

Fisheries and the World

William Cheung, Daniel Pauly,
and Rashid Sumaila

ABUNDANT FISHERIES RESOURCES have played a prominent role in Canada's economic, social, and political history over the past 150 years. On Canada's east coast, the Grand Banks once supported a huge biomass of Atlantic cod and other marine life. While First Nations peoples used these resources sustainably for centuries, the systematic exploitation of the emblematic Atlantic cod shaped the settler populations from France and the British Isles in what was to become Canada. Indeed, the perennial pre-Confederation conflicts between France and Britain along the Grand Banks and similar locations were largely driven by competition over fisheries resources, with Britain gradually reducing France to a small foothold in Saint-Pierre and Miquelon.

Overfishing—fuelled by subsidies, mismanagement, and incomplete scientific understanding of ocean ecosystems—drove the once world-renowned Atlantic cod fisheries into collapse (Figure 1A). It is estimated that the cod fishery likely provided sustainable yields of 100,000 to 200,000 tonnes per year until industrial trawlers from Europe began to massively increase the catch, substantially reducing the size of the stock. Then, the Canadians took over and unleashed their own trawlers onto this diminished cod stock, which predictably and famously crashed in 1992.

The rise and fall of fisheries on Canada's Pacific coast mimicked the disaster of the east coast fishery. For tens of thousands of years, the coastal First Nations in British Columbia have been dependent,

nutritionally and culturally, on salmon and other fish such as herring. After contact with Europeans, First Nations populations decreased substantially, resulting in a marked decline in their participation in the fisheries. Simultaneously, the expansion of industrial non-Indigenous fisheries resulted in dramatic increases in salmon and herring catches (Figure 1B). Many of the First Nations found themselves working alongside Asian immigrants in the salmon canneries dotting the early-twentieth-century coast of British Columbia. However, the salmon and herring stocks did not last long, and catches soon diminished to a small fraction of historical levels. British Columbians, like other Canadians, must now import much of the fish they consume.

In the Canadian Arctic, fisheries have remained small-scale, mainly supporting the livelihood of Inuit and other small coastal communities (Figure 1C). Before the early 1950s, the Inuit were mostly nomadic, and substantial amounts of fish were used to feed sled dogs needed for hunting and transportation. Because fisheries catches by the Arctic communities continue to be used mostly for subsistence purposes, more recent catches reflect the changing population size and consumption pattern of northern residents and their transition away from dogsleds to more modern forms of transport.

Canada currently finds itself with the majority of its commercial fish stocks needing to be rebuilt. Yet, in contrast to the US, Canada has no enabling legislation—indeed, not even a plan for action.

Any plan to rebuild Canadian fisheries stocks will take place in a highly globalized reality of resource markets. Although Canada sources a large amount of the fish it consumes from its three major Exclusive Economic Zones (EEZs), we also export a large proportion of our fisheries catch, while simultaneously importing a sizable amount of the fish consumed domestically. Based on data extracted from the United Nations Comtrade Database, in 2008, 47 percent of Canada's seafood imports came from the United States, followed by Thailand, China, Peru, and Chile. This means that the price of fish available to Canadians depends partly on the supply of fish from foreign waters.

The import and export and values of seafood products to and from Canada have increased enormously from 1965 to 2015. According to the UN Comtrade data mentioned above, over this period, which

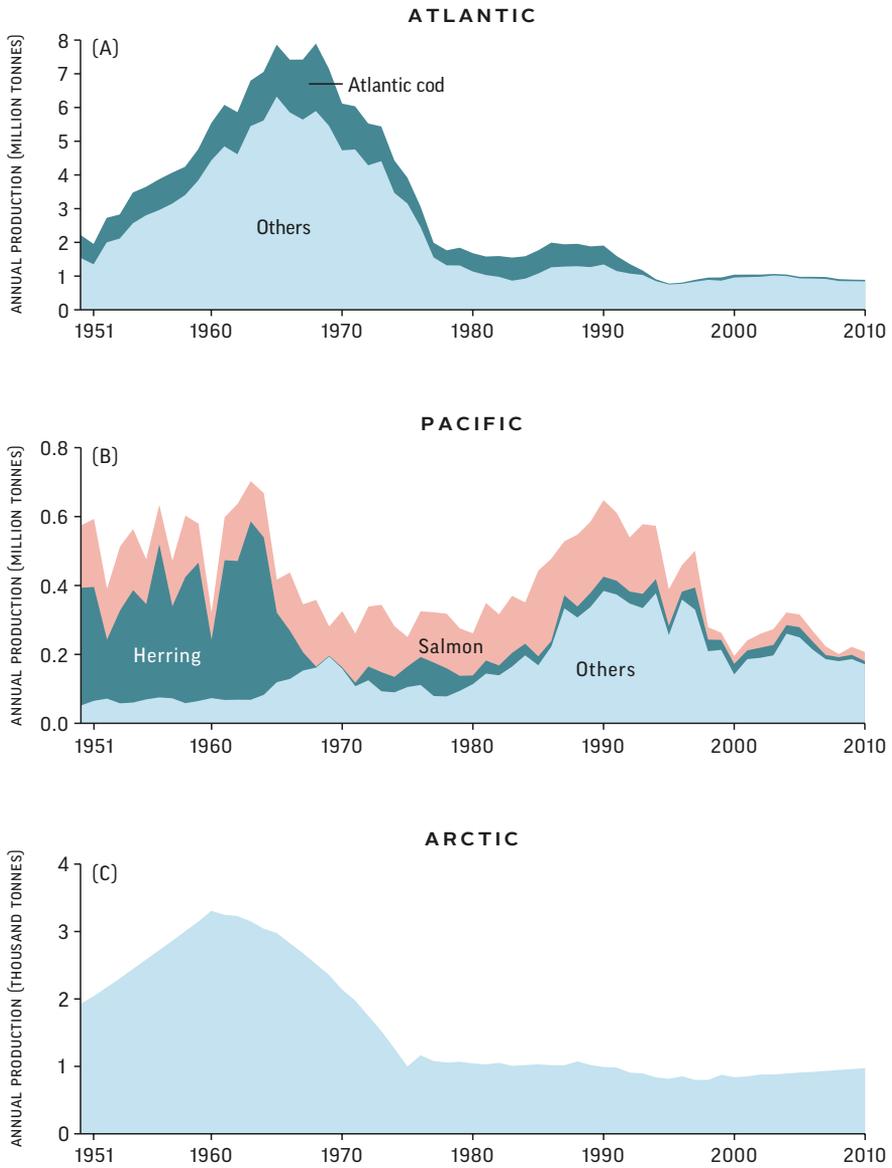


FIGURE 1. Fisheries catches within Canadian Exclusive Economic Zones in the Atlantic (A), Pacific (B), and Arctic (C) oceans. Source: *Sea Around Us*; www.seaaroundus.org

brackets the centennial and sesquicentennial anniversaries of Confederation, export value increased from \$137 million to \$4,692 million, while imports rose from only \$17 million to \$2,522 million (all figures in USD). Over time, the proportion of imports to total exports has increased from about 11 percent to 35 percent. These data demonstrate the increasing globalization of Canada's seafood production and consumption, and the need for Canadians to think of fisheries in a more international context.

Any future consideration of Canadian fisheries is also set against a backdrop of global climate change. The waters along Canada's three coasts are currently experiencing effects of a changing climate that will intensify over the coming decades. This poses a major challenge to the Canadian government, and to society at large, in mitigation and adaptation. The world's oceans—including those bordering Canada—are getting warmer, less oxygenated, and more acidic (as a result of increased surface ocean carbon dioxide concentrations). These changes in the ocean environment are causing the distribution of commercially important fish stocks to shift tens to hundreds of kilometres per decade toward the pole, and into areas and depths with cooler waters. In the Arctic, the warming ocean temperatures and decreasing sea-ice coverage are driving an influx of species, including salmon, that previously inhabited only lower latitudes. On the Pacific and Atlantic coasts, our fish and invertebrates are gradually shifting their distribution ranges northward toward Alaska in the west and the Arctic coast in the east. Moreover, species from south of the Canada-US border are also becoming increasingly abundant in Canadian waters. Salmon, and species with similar characteristics, will be particularly impacted because the mouths of the rivers to which they must return will become too warm for them, as already observed in the case of the sockeye salmon run in the mighty Fraser River of southern British Columbia.

Climate-dependent shifts in Canadian fisheries resources will have dramatic effects on the lives of all Canadians. Many coastal communities, particularly First Nations, are nutritionally dependent on fish and shellfish. Decreases in traditional food fishes such as salmon will have a significant effect on these communities. And there will also be strong financial implications that will affect us all—even those living thousands

of miles from the coast. Computer models developed by the authors of this article project the biological and economic responses of fish stocks to climate change and suggest that potential fisheries revenues in Canada could decrease by up to 30 percent by 2050 under business-as-usual carbon emissions scenarios. Catches of Pacific salmon and herring, for example, are projected to further decrease by more than 30 percent.

Through the globalized seafood supply chain, Canadians will feel the impacts of climate change on fisheries in tropical regions far from home. As a small but perhaps symbolically important example, the decrease in catch of tropical tuna could increase the price of sushi in restaurants in Vancouver. Farming of Atlantic salmon is also dependent on fish feed originating from other parts of the world, especially anchovies taken in the waters off Peru. The changing distribution of fish stocks has additional geopolitical implications and can destabilize management of fisheries resources that are shared between countries (e.g., Atlantic cod or Pacific salmon stocks that are shared between the US and Canada). In the Arctic, local fisheries for “new” species that move into new habitats made available by climate change may attract competition from the developed industrial fisheries of the US, Russia, and East Asian countries. These developments will further increase the likelihood for mismanagement and overexploitation of fish stocks, and thus exacerbate the impacts of climate change on seafood supply.

In the face of these myriad challenges and complexities, Canada needs concrete policy to rebuild its depleted domestic stocks and conserve current fisheries. In 1996, the Canadian government passed the Oceans Act, which outlines a strategy to conserve marine biodiversity and resources. It is now critical that this act be translated into action in order to meet the grand challenges to the future sustainability of Canadian and global fisheries. For example, Canada should meet its international commitment of setting aside 10 percent of its waters as protected areas, with monitoring programs that track effectiveness toward meeting conservation goals. For overexploited or endangered fish stocks, concrete recovery strategies that include protection of critical habitats are needed. Canada already has the legislative tool to do this through the Species at Risk Act (SARA). What we still lack is a means to effectively implement this important legislation.

To achieve these goals, we need government resources, the intellectual capacity of government and academia, and fair and equitable policies and processes that are supported by an engaged citizenry. Given the importance of the oceans and fisheries to Canada, as the past and present demonstrate, this will be a good long-term investment for Canada.

Internationally, Canada must be an important player in solving the global challenges to oceans and fisheries, and must contribute positively to ensuring the sustainability of global fisheries resources. This can be done by promoting seafood sources from ecologically sustainable fisheries, joining forces to eliminate subsidies that lead to overfishing, and supporting socially equitable fisheries. We must improve our ability to track the sources of seafood and educate the seafood industry and the public about seafood sustainability. Canada can also play an active role in supporting the sustainability of the fisheries of other nations by sharing our wealth of expertise and experience on fisheries and oceans. For example, Canada's researchers played an important role in informing fisheries management in the Asia-Pacific region in the 1980s and 1990s, and this collaborative work has made long-lasting contributions to sustainable fisheries in this region.

The most effective solution to climate change is through the mitigation of greenhouse gas emissions. This requires international co-operation through such mechanisms as the recently ratified Paris Agreement under the United Nations Framework Convention on Climate Change, of which Canada is a signatory. Bi- or multilateral agreements that consider the effects of climate change are also needed to reduce conflict in the sharing of transboundary fisheries resources and to ensure their effective management. Federal and provincial management authorities and local communities need to develop adaptation plans and actions to reduce climate-induced changes in seafood supply. These may include building up resilience of coastal ecosystems through a network of marine protected areas, or diversification of income and livelihood sources for coastal communities.

Fisheries are an integral part of Canada's economy and have been central to our country's evolution into a globally important nation over the past 150 years. However, the future sustainability of fisheries and seafood industries is at a crossroads because of overfishing, climate

change, and globalization. Full appreciation of the complex challenges facing sustainable fisheries at home and around the world is key to ensuring that future generations of Canadians have the opportunity to enjoy seafood and healthy oceans. The solutions are available; all of us, from members of the government and private sectors to the public, need to act upon the challenges swiftly before it is too late.