate, both of which are important in determining what percentage of the fish's range needs to be protected to ensure sustainability.

Traditionally, fisheries managers have designated quotas based solely on population size and reproductive rate. However, population size and growth-rate can depend not only on how fast the fish can reproduce, but also on factors such as the amount of food available, the prevalence of predators, water temperature, and whether there are enough nest sites available. All the plants and animals in an ecosystem are bound up in a food web, and a change in one part of the food web could have repercussions throughout the whole.

Pauly leads a growing band of marine scientists advocating an ecosystem-wide approach to fisheries management. Ecopath, the ecosystem-modelling program developed by Pauly and colleagues, tries to make sense of these complex systems. It divides species in an ecosystem into functional groups (predators, herbivores, and so forth), and uses the relative numbers of animals in each group to provide a snapshot of the whole system. Recent upgrades allow scientists to model the effects of various management policies over time, and the effect of marine protected areas on the growth rate of populations.

Ecosystem-wide models have been useful in research, but slow to be adopted by fisheries managers — partly due to the difficulty in estimating fish populations for various species in an ecosystem, especially those not regularly fished.

One method is to count fish larvae. Most fish go through a juvenile stage during which they float along in the ocean currents as plankton. By determining the relative abundances of the fish larvae in an area, researchers can get a reasonable idea of the adult fish numbers from a wide range of species.

Regulatory bodies are slowly catching on to benefits of ecosystem-based modelling. The Gulf of Mexico Fishery Management Council — a Florida-based fisheries authority made up of five U.S. states — recently said it would look at ecosystem-based modelling as a way of regulating fishing.

— Benjamin Lester

"The various things that are being proposed to improve sustainability are nothing better than bandages on a cancerous limb. Absolute monsters are ready to destroy our civilisation, and we're not prepared to deal with it."

UNIVERSITY OF BRITISH COLUMBIA

>> doctorate in fisheries biology and biological oceanography in 1979.

This was followed by 15 years with a fisheries institute in Manila that few scientists had heard of before Pauly joined. From this base at the International Centre for Living Aquatic Resources Management, he sailed the tropical seas, lived with local fishermen and churned out an avalanche of research publications. Many of those appeared in non-peer-reviewed publications, dismissed by some scientists as 'grey literature'. But Pauly felt it was the surest way to reach those who would most benefit.

Asked what drives him, Pauly at first mulls over Freudian interpretations of guilt stemming from his privileged position when so many other "persons of colour" are suffering deprivation. Then he says his ethos stems from wanting "to be respected by the people that I respect".

"I don't want to help rich countries get richer. I constantly think about levelling the playing field." And then, once again, his wry, self-deprecating humour bubbles to the surface. "Actually it could be that I have become a complete workaholic and that I don't know any better."

Pauly's professional colleagues, including those who disagree with him on the interpretation of fish population data or on the best strategy for curbing overfishing, all marvel at his capacity for work. "He's probably got the best knowledge of fisheries literature of anyone I've ever talked to," says Ray Hilborn. "The guy worked like a maniac."

That is, until a Saturday night in late January 2005, when Pauly had a stroke serious enough to be a potential career-ender. "That day I sent the proofs of two articles back to London. I had worked so crazy, so much that day that I could not get out of it. I was like a car that was idling too fast."

The stroke hit as he was dining with his wife Sandra and some of her colleagues. It left much of his right side paralysed. "I'm left-handed, which came in handy, because the right side was kaput," he says with a laugh.

Pauly has still not fully recovered the use of his right arm and hand, but he's learnt how to conceal most of the effects. "I can fool people who don't know me."

What Pauly can't hide — and what is a much crueller blow — is the residual slur in his speech and the occasional need to grope around for words. In face-to-face encounters, his ebullient personality mostly masks this deterioration. But it's apparent in public appearances, and the difference jumps out at you after listening to interviews with him recorded before the stroke.

Throughout our many interviews and conversations, the once cautiously optimistic and cheerful scientist has become increasingly wracked with pessimism.

What makes this especially poignant is that, two years ago, Pauly looked to be well on the way to being recognised as a present-day Jacques Cousteau, a charismatic figure who could surmount the background clamour and din of various ecological catastrophes and plant the plight of the world's fish in the public consciousness.

Instead, he is now leading a life of quiet despair, fearing that the world is incapable of making the profound changes necessary to avoid major ecological disaster — not only in the oceans, but even more importantly in climate change and energy sustainability. Throughout our many interviews and conversations over the past three years, the once cautiously optimistic and always cheerful scientist has become increasingly wracked with pessimism.

"The various things that are being proposed to improve sustainability are nothing better than bandages on a cancerous limb," Pauly says. That comment was followed by a prolonged outburst, minus the usual stroke-related delay in finding the correct words. He began with a caustic comment about the conservation campaign that urges people not to eat some kinds of fish, and to eat others only if they have reached a certain minimum size.

"Yeah, that's going to help a lot. What we should do [for sustainability] is so much bigger than what we can currently conceive of as measures. Separate your trash. Vote for the right guy. It all makes zip difference.

"It's as if we are in 1940, the Nazis are at the door, and Neville Chamberlain is waving a piece of paper and proclaiming 'peace in our time'. Absolute monsters are ready to destroy our civilisation, and we're not prepared to deal with it," he laments.

So why has he not spoken out like this before? "I would marginalise myself if I really came out strongly. They would say I'm a kook ... The gap between the enormity of the reality and what I'm supposed to say to be regarded as a co-operative player is so immense that I prefer to remain silent.

"All my life, if you can see the arc, I've been trying to live a normal life. And in my science I've been trying to become mainstream."

PETER CALAMAI *is a science writer for Canada's* Toronto Star. *His previous article for* Cosmos *reported on the feverish search of physicists for the Higgs boson — the so-called 'God particle'.*