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Fishing for the future: An overview of challenges and opportunities

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ABSTRACT

This paper surveys the current state and major trends in global fisheries; the environmental and social dimensions of fisheries; and explains how the international community has tried to meet the policy challenges associated with oceans and fisheries. The ocean and the freshwater ecosystems of the world make significant contributions to people's well-being via the many vital social and environmental services they provide (for example, food and nutrition, employment and incomes, carbon cycling and sequestration). The impact that the increase in fishing since the 1950s has had on wild fish stocks, and the significant increase in aquaculture production in the 20th century, have resulted in severe environmental impacts. This has significant effects on marine ecosystems and the health of oceans. The erosion of the resource undermines communities' long-term interests, including food security, employment, and income. Attempts by the global community to address challenges of sustainable production by improving the governance and management of fisheries resources range from national management of fisheries resources, to regional fisheries management organisations (RFMOs) for international fisheries stocks. These attempts have not always successfully met the challenge of balancing current and future use of fisheries.

1. Introduction

The global ocean and the freshwater ecosystems of the world provide many vital services to humanity [1]. The world's ocean provides 50% of our oxygen and fixes 25% of global carbon emissions. It is thus one of the largest "carbon sinks" in the world and a crucial moderating force in the planet's climate. The health of the ocean therefore has direct implications for all life on Earth. Fisheries are of immense scale and economic importance, which also means they have a significant environmental impact that must be managed effectively to ensure sustainability. According to the United Nations Food and Agriculture Organization (FAO), marine and inland fisheries and aquaculture supplied the world with about 148 million tonnes of fish in 2010, with a first-hand total value of US$218 billion [2]. Using the average global multiplier, a measure of the average economic impact of a dollar of landed value (LV) of fish sold at the dock,[1] these sectors created economic impacts of nearly US$660 billion in 2006. Of the total amount of fish supplied, about 40% was marketed live, fresh, or chilled, while 46% was processed in frozen, cured, or other prepared forms for human consumption, with the remaining 14% allocated to non-food uses [2].

Fish and fishery products are among the most traded food commodities in the world. According to the FAO [2], these products represent about 10% of total agricultural exports and 1% of world merchandise trade in value terms (US$102 billion); in 2012, nearly 37% of total fishery production was exported in various forms.[2] Fisheries and aquaculture are particularly important in developing countries where they support numerous small-scale artisanal and subsistence fishers, who often provide crucial food supplies; sustain regional economies; and support the social and cultural values of their areas. These sectors are crucial to livelihoods in many coastal communities around the world. This heavy dependence also poses a major socioeconomic challenge: how to balance current and future needs for fishery resources [4].

Throughout the 20th century, this balance was so tilted towards humanity's current needs that the oceans' ability to meet humanity's future needs became a concern. The declining state of the world's oceans and the fisheries they support has now been an item on the global agenda for many years, but the efforts of the

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[1] A multiplier of 3 is established in [3].

[2] Different international organisations classify fishery products differently. The WTO system classifies fish and fishery products as industrial goods, which means that both in their statistics, but, more importantly, in the application of the rules of WTO agreements, the rules on industrial goods apply to fish and fishery products.

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international system at cooperation, both in the United Nations (UN), including the FAO, the Organisation for Economic Co-operation and Development (OECD), the World Bank, the WTO, and at regional levels, have not delivered results strong enough to restore ocean health.

Despite the progress achieved on ocean governance in agreements such as the UN Convention on the Law of the Sea (UNCLOS) and the UN Fish Stocks Agreement, national, regional, and local fisheries management schemes are frequently not delivering sustainable fisheries. In an attempt to fill the gaps in management, private sector efforts have begun to build markets in developed countries for products from certified sustainable fisheries, but mislabelling and IUU fishing undermine both sustainability efforts and government revenue streams. The economics of the fishing industry continues to be distorted by subsidies that incentivize overfishing and overcapacity (for example, [5–7]). WTO Members agreed in 2001 to negotiate reductions in these subsidies, but after more than 10 years, the negotiations remain deadlocked, partly as a result of fundamental disagreements over the respective level of commitments expected from emerging and more advanced economies.

An additional dimension to the challenge of sustainable fisheries is the extent to which other ocean activities impact the health of fisheries stocks, and the impact of climate change on ocean temperature and acidification. It is the synergistic effect of these multi-stressors, together with irresponsible fishing and aquaculture practices, that have resulted in the observed negative impacts on freshwater, coastal, and marine ecosystems. Hence, to tackle ecosystem degradation and ensure sustainability, a more comprehensive ecosystem approach to governance and policy reforms is needed. It also requires considered and cooperative policy responses from the international community [8,9]. The global response will need to integrate the use of trade policy tools, an important theme of the Special Issue, as well as the management and governance of fisheries resources themselves.

The rest of the paper is organised into two main sections. The first section discusses the environmental dimensions of oceans and fisheries. In the second section, the social dimensions of oceans and fisheries and the links between the social and environmental dimensions of fisheries are addressed.

2. Environmental dimensions of oceans and fisheries

Fishing effort has seen rapid increases since World War II, when most fishing was still concentrated in coastal waters. Similarly, aquaculture production has seen a huge increase, which has made it a significant contributor to total global fish supply since the mid-1990s. These rapid increases have led to a number of concerns over their environmental impacts. Here, the most recent evidence of the environmental impacts of fishing on key species and the ecosystem at large, including the status of relevant stocks are first addressed. Next, the environmental consequences of farmed fish production are presented. Finally, the paper looks at the governance measures in place to manage fishing, including the local, national, and regional resource management schemes, and summarizes the latest information available on their effectiveness.

2.1. Evidence of the environmental impacts of fishing

Fishing effort increased rapidly following World War II, particularly off Europe, North America, and Japan [10]. The spatial coverage of global fishing effort also rapidly expanded to cover most of the world's oceans by 2005 [11], with an increase in overall fish catches continuing until 1996, when they peaked at about 86 million tonnes (t). Catches thereafter have been relatively stable, or even declining, according to FAO statistics. The

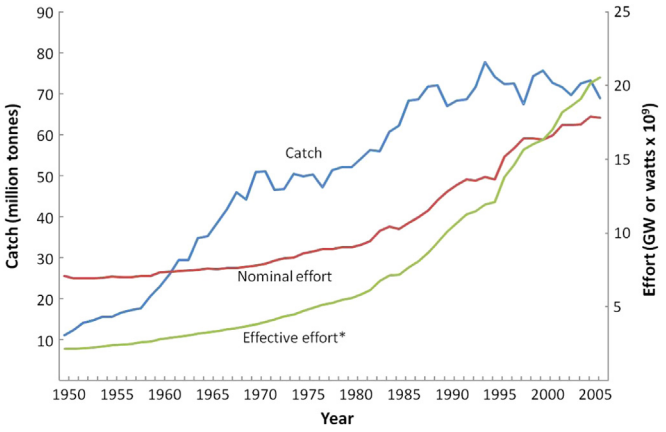

Fig. 1. Global trends in estimated fisheries catch and fishing effort (nominal and effective), 1950–2006 (*Source*: [12]).

expansion of the geographic extent of fishing has been accompanied by a ten-fold increase in global fishing effort since 1950 (Fig. 1), a figure that rises to 25-fold for Asia over the same period [12]. Overall, the decline in global catch per unit effort suggests a decrease in the biomass of many fished populations, likely by over 50% [12]. The reasons for this large increase in fishing effort are many, with ineffective management, technological innovation, and the provision of subsidies chief among them. The expansion of capacity has been such that the World Bank and FAO estimated in 2009 that the total global catch could be achieved with only half of the effort actually employed [13].

More specifically, some of the most traded fish (for example, tuna and cod-like species) are reported to be currently overfished in many parts of the oceans. Examples of highly traded fish include Namibian hake and Atlantic bluefin tuna (BFT). BFT stocks are highly migratory and have a long life span of up to 30 years. Total catches of BFT were stable at around 5000–8000 t per year from the 1950s to the 1970s. From the mid-1990s, the catches increased steadily from 9000 t to 40,000 t per year, followed by a substantial decrease in catch to 24,000 t per year in the last decade [14,15]. Many BFT stocks are currently reported to be at risk of being overfished to depletion. Other examples exist—stock assessment scientists report that bigeye tuna stocks in the Western Central Pacific Ocean (WCPO) are currently being overfished [16], meaning that more fish are being removed from the stock than the stock is capable of regenerating [17]. Similarly, [18] states that there has been a significant depletion of yellowfin tuna stocks in some areas of the WCPO due to fishing.

The result of massive overcapacity in the global fleet and the depletion of fish stocks (which have become harder and harder to catch) is a substantial net economic loss to the global economy; the World Bank and FAO estimated that this amounted to around US$50 billion in 2004 [13]. An updated recent estimate put the loss at US$67 billion a year [19].

The rapid increase in fishing effort after WWII was partly caused by the development of highly efficient fishing methods and technology on board fishing vessels (echo sounders, fish finders, gear, and vessel technology) combined with poor management regimes that did not allow for effective caps on fishing effort. The combined effects of the sheer volume of fishing, and the fishing gear and techniques applied, has resulted in a number of environmental impacts, including (i) overfishing of fish stock; (ii) destruction of fish habitat; (iii) the fishing down of marine food webs; (iv) ecological disruption; and (v) by-catch problems.[3]

[3] By-catch refers to fish and other marine life that are caught unintentionally as part of fishing operations.

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