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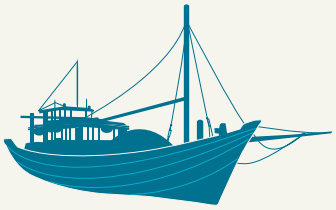
Humpback Whale © Jürgen Freund / WWF

# Whales are Vital for Marine Ecosystem Health

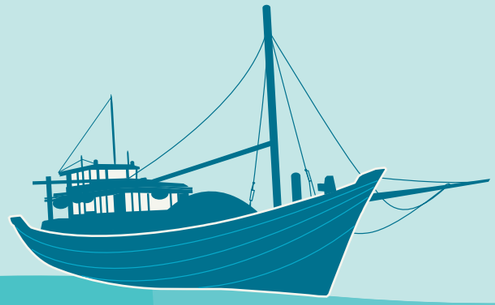


**HUMANS ARE SOLELY RESPONSIBLE FOR THE INCREASING SCARCITY OF FISHERIES AND OTHER FOOD RESOURCES.**

There has been an ongoing debate at the IWC focused on the role that large whales play in the ecosystem and whether they should be viewed as competitors for fisheries resources, a marine resource to be harvested, or essential elements of healthy marine ecosystems. Historical and cultural values will greatly influence perspectives on this, but modern science overwhelmingly supports the view that whales play an important regulatory function in marine ecosystems. While it is tempting for some to believe that whales eat fish, and therefore fewer whales will leave more fish for human consumption, several studies and multiple scientific meetings throughout the years have concluded that there is "no clear and direct relationship between marine mammals' predation and the potential catch by fisheries" [1,2]. In fact, the IWC Scientific committee in 2003 concluded that for 'no system at present are we in the position, in terms of data availability and model development, to provide quantitative management advice on the impact of cetaceans on fisheries…"

Humans are solely responsible for the increasing scarcity of fisheries and other food resources. Whales have been shown to play an important role in the maintenance of healthy marine ecosystems. In addition to the various biological, bio-physical and bio-chemical contributions whales make, they have an inherent cultural and biodiversity value, and can render ecosystem services and strengthen economic security for coastal communities through their ecotourism potential [3].

# THE SCIENCE



## Iron (Fe) & Nitrogen (N)

## 66% - 90%

### WHALES REMOVED FROM GLOBAL ECOSYSTEMS SINCE 1000 AD

From the time that Basque whaling began around 1000 AD, it is estimated that 66-90% of all whales have been removed from global ecosystems [4,5]. While some populations of whales are increasing in number [6], total numbers of great whales and their combined biomass is still estimated to be only 15% of what it was prior to whaling [4]. Blue whales are thought to amount to only 1% of their pre-whaling numbers [7].

It is tempting for some to believe that these dramatic decreases in whale numbers and biomass would yield a surplus of marine resources for human harvesting. However, this argument has never held up under scientific scrutiny [1,2]. Even in the very few cases where the prey of large whales overlaps with commercially targeted marine resources, there are many reasons why reducing whale numbers will not result in increased fisheries yields.

### ECOSYSTEMS ENGINEERS

An increasing number of studies show that whales play an important role as ecosystem engineers, supporting healthy ecosystems in ways that extend well beyond simple predator-prey relationships [8].

Iron (Fe) and nitrogen (N) are both limited in marine ecosystems, but essential for plant and animal life at all levels of the food web. These elements need to be available at the surface of the ocean where they can stimulate primary productivity through photosynthesis. Many whales feed at depth, but defecate and urinate at the surface, thus playing a crucial role in transporting these limiting nutrients. This contribution exceeds their calculated consumption, thus enhancing, rather than limiting ocean productivity and fishery yields [9,10]. This process also helps to combat climate change and global warming, as carbon is absorbed and sequestered during photosynthesis.

### REMOVING A TOP PREDATOR COULD POTENTIALLY DISRUPT THE FOOD WEB

Marine ecosystems are infinitely complex and the pathways that link whales and commercially harvested fish involve myriads of other species and marine processes [17]. Some researchers have found that, rather than yielding a fisheries surplus, the large-scale removal of whales from ecosystems has been associated with ecosystem disruption and "trophic cascades" that impact multiple species, and in some cases lead to ecosystem collapse [18-20]. In the North Pacific, for example, the scarcity of baleen whales after whaling, led killer whales that previously fed on large whales, to switch prey to smaller marine mammals such as seals, sea lions and sea otters. Sea otters control urchin populations, which, if left unchecked can destroy kelp beds. Kelp forests act as important nurseries for several fish species, and their loss can have significant cascading impacts on (commercial) fish stocks [19,21]. Similar prey-switching and trophic cascades are also thought to have occurred in the Southern Hemisphere [4].

Whales promote vertical mixing of nutrients in the water column through their diving and surfacing [12], as well as by "ploughing" the seabed and suspending nutrients during bottom feeding [13,14].

Furthermore, due to their large body mass, baleen whales store a great deal of carbon, both when living, and when their carcasses sink after death [11]. It is estimated that large baleen whales now store less carbon than they did in the pre-whaling era.

### NITROGEN (N)

Whales also transport nutrients horizontally - from highly productive temperate and polar feeding grounds to nutrient poor tropical breeding grounds, where they excrete nitrogen in their urine, and contribute other nutrients through their placentas and carcasses [8].

While live whales transport important nutrients upward through the water column, whale carcasses sink and transport carbon and other organic matter to the seabed [15]. Decomposing whale carcasses create their own mini-ecosystems: more than 200 species can inhabit a single skeleton, contributing to marine biodiversity and ecosystem complexity [16].

Recent evidence suggests that we are entering a new geological era, the Anthropocene, marked by mass extinctions of a range of terrestrial and aquatic species. Unlike previous mass extinctions that were driven by climate change and/or catastrophe (volcanic eruptions, asteroid impact), today's extinctions are human-driven. In the marine realm extinctions are disproportionately affecting large-bodied marine animals, including marine mammals and large predatory fish. While climate change and habitat loss play an increasing role, human direct takes have been the dominant cause of species loss to date [22].

It is estimated that large predatory fish biomass today is only about 10% of pre-industrial levels [23]. World per capita fish consumption increased from an average of 9.9kg in the 1960s to 19.7kg in 2013. The United Nation's Food and Agriculture Organization's (FAO) analysis of assessed fish stocks indicates that the proportion of fish stocks within biologically sustainable levels has declined from 90 percent in 1974 to 68.6 percent in 2013, meaning that nearly a third of the world's fish stocks are being fished at a biologically unsustainable levels [24].

These statistics make it clear that humans and not whales are responsible for the increasing scarcity of fisheries resources [25]. The Convention for the Conservation of Antarctic Marine Living Resources (CCAMLR), the Common Fisheries Policy of the European Union (EU), FAO Technical Guidelines for Responsible Fisheries, and the United Nations Convention on the Law of the Sea (UNCLOS), all require that the possible effects of a fishery on its ecosystem should be taken into account.

Fisheries bycatch remains the leading cause of human-induced cetacean mortality, responsible for the death of an estimated minimum of 300,000 cetaceans per year [26]. It is clear that fisheries present a greater threat to cetaceans than vice versa. **Any collaboration of the IWC with the FAO or other intergovernmental organisations in relation to cetaceans should focus on mitigating bycatch as a means of sustaining biodiversity and maintaining ecosystem health and therefore food security.**

Humpback whale © Cat Holloway / WWF

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