

# Silent water: a brief examination of the marine fisheries crisis

Jennifer Jacquet

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**Abstract** This paper is an attempt to synthesize and briefly examine the causes of the marine fisheries crisis, and to speculate about future initiatives. Ultimately, the human appetite is at the root of the marine fisheries crisis. But religion, technology, population pressure, science and our economic systems have provided vehicles for human appetite and thus contributed to overfishing. These various topics are further discussed in the context of the potential restoration of marine fisheries populations.

**Keywords** History · Marine fisheries · Overfishing · Shifting baselines

## 1 Introduction

In what is now the Republic of the Congo, a hungry man crouches at the edge of an ancient, overflowing river. He holds a spear carved from deer antlers and watches for the gentle movements of the giant river catfish, greater than 2 m in length, that have come to spawn in this floodplain. This may be the world's first fisher; the time is the rainy season, 90,000 years ago (Yellen et al. 1995).

This fisher is a hunter-gatherer, the dominant lifestyle until roughly 10,000 years ago, which Sahlins (1972) describes as the “Original Affluent Society.” Sahlins (1972, p. 25) excerpts John Eyre's description of a hunter-gatherer village in remote Australia in 1845:

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All titles with gratitude to The Talking Heads.

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J. Jacquet (✉)  
The Sea Around Us Project, The Fisheries Centre, University of British Columbia, 2202 Main Mall,  
Vancouver, BC, Canada V6T 1Z4  
e-mail: j.jacquet@fisheries.ubc.ca

At Moorunde, when the Murray annually inundates the flats, freshwater crayfish make their way to the surface of the ground... in such vast numbers that I have seen four hundred natives live upon them for weeks together, whilst the number spoiled or thrown away would have sustained four hundred more. An unlimited supply of fish is also procurable at the Murray about the beginning of December... The number [of fish] procured... in a few hours is incredible....

The hunting-gathering, fishing tradition still exists, especially in the developing world and in native communities, where small-scale fishers and their families rely heavily on fish for subsistence (e.g., Johannes 1978; Johannes et al. 2000). Fish is the last major group of wild animals exploited for food. But marine fisheries and the livelihoods that depend on them are threatened (Myers and Worm 2003; Pauly et al. 1998; Worm et al. 2006). Accounts of former abundance, by Eyre and others (e.g., Jackson et al. 2001; Roman and Palumbi 2003; McClenachan et al. 2006) now seem astounding. What happened to Eyre's fish? Focusing on the marine sector, from a Western cultural perspective, this paper briefly explores the origins, present state, and future of the fisheries crisis.

## 2 And you may ask yourself: well, how did I get here?

About 1,700 years ago, Christianity replaced pagan animism as the predominant axiom in Europe. The Judeo-Christian God preemptively responds to the fisheries crisis in the Bible's Genesis 1:28: humans "have dominion over the fish of the sea and over the birds of the air and over every living thing that moves upon the earth." The Christian-based belief in domination over nature arguably had great implications for resource use and technological innovation throughout Europe and, later, North America (White 1967), where the fishing industry would further expand. (The Judeo-Christian belief system accounts for early resource use philosophy but does less well explaining the foundations of resource domination in later years.)

Religion also influenced marine fisheries when, near the beginning of the 11th century, the Catholic Church made meatless Fridays compulsory for its members (Bell 1968). Curiously, 'meat' did not include fish, for which demand then increased. Freshwater fish became scarce and coastal fishes such as herring and cod were sent inland (Barrett et al. 2004). In Europe, religion essentially changed marine fishes from "catch to commodity" (Fagan 2006).

But the open ocean remained an avoided frontier (especially as most Europeans considered the Earth to be flat) and fishing was limited to inshore stocks. Then, a shift occurred as the Middle Ages ended, and the Age of Discovery began. "The image of boats hugging the coast, almost a perfect metaphor for the tight mental horizon of the Middle Ages, was crumbling" (Berman 1984, p. 41).

Europe looked to expand the geographical base of its economic operations, including the quest for new fishing grounds (Berman 1984). During the 14th century, cod fishing expanded through the Northwest Atlantic (Barrett et al. 2004). The first circumnavigation of the Earth, initiated by Magellan in 1519 and completed in 1522, re-established the ancient knowledge that the Earth was round. With this discovery, the number of overseas voyages increased, and so did fishing.

After Magellan's voyage, a scientific revolution took place between the 16th and 18th centuries and science was defined around Bacon's reductionism rather than the holism of the Ancients. This approach would revolutionize science and mathematics and would later

have profound implications for the whole of the environmental sciences. The culmination of the era was Newton's *Principia*. Incidentally, Newton's *Principia* was nearly not published because of a book about fish. The Royal Society backed out of their agreement with Newton due to financial disaster after the publication of *On the History of Fish* (Willughby 1686). This pricey failure nearly cost timely mathematical explanations of the orbits of heavenly bodies, three laws of motion, and the universal law of gravitation (Bryson 2003).

The scientific revolution began a transition from religion-dominated thought to cognitive reasoning. "Ever since their invention, the highest expression of objectivity in science has been quantification" (Roszak 1973, p. 270). Mathematics would eventually provide the foundation for the fisheries models (e.g., maximum sustainable yield) used by quota-setting managers in the 20th century (Smith 1994).

Another element fundamental to modern science emerged at that time: the concept of nature in which the dominant analogy was a machine that generated regularity, permanence and predictability of the universe (Kearney 1971). When not predictable, nature became at least intelligible, as documented by Darwin's (1859) *The Origin of Species*. In 1883, a year after Darwin's death, T.H. Huxley, appointed to three British fishing commissions, gave a speech at the International Fisheries Exhibition in London. He explained why overfishing or "permanent exhaustion" was scientifically impossible and proclaimed that, "probably all the great sea fisheries are inexhaustible... nothing we do seriously affects the number of fish." Over the next century, humankind would test Huxley's hypothesis.

### 3 And you may tell yourself: my god, what have I done?

From the engine, to the steel hull, to the trawl, to ice, modern technology is conspicuously occidental (White 1967) and technological advances in fisheries also originated in the Western world (though they would eventually spread to and be outdone by the East). The Industrial Revolution had immediate impacts on fishing. In the North Sea, steam ships equipped with otter trawls reported catches more than six times greater than those of sailing ships (Kurlansky 1997).

By the 1850s, after fewer than 20 years of fishing for them, inshore stocks of halibut in the Western Atlantic had disappeared (Pauly and Maclean 2003). It is now understood that industrial fisheries require only 10–15 years to reduce fish populations to one-tenth of their pre-fishing size (Myers and Worm 2003). But in the 1890s, North Atlantic fishers experiencing lower catch rates asked naturalists to determine the cause. The field of fisheries science was born and so the search for culpability in the fisheries dilemma began (Pauly 1994).

The open-access nature of ocean resources was one of the first characteristics faulted. "You are lost if you forget that the fruits of the earth belong to everyone and that the earth itself belongs to no one," writes Rousseau (1754, p. 109). But others argued the notion of the earth (and the seas) belonging to no one was the trouble. Hardin (1968), in his essay, "The Tragedy of the Commons," recognizes the fate of fisheries:

Likewise, the oceans of the world continue to suffer from the survival of the philosophy of the commons. Maritime nations still respond automatically to the shibboleth of the 'freedom of the seas.' Professing to believe in the 'inexhaustible resources of the oceans,' they bring species after species of fish and whales closer to extinction."

But while technology and the oceans' accessibility can be partially blamed, the majority of the world's fishers uses low-tech gear and is coast-bound. Yet, this group, the small-scale fishers, catches roughly the same amount as the industrial sector, which is possible because the small-scale sector employs nearly 25 times more people (Pauly 2006).

In his 1798 essay on population, the Reverend Malthus outlines the impending doom of overpopulation outstripping food supply. This idea has since been adapted to developing world fisheries. Large coastal populations using destructive fishing practices produce a phenomenon Pauly (1997) describes as "Malthusian overfishing," which threatens fish stocks as well as food security. Though Schumacher (1973) contends that "Small is Beautiful," the small-scale fishing sector has also contributed to the marine fisheries crisis.

Around the time that Rachel Carson's (1951) *The Sea Around Us* won the National Book Award, the concept of maximum sustainable yield (MSY) became prevalent in Europe and North America. Soon after, in the late 1970s, Larkin (1977) wrote the epitaph for MSY, and managers began to make conservative quota recommendations. But the effects of the mathematization of fisheries management were still to come. "An institutional juggernaut had been set in motion" (Walters and Maguire 1996, p.129) and the failure of fisheries science climaxed with the devastating collapse of northern cod in the early 1990s. Mathematics had a definitive role in the marine fisheries crisis.

Then there is a debate that never really occurred in the ocean realm: in the early 20th century, John Muir and Gifford Pinchot would come to embody the respective philosophies of preservation and conservation (Nash 1982). But in terms of fisheries and the oceans, the preservationist approach was by no means fully considered. Globally, approximately 0.6% of the oceans are dedicated as marine protected areas (MPAs) (Wood 2007) as compared to the 12% of terrestrial area that has been designated as protected (Chape et al. 2005). Furthermore, only 0.01% of the oceans are actually closed to fishing (Pauly et al. 2002).

Five years after Muir's death, the Smithsonian Institution ran an article in its annual report entitled, "The Sea As a Conservator of Wastes and a Reservoir of Food" (Moore 1919). By the middle of the 20th century, this strategy was expanded to include the dumping of radioactive wastes as an ecosystem service (Bryson 2003). In 2004, 65% of the U.S. coastline (excluding Alaska), most of it on the eastern seaboard, was under fish advisories (EPA 2004). Modern industrial pollutants have infiltrated the marine food web. Fisheries that had sustained people for thousands of years are, instead, now poisoning them (Booth and Zeller 2005).

#### 4 Into the blue again after the money is gone

Pitcher and Hart (1998, p. 218) write, "Alone among the social sciences (and often disavowed by them) only economics offers an internally consistent and rigorous mechanism for achieving cooperation." Pitcher and Hart are not alone; many scientists and managers have turned to the field of economics to understand and perhaps help alleviate the fisheries crisis. From an economic standpoint, a significant flaw in fisheries management is thought to stem from the lack of tenure right (Hardin 1968). In the early 1980s, 200-mile exclusive economic zones (EEZs) were established for coastal nations, but economists argue for further privatization using mechanisms such as Individual Transferable Quotas (ITQs) and the elimination of flags of convenience.

Yet, Clark (1973) demonstrates that the overexploitation of fisheries is possible even under privatized fishing rights because private firms adopt high rates of discount. Sumaila and Walters (2005) address high discount rates with "intergenerational discounting," a

method to better incorporate future generations in management decisions that will ultimately affect them. Sumaila (2004) demonstrates that, when considering the benefits to future generations, marine ecosystem restoration becomes economically viable.

But the biggest improvement in fisheries management could come from the elimination of perverse subsidies, which is necessary for any constructive environmental change (Holling 2001; Meyers and Kent 2001). Today's fisheries are, in part, kept afloat with public tax money. In total, governments subsidize the global fishing fleet with US\$30–34 billion annually (Sumaila and Pauly 2006), which accounts for 35–40% of the landed value of fish (Sumaila et al. in press) or an average of about US\$0.33 per kg of marine fish. This over-investment in fisheries in the short-term encourages excess capacity and overfishing. To compensate and reduce excess capacity, some governments buy back boats from the fishing industry, which is also a subsidy (Clark et al. 2005). In addition to subsidization, the industrial fishing sector operates under an economic system that encourages externalities and corporate policy that, by legal definition, cannot take into account the public good (Bakan 2004).

Perhaps because corporations have become so powerful, environmental non-governmental organizations (ENGOS) have recently gained influence, in some cases enough to challenge governments (Buttel 1992). ENGOS now lobby governments for the expansion of MPAs, the delineation of exclusive fishing zones for small-scale fishers, and the outlawing (and enforcement) of destructive fishing practices, such as bottom trawling, discarding fish, and the use of dynamite.

Other ENGOS have forsaken government for grass roots efforts and engagement in “exemplary action,” which emphasizes the presumed power of an individual as an ecological consumer (Eckersley 1988). In terms of fisheries, this movement is best seen through the attempts to change seafood consumption patterns (e.g., seafood wallet cards, the Marine Stewardship Council eco-certification). However, consumer awareness attempts, though perhaps successful in raising awareness of seafood products, have unfortunately made no demonstrable impacts on the resource itself (Jacquet and Pauly 2007).

## 5 You may ask yourself: am I right? Am I wrong?

“Shallow ecologists think that reforming human relations toward nature can be done within the existing structures of society” (Naess 1988). The philosophical application of deep ecology has occurred in the terrestrial realm but, so far, has not been substantially applied to the oceans. Perhaps this is, in part, due to the physical property of the ocean itself: it is difficult to see what we have done. But within the last decade or so, we have seen the 40,000 unemployed fishers after the collapse of the northern cod (Harder 2003). We have seen jellyfish blooms around the world (Purcell et al. 2001). We have seen innumerable scientific articles that prophesize a bleak future for marine fisheries—but not a future without hope (e.g., Pauly et al. 2003). Rebuilding marine ecosystems is possible. But to do so, is a fundamental change in prevailing basic assumptions required?

A new *Sea Ethic*, promoted by the Blue Ocean Institute, would help society create a relationship with the oceans in the manner that *A Sand County Almanac* (Leopold 1949) did with the land. In her chapter, “Save the Whales, Screw the Shrimp,” Williams (2002) challenges that preserving nature is a moral issue (and recognizes the pecking order in preservation with her title).

Other scientists see the capacity of more practical technical fixes, though they, too, require fundamental shifts in values. Dayton (1998), for instance, called for a reverse of the

burden of proof; fishers should be required to demonstrate that their actions do *not* cause damage to marine ecosystems rather than requiring that resource managers prove that they do. Walters (1998) argued that our conceptual view of the seas should change. Currently, more than 99% of the world's oceans are open to fishing; this should be reversed, and the oceans should be considered closed to fishing with small exceptions, i.e. fishery openings, as is the case with salmon in the Pacific Northwest. Russ and Zeller (2003) and Zeller (2005) likewise argued that fishing should be considered a privilege, rather than a right, and call for more marine closures with the aid of international ocean zoning.

Pauly (1995, 2007) identifies the constraints of the human lifetime in terms of fisheries. Each generation thinks that the ecosystem they were exposed to when they were young was more or less pristine and this, in part, is why resources are misused. He describes this phenomenon as “shifting baselines” and emphasizes the need to recognize and overcome our “collective amnesia.” To address the shifting baseline, many ecologists are incorporating history in their research to get a sense of former abundance (Schrope 2006).

Lewis (1992) vehemently criticizes radical environmentalism as destructive to the environmental movement. Yet, whale populations are beginning to rebound largely because of early efforts by Greenpeace, which simultaneously communicated whale folklore and gruesome whale hunts. Their media efforts created a public outrage and an eventual moratorium on whaling. So far, campaigns of this kind have been less successful in terms of fisheries, though they do exist (e.g., WildAid's shark campaign; see Watts and Wu 2005).

News of the fisheries crisis has begun to permeate popular culture. For instance, the recently published novel, *The Swarm* (Schätzing 2006), describes in detail the changes happening in the world's oceans (the disappearance of whales and fish, for instance, and the subsequent takeover by toxic blooms and jellyfish). A terrific, science-fictional threat to humanity follows, which Worm (2006) calls “Armageddon in the oceans.” Millions of Schätzing's novels have sold worldwide. In Germany, where it was initially published, *Der Schwarm* has led to an increase in marine science funding (Worm 2006).

Roughly 500 years after the dawn of science, religion might also, directly or indirectly, play a role in marine ecosystem restoration and the protection of fisheries (Dunham and Coward 2000). Although the Catholic Church and many other religious entities have yet to exhibit enlightenment in terms of birth control and contraception (Bayes and Tohidi 2001), there has been progress in fisheries. In 1966, Pope Paul VI, along with U.S. bishops, terminated obligatory ‘meatless’ Fridays, except during Lent (Bell 1968). Recently, one religious group initiated a “What Would Jesus Drive?” campaign because “transportation is a moral issue.” Will religious leaders likewise consider fisheries a moral issue and ask, “What Would Jesus Fish?”

## 6 Same as it ever was

But is a fundamental shift in values possible on a global scale? Moreover, would it substantially affect market demand? The U.S. now eats almost five times more fish than it did 100 years ago (NMFS 2006). Worldwide, per capita consumption of marine fishes has doubled since the 1960s (WHO 2006). So, too, has the global population. How can marine fisheries feed the global appetite? They cannot.

Humans began farming on a global scale roughly 10,000 years ago and this lifestyle became predominant over the hunter-gatherer one (Quinn 1992). Now the agricultural model of production is being applied to seafood. After the Papal decree of meatless

Fridays, some European monasteries tried to establish artificial fishponds to meet fish demand. These ponds were unsuccessful as people found fish, instead, in the sea (Fagan 2006). Now, 1,000 years later, the oceans are nearly empty and the artificial ponds (many of which float at sea) are a reality. In the last decade, aquaculture production has doubled. In 2004, aquaculture produced nearly 40% of all fish consumed, or nearly 60 million tones (FAO 2005).

Wilson (2002) writes about aquaculture, “What was free for the taking must now be manufactured.” Eventually, fish biotechnology might entirely compensate for the decline in wild fish supply. In the meantime, though, many fish species raised in fish farms require wild, ocean-born fish for feed (Naylor et al. 2000). In this way, aquaculture puts additional pressure on ocean fisheries.

Furthermore, aquaculture has many ethical dimensions, which include the loss of traditions and the ethical concern of domesticating wild fish. In the Sea of Sicily, *tonnaras* were complex systems of nets to catch tuna as well as a thousand-year-old right of passage for the local men, who learned how to set the nets, sing songs about tuna, and speak an entire *tonnara* language (Maggio 2000). Italy’s last *tonnara* has closed and the songs are silent. Instead, juvenile tuna are captured at sea, slowly towed toward shore, and fattened in net pens off the Mediterranean coastline until they are sold (Volpe 2005).

White (1967, p. 1203) writes, “All forms of life modify their contexts.” After more than 90,000 years of fishing, will the modification of the oceans include the virtual elimination of wild marine fisheries? The human appetite, from the first fisher to the six and a half billion potential seafood consumers alive today, is ultimately the root of the marine fisheries crisis. The human mind, equal in number and technically more impressive, is ultimately the decider of how we satiate the collective appetite for seafood and whether we do so with only ourselves in mind.

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