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World War II and the “Great Acceleration” of North Atlantic Fisheries

Poul Holm

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World War II impacted both the marine and the terrestrial environment of the North Atlantic, triggered major political and economic decisions with profound cultural implications, and eventually induced a change in ocean management. The War helped develop technologies and state responses to immediate post-war market problems and impacted the Great Acceleration of fisheries between 1945 and 1975. During the war, fisheries were closed completely only in certain parts of the most fished waters, such as the central North Sea and the English Channel. Even in the most affected Northern European waters some fishing continued throughout the war. Fishing was carried on in the waters off Iceland and the Arctic, but extractions were much reduced. Previously unfished stocks in the Baltic were targeted for the first time ever. The effect of the closure of certain fisheries was an overall increase of survival rates of marine animals. Technological advances made during the War increased the fishing efficiency of vessels when the technology was put to commercial use soon after the War. The immediate benefit of better catch-per-unit effort after the War was concealed by the slump in the international fish market. The wartime ‘dividend’ of marine resources was largely spent by the mid-1950s in the North Sea and by 1960 in the wider North Atlantic. The war disrupted market allegiances, effectively ended old fishing patterns and introduced a forced modernisation in the High North. Among North Sea countries, Denmark in particular responded to the disruption of the market for fresh fish by introducing reduction fishery, which led to severe environmental stress and eventually a collapse of the North Sea herring stock. Before WWII, the oceans had largely been regulated according to the international law of open access to all ocean resources. North Sea countries resumed negotiations over fishing rights after 1945, expecting to revert to old principles. However, U.S. President Harry Truman’s declaration against Japan came to impact fishing negotiations in the North Atlantic and changed post-war fishing management forever.

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World War II and the “Great Acceleration” of North Atlantic Fisheries

Poul Holm¹

The expression “Great Acceleration” denotes the sharp increase in human planetary footprint in terms of population and resource use in the second half of the twentieth century. According to Schimel et al., who developed the concept, acceleration “followed” World War II,² but these authors do not discuss the possible linkages between the war and the acceleration. Indeed, the literature on the



short and long-term environmental impacts of the war is surprisingly thin.³ In particular, there is a dearth of historical studies on the impact of the war on ocean life. In his magisterial study of twentieth-century environmental history, J.R. McNeill briefly notes that World War II “swept fishing fleets from the sea and allowed stocks to recover where they had formerly been reduced, notably in the North Atlantic”; after the war, fishermen experienced bonanza catches, and indeed fisheries developed rapidly in the next twenty years.⁴ While McNeill’s picture is generally true, it needs to be qualified for certain regions. More importantly, McNeill does not discuss the linkages between war and post-war fisheries.

I shall argue that WWII had fundamental consequences for the fishing industry, which in its turn increased its ecological impact both at sea and on land. The changes were due to the partial reprieve for fish stocks and to immediate post-war developments: the use of naval technology for commercial fishing, reorientation of markets, and reassessment of ocean policies in the light of the war. I concentrate on four areas which responded in distinct ways to the impact of war: the eastern North Atlantic, including Greenland, Iceland, the Faroe Islands and northern Norway; southern Scandinavia, particularly Denmark

¹ The paper was first presented at the symposium *The Long Shadows of World War II*, Helsinki University, August 2012. A revised version was presented at the *Oceans Past IV* conference at Murdoch University, Perth, Australia. I gratefully acknowledge support from Australian National University in the form of a visiting research fellowship, which provided me time to write this paper. I am thankful for comments by Dr. Simo Laakonen and the perspectives of discussants of a draft of the paper at the Rachel Carson Center at LMU in Munich.

² D. Schimel, C. Redman, J. Dearing, L. Graumlich, R. Leemans, C. Crumley, K. Hibbard, W. Steffen, R. Costanza, “Evolution of the Human-Environment Relationship”, in *The Encyclopedia of Earth*, May 2, 2007, available on the web at: http://www.eoearth.org/article/Evolution_of_the_human-environment_relationship (accessed February 15, 2013).

³ An excellent introduction to war and the environment is R.P. Tucker, E. Russell (eds), *Natural Enemy, Natural Ally: Toward an Environmental History of War*, Oregon State University Press, Corvallis 2004.

⁴ J.R. McNeill, *Something New Under the Sun. An Environmental History of the Twentieth-Century World*, Norton, New York 2000, p. 246.

and western Sweden; the southern North Sea countries; and the Baltic Sea. My paper discusses the impact of war on fish stocks, fishing technology, landscapes, markets and fisheries management.

In addition to published literature, I draw on data for Atlantic fish landings. Since 1903, the International Council for the Exploration of the Seas (ICES) has been reporting on fishery landings from all countries bordering the North Atlantic (Mediterranean and North African fisheries not included) and compiling figures for wartime landings. While recent fisheries statistics are notorious for their unreliability, figures before 1950 and the beginning of international fisheries management are considered to be of high quality.⁵ I have had access to Excel spread sheets, kindly provided by ICES, containing landings statistics for European members from 1935 to 1949, with the exception of Spain, where no records exist for the Civil War period before 1940.

Marine extractions before, during and after the War

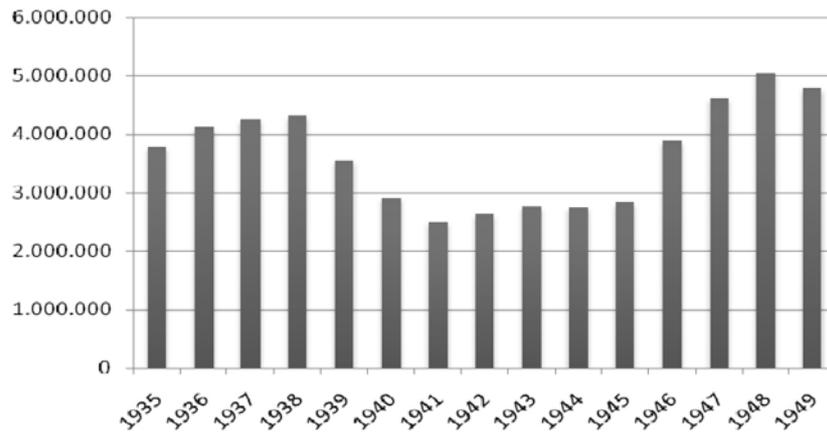
In 1938, global marine fisheries are estimated to have landed about 20.7 million metric tonnes (MT), based on national reports from all major fishing nations. Global extractions expanded rapidly in the 1920s and 1930s from an estimated 9 million MT in 1914. The Second World War presumably halted fisheries, but there are no global wartime figures. The first available figure is for 1950, when global landings were 20.4 million MT or slightly below the pre-war maximum. The 1950s, on the other hand, saw landings rise quickly to 27.4 million MT by 1961.⁶

The European picture differs somewhat from the global one. Figure 1 summarises total European landings from the Eastern North Atlantic based on the ICES database. Landings peaked at 4.3 million

⁵ R.T. Poulsen, P. Holm, "What Can Fisheries Historians Learn from Marine Science?: The Concept of Catch per Unit Effort (CPUE)", in *International Journal of Maritime History*, 19, 2, 2007.

⁶ J.R. Coull, *World Fisheries Resources*, Routledge, London 1993.

Figure 1. Total European fish landings. Eastern North Atlantic, 1935-1949 (t)



Source: ICES database

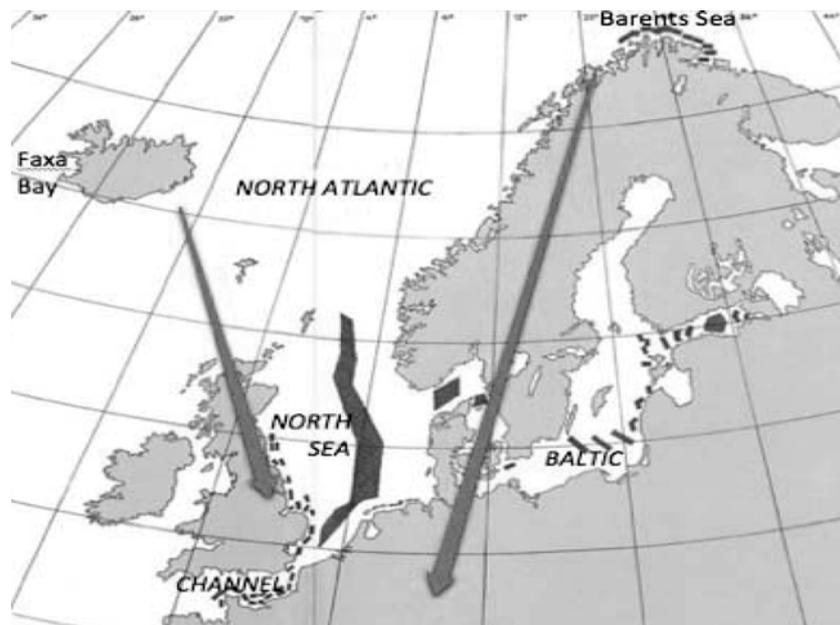
MT in 1938. Post-war recovery was quick, with landings surpassing the pre-war level already by 1947. We do have figures for wartime extractions and perhaps the most striking datum is the continuation of fisheries, with a decline in 1941 to 2.5 million MT, almost 60% of the pre-war maximum. WWII did not bring universal reprieve for all fish stocks. While fishing certainly was impossible in central war zones, clearly there were continuing efforts in some regions. Which were these regions, and how did this activity impact post-war recovery?

The closing of the sea

A substantial reduction of fishing power was caused by requisitioning of fishing vessels for naval operations and drafting of able-bodied seamen. In the UK, the Royal Naval Patrol Service (RNPS) at its peak operated a fleet of 1,637 small craft, in particular trawlers and whalers, in addition to paddle steamers and yachts, for anti-sub-

marine and minesweeping operations, primarily to clear the shipping lanes into British ports.⁷ In the major ports such as Hull and Grimsby, the Admiralty requisitioned almost all vessels, but a few were returned during the war and used for inshore fishing. The German Admiralty requisitioned suitable vessels from occupied countries, especially the Netherlands and France. The Dutch steel-built motor vessels were eminently suited for wartime tasks.⁸ Overall, the commissioning of vessels for war took considerable fishing power out of Continental and British fleets, whereas the fishing fleets of the Nordic countries were largely left in place.

Map 1. North Atlantic fish trade and mining during World War II. Black shading = German minefields. Arrows = main lines of fish provision for Allied and Axis powers



⁷ <http://www.royal-naval-reserve.co.uk/lost.htm> (accessed 1 February 2013).

⁸ F. Looimeijer, "The Beamtrawl Industry. Fifty Years Dutch Inshore Fishery", in *Studia Atlantica* 3, P. Holm, D.J. Starkey (eds), Fiskeri- og Søfartsmuseet, Esbjerg 1997.

Mining of the North Sea and English Channel (Map 1) began soon after the declaration of war and effectively closed large areas such as the Dogger Bank to fishing. Major inshore nursery grounds were also closed and thus flourished as feeding grounds for new year-classes of fish such as plaice. To this day, minefields in the German Bight present a danger to shipping and constitute a protected area for marine life.⁹

Submarine and aircraft attacks posed a threat to fishermen operating outside the minefields, although these attacks never succeeded in bringing fishing to a standstill. A near-complete inventory of Swedish losses in the North Sea between 1940 and 1945 shows a total loss of 31 vessels and the lives of 91 fishermen. 24 ships were lost to mines, five due to other causes such as artillery fire, and in the last month of the war one vessel was sunk by a submarine and another by a bomber airplane.¹⁰ The major threat to Swedish fishermen was German forces' mining of the Skagerrak, the entrance from the North Sea to the Baltic, in April 1940. However, in certain parts of the North Sea mining was very limited. It was therefore possible to continue fishing in some areas outside the immediate theatre of war, such as the Danish North Sea coast.

Outside of the North Sea, the war also imposed constraints on fishing. In the northern North Atlantic, freak airstrikes and torpedo attacks posed a threat to Icelandic and Faroese vessels carrying fish supplies for the UK market.¹¹ One incomplete count of Icelandic losses at sea lists 16 vessels, mostly hit by mines or submarines. Sev-

⁹ C. Böttcher, T. Knobloch, N.-P. Rühl, J. Sternheim, U. Wichert, J. Wöhler, *Munitionsbelastung der deutschen Meeresgewässer: Bestandsaufnahme und Empfehlungen (Stand 2011)*, Hamburg 2011, available on the web at: http://www.schleswig-holstein.de/UXO/DE/Service/PDF/Anhang/Anhang_10200__blob=publicationFile.pdf (accessed February 15, 2013).

¹⁰ G. Åberg, D. Edvardsson, *Dom hade inget val. De västsvenska fiskarna under krigsåren 1939-1945*, Bohusläns Museum, Uddevalla 1986, pp. 56-57.

¹¹ J.P. Joensen, "The Fisheries of the Faroe Islands. An Overview", in *The North Atlantic Fisheries, 1100-1976: National Perspectives on a Common Resource, Studia Atlantica*, 1, P. Holm, D.J. Starkey, J.T. Thór (eds), Fiskeri-og Søfartsmuseets studierie 7, Fiskeri-og Søfartsmuseet, Esbjerg 1996, pp. 27-62.

eral airstrikes on Icelandic trawlers occurred, but most did not succeed.¹² The Baltic Sea, on the other hand, was a relatively safe area for fishermen, as its control by the Axis remained uncontested until the last few months of the war.

War-time fish supplies

The War caused food shortages, malnourishment and outright hunger in many countries. Being a perishable commodity, however, fresh fish was not usually rationed. Marine food became an expensive if still highly sought-for source of dietary variety. Rationing of other products led to innovative practices such as the use of fish skin as replacement for unavailable high-end snake or crocodile skin products.¹³

The long-term impact of fish shortage on human health must have been marginal, but nevertheless culturally important as a marker of deprivation. In the European countries of the ICES database, fish landings per capita fell from 18.7 kg in 1938 to 10.9 kg in 1941 and 11.9 kg in 1944. By 1947, landings per capita had been more than restored to a level of 20.8 kg.¹⁴ Fish consumption was much more important in the United Kingdom than in Germany. Pre-war landings per capita had been above 20kg per capita in the UK, less than 10kg in Germany. Both countries suffered steep declines in domestic landings as soon as the war broke out. UK landings fell to a quarter of the pre-war rates (from 1.1 million MT in 1938 to 273,000 MT in 1941), while German landings in 1941 dropped to a mere 13.5% of the pre-war rates (from 681,000 MT to 92,000MT). Although fish supplies were not indispensable to either country, both went to great lengths

¹² <http://members.shaw.ca/amacdona/icelwwii.htm> (accessed February 15, 2013).

¹³ Some specimens are displayed in the Imperial War Museum, London, and Fiskeri-og Søfartsmuseet, Esbjerg, Denmark.

¹⁴ Consumption per capita will have been less, especially before and after the war, because of exports to countries such as Spain and Italy. Precise figures for consumption per capita are not available for all countries. My calculations are based on the ICES database. European population statistics are from F. Rothenbacher, *The European population 1850-1945*, CD-Rom, Palgrave, Basingstoke 2002.

to secure supplies from other sources and forced a complete reversal of pre-war market orientations on allied and occupied countries. This reorientation of the fishing industry was to be of long-term economic and environmental consequence, as we shall see below.

During the war, Germany received most of its marine food supplies from Norway and Denmark. Before the war, Danish landings had been oriented towards the British market for fresh fish while Norwegian ones had been directed towards South European consumers of salted cod. Nazi Germany had a vision of a *Großraumwirtschaft*, which was to establish a division of labour and supplies across Europe to serve the Reich. While the war quickly made this vision fall to pieces, it did impact the fishing industry. Nazi Germany saw Norway as the main supplier of marine protein for the future and to that end intended a complete technological reform of the Norwegian fishing industry.¹⁵ Wartime Norwegian landings declined by one third of their pre-war total of 1.2 million MT to 0.8 million MT. Nevertheless, in 1943-44 the country still provided total exports of around 400,000 tonnes of fish products, or half of German supplies of fish products, including almost all of its tinned fish, which was important as provisions for the army. Germany had no market for traditional Norwegian stockfish and saltfish products, and wanted them replaced by frozen fish. Consequently, German companies established four freezing plants in northern Norway, manned by local as well as more than one thousand East European forced labourers. The freezing capacity in the whitefish sector increased from ten to 350 tons per day within a couple of years, and Norwegian fishermen enjoyed exceptional price increases.¹⁶

Denmark, and to a lesser degree Belgium, also supplied Germany with fresh fish. As there were few minefields near their shores, fisheries continued in these countries throughout the war. Belgium increased

¹⁵ W. Björn, *Norwegens Wirtschaft 1940-1945. Auswirkungen der deutschen Besatzungsherrschaft auf die norwegische Volkswirtschaft in der Zeit des Zweiten Weltkriegs*, Vdm Verlag, Saarbrücken 2008.

¹⁶ B.-P. Finstad, "The Fisheries in Finnmark in the Postwar Period", in *Studia Atlantica*, 2, Fiskeri-og Sofartsmuseet, Esbjerg 1996.

landings somewhat to around 50,000 MT in 1944, and Denmark trebled its landings to about 250,000 MT in the same year (ICES database). The landings were directed to high-end consumers and commanded very high prices that induced fishermen to brave the danger of occasional air attacks. With the Norwegian and Danish imports and also supplies from neutral countries such as Sweden, it is likely that Germany was able to almost compensate for its loss of domestic fisheries.

In the UK, Danish and Dutch vessels that had fled occupied ports on the Continent in fact landed a large part of what was counted as British landings. Northern Ireland was a relatively more protected area during the war and Northern Irish landings thus doubled. Most of the UK's fish supplies, however, about half a million MT, reached the UK on Icelandic and Faroese fishing vessels. In the North Atlantic islands, the traditional production of salt fish for the Mediterranean market ceased completely. Instead, the islanders filled the holds with iced fresh fish for immediate transportation to the UK. This entailed the loss of labour-intensive production plants on land, but high incomes in the fishery and work for the US and British armies more than compensated for the loss of employment.

Most neutral countries such as Ireland, Portugal and Sweden¹⁷ retained their habitual landing levels throughout the war, while Finnish landings contracted severely as the country fought against the Russian invasion. A good part of Irish landings went to the UK, while Sweden benefitted the German market. Landings in Portugal, Spain and Finland will have mainly been for domestic consumption.

Greenland was occupied by American forces and lost all contact with the Danish government. The protected and subsidised market of the Danish trade monopoly was thrown open to the occupying forces of the United States and the island experienced the benefits of high prices in a free market. The Greenlandic fishing industry responded rapidly with a doubling of cod landings.¹⁸

¹⁷ Spain was excluded from this analysis as no data are available for 1935-1939 in the ICES database.

¹⁸ A. Kjær Sørensen, "Fishing by the Greenlanders", in Holm, Starkey, Thór, *The North Atlantic Fisheries* cit., pp. 89-104.

In sum, fish became hard to come by during the war. With domestic and North Atlantic provisions, I reckon that in 1941 the UK market received only about half of the marine protein that had been available in 1938, and per capita consumption will have been similarly reduced. By 1944, provisions were two-thirds of the pre-war level. Because of the more varied nature of sources of provision, it is not possible to make a similar estimate for the German market. However, Germany had priority access to fish landings from the occupied countries, so was probably better able to supply the domestic market in the first years of the war, whereas major shortages became apparent towards the end.

Marine ecology

Let us now turn to the consequences of WWII for marine ecology, especially fish populations. Unfortunately, there is much that we simply do not know and are unlikely ever to know about what happened below the sea surface, such as the possible effects of the noise of warfare. We know that whales depend on sound for communication across long distances, and it is likely that protracted ocean battles and deep-water bombing of submarines impacted marine life. Possible effects may have ranged from deafness to deterrence from migratory routes.¹⁹

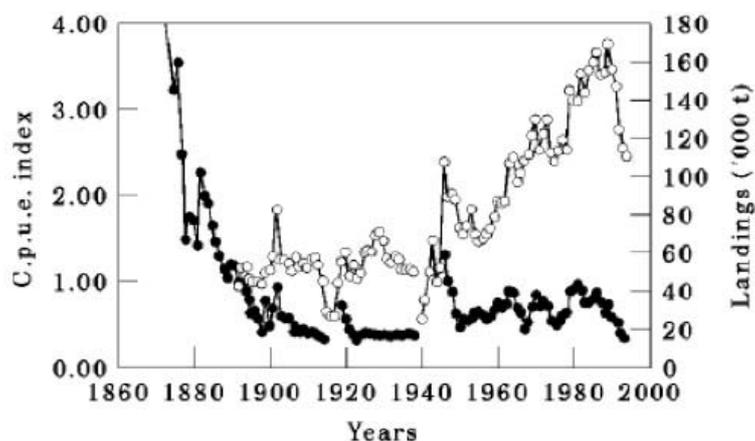
World War I proved that human slaughter can bring peace to fish stocks. Since fish grow throughout their life, fishermen were landing much larger specimens in 1919. Biologists established that increased post-war catch rates of plaice, *Pleuronectes platessa*, in the North Sea were due to the fact that the fish lived longer and grew bigger.²⁰ In scientific literature, the effects of the Great War on the fisheries came to

¹⁹ For an overview of acoustic impacts on whales, see International Whaling Commission, *Scientific Committee (IWC-SC) Report. Annex K*, Report of the Standing Working Group on Environmental Concerns, May 2004, 12.2.2.5, available on the web at: <http://iwc.int/cache/downloads/1s2a20o37mf4wggw8sgk0888c/2004%20SC%20REP.pdf> (accessed February 15, 2013).

²⁰ J.O. Borley, *The Plaice Fishery and the War*, Fishery Investigations, 2, 5, 3, London 1923.

be known as the Great Fishing Experiment.²¹ Studies of the impact of WWII on North Sea plaice published in 1949 and later showed that the wartime forced moratorium on North Sea fishing grounds had indeed allowed the stock to recover.²² Fisheries biologists use Catch Per Unit Effort (CPUE) as the main index of returns on fishing, typically measured as the catch by vessel per fishing hour or day.²³ This index shot up dramatically immediately after the war (Figure 2).

Figure 2. Time trends of international landings (◦, in '000 t) and combined c.p.u.e. index (•)



Source: A.D. Rijnsdorp, R.S. Millner, *Trends in Population Dynamics and Exploitation of North Sea Plaice (*Pleuronectes platessa* L.) since the Late 1800s*, *ICES Journal of Marine Science*, 53, 1996, pp. 1170-1184

²¹ T.D. Smith, *Scaling Fisheries: The Science of Measuring the Effects of Fishing, 1855-1955*, Cambridge University Press, Cambridge 1994, pp. 158-162.

²² M. Graham, "Overfishing", in *Proceedings of the United Nations Scientific Conference on the Conservation and Utilisation of Resources*, editor. VII. Wildlife and fish resources, FAO, Rome 1949, pp. 20-24. R.S. Wimpenny, *The Plaice: Being the Buckland Lectures for 1949*, Edward Arnold & Co., London 1953. A.D. Rijnsdorp, R.S. Millner, "Trends in Population Dynamics and Exploitation of North Sea Plaice (*Pleuronectes Platessa* L.) since the late 1800s 1996", in *ICES Journal of Marine Science*, 53, 1996, pp. 1170-1184.

²³ Poulsen, Holm, *What Can Fisheries Historians Learn from Marine Science?* cit.

There is a lack of studies of catch rates for other main commercial species. Published investigations on cod and other gadoids did not produce detailed documentation of age structure and were therefore of limited value for understanding the ecological impact of the war.²⁴ Recently, however, in connection with increasing interest in Marine Protected Areas as a conservation instrument, there has been renewed biological study of the effects of WWII. A study of gadoids such as haddock, *Melanogrammus aeglefinus*, cod, *Gadus morhua*, and whiting, *Merlangius merlangus*, has documented that all older age categories responded positively to the ending of fisheries in the Buchan waters off NE Scotland. The abundance of very old, >10 years old, haddock in the population increased nearly twelve times between 1939 and 1945, and overall older age groups built up. After 1945 the number of old fish decreased fast when fishing recommenced. These results are now used to argue for the utility of Marine Protected Areas as a policy instrument to protect fish stocks.²⁵

It is likely that similar effects on marine life occurred in all other marine regions that were effectively closed to fishermen. The Dogger Bank, a major area in the central North Sea, must have remained virtually untrawled for almost six years, and fishermen reported catches of very large specimens when they did begin fishing there again – or indeed during the war when fishermen occasionally ventured outside inshore grounds.²⁶ However, some important breeding grounds in inshore waters were if anything probably more heavily fished during the war than in any other recent time. Danish fishermen were given a free hand within a 60-mile inshore limit by the German Navy. Considering that most

²⁴ A.R. Margetts, S.J. Holt, “The Effect of the 1939-1945 War on the English North Sea Trawl Fisheries”, in *Rapp P-V Réun-Cons Int Explor Mer*, 122, 1948, pp. 26-46. B.B. Parrish, “The Haddock Stocks in the North Sea During the Second Half of 1945”, in *Rapp P-V Réun-Cons Int Explor Mer*, 122, 1948, pp. 47-54.

²⁵ D. Beare, F. Hölker, G.H. Engelhard, E. McKenzie, D.G. Reid, “An Unintended Experiment in Fisheries Science: A Marine Area Protected by War Results in Mexican Waves in Fish Numbers-at-Age”, in *Naturwissenschaften*, 97, 2010, pp. 797-808.

²⁶ K. Venøes, N.Bach, *Små fisk og store fisk. Storfisken Kristian Venøes livserindringer*, Hovedland, Aarhus 2000.

pre-war fishing had occurred outside of this limit, the environmental impact on these breeding grounds must have been very heavy.

The Baltic saw a radical increase in fishing effort by German steam trawlers, which shifted their interest from the North Atlantic to safer waters. They expanded to areas near Gotland in the mid-Baltic, where no commercial trawling had been done before. Similarly, 147 Swedish trawlers relocated from the Bohuslän North Sea coast for the Baltic cod fishery. After the war these new fishing grounds continued to be the target of fishermen who until the war had concentrated on inshore fisheries. Baltic cod became an important target species for Eastern European fishermen in particular. Landings plateaued by the second half of the 1950s, indicating a full use of the resource.²⁷ In the northern Baltic, on the other hand, Finnish fishing pressure declined during the war, and very likely Russian fisheries were also much reduced.

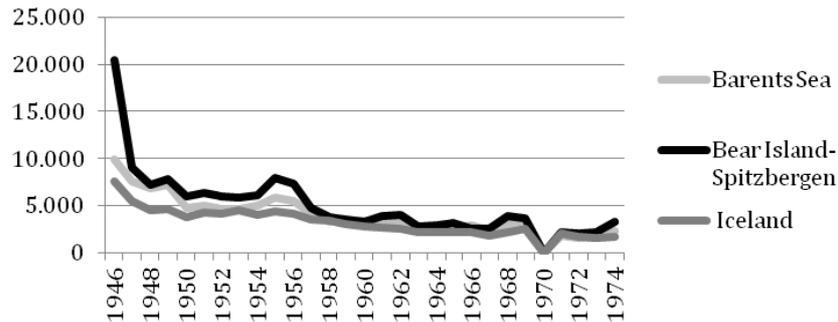
Before the war, the Icelandic waters had been heavily fished by British, German and French trawlers. CPUE was almost halved for cod between the early 1920s and the late 1930s, and haddock and plaice stocks showed clear signs of overfishing.²⁸ The war left stocks to Icelandic and Faroese fishermen, who were not in a position technologically to keep up the fishing pressure, as their domestic fleets were mostly made up of wooden sail-powered vessels with auxiliary engines and old steam trawlers; so in effect the stocks got a reprieve. When international fishing began after the war, British and a little later German trawlers reported excellent catches, and the returns were sustained for the next ten years, as is evident from the CPUE records.²⁹ By the mid-1950s, returns decreased and accentuated management concerns which the Icelanders had begun expressing even before the war.

²⁷ G. Åberg, D. Edvardsson, *Dom hade inget val. De västsvenska fiskarna under krigsåren 1939-1945*, Bohusläns museum, Uddevalla 1986, p. 19. M. Eero, *Dynamics of the Eastern Baltic Cod (Gadus Morhua) Stock in the 20th Century under Variable Climate and Anthropogenic Forcing*, PhD thesis, University of Southern Denmark, Copenhagen 2008, p. 27.

²⁸ J.Th. Thor, *British Trawlers and Iceland 1919-1976*, Fiskeri- og Sofartsmuseet, Esbjerg 1995.

²⁹ Ibid. On the concept of CPUE see Poulsen, Holm, *What Can Fisheries Historians Learn from Marine Science?* cit.

Figure 3. British catch per unit effort, Arctic and Icelandic grounds 1946-1974



Source: Thor 1995, *Bulletin Statistique* and *Fisheries Statistical tables 1946/1976*

Bumper catches were also made in the Barents Sea and in the Bear Island and Spitsbergen grounds immediately after the war. According to one skipper, the fishing grounds had such enormous shoals of fish that to make full use of the space in the fish hold the heads of the catch were cut off and dumped. This was in fact bad practice, as eventually hundreds of thousands of rotting fish heads were left behind, polluting the fishing grounds.³⁰ Catches in the Norwegian Sea were already 56,500 tons by 1947, a quantity not surpassed by British trawlers in this region until 1966. In the Barents Sea, British catches increased rapidly to a maximum of 206,000 tons in 1949, but after 1952 rarely exceeded 100,000 tons. On the Bear Island-Spitsbergen grounds, the best result of almost 126,000 tons was recorded already in 1946. Catches then declined rapidly to levels generally much below those recorded in other areas. Figure 3 brings out that strong immediate returns on the newly opened grounds were followed by declines in CPUE. The statistics show successive but ever smaller waves of increased catches as the descendants of abundant wartime year classes came of age (Figure 3).

³⁰ Thor, *British Trawlers and Iceland 1919-1976* cit.

In general, the war had brought a temporary reprieve from the fishing pressure of the 1930s. Strong year classes of fish sustained good catches through the 1950s, but the wartime dividend had been spent in the North Sea by the middle of the decade, and in the wider North Atlantic by its end.

The Great Acceleration I: the application of war technologies to fishing

A prerequisite for the fishing down of replenished stocks in the post-war years was an increased technological race, which owed a good deal to inventions and improvements forced through by Navy demands during WWII. Post-war trawlers were not only faster and possessed greater fishing capacity than their predecessors, they were also equipped with all the positioning, fish-finding and communication technology developed during the war, which helped them find and catch more fish.

The British gramophone manufacturer Decca Records played a major role in the development of positioning systems during the war and put its technologies to commercial use soon after it. Decca Radar was launched in 1949. Probably due to costs, it was only slowly adopted for fishing during the next decade, although it did help vessels to sail through night and fog and thus increase their days of fishing. Of more immediate significance was the Decca Navigator Co. Ltd., which put to commercial use a system allowing vessels to determine their position by means of triangulating radio signals from a chain of land-based stations. The system was developed by the British Navy and made operative for inshore traffic in 1944. The system worked only in near-shore waters to a distance of at best 750 km from the shore.³¹ North Sea fishermen found the system hugely beneficial, as it enabled them to reach good fishing grounds with great precision. Decca charts quickly became coveted assets for skippers.³²

³¹ W. Blanchard, "Hyperbolic Airborne Radio Navigation Aids: A Navigator's View of their History and Development", in *The Journal of Navigation*, 44, 3, 1991.

³² Many maritime museums such as the Fisheries and Maritime Museum Esbjerg (Denmark) hold collections of Decca charts.

Underwater locating technologies similarly became of use to the fishing industry. Known as ASDIC in Britain and sonar in the US, acoustic technology was of huge military importance as a means to detect submarine vessels. The technology was first developed for commercial use by fishing vessels in 1957, when the Norwegian company Simrad produced echo sounders to locate shoals of fish as well as monitor depths and bottom contours.³³

Many other wartime inventions or rapidly progressed technologies such as plastics and synthetic rubber and twines helped increase fishing power in the immediate post-war years. Further research might establish the rate of increase in fishing power before and after the war, but it seems safe to conclude that a strong increase in fishing power followed from the application of technologies of human warfare to the extraction of marine life.

The Great Acceleration II: new strategies and environmental impacts on land, sea and cities

The war forced a reorientation to new markets on most fish-producing nations, and the difficult market conditions after the war exacerbated the need to quickly introduce new processing technologies and products. In Northern Norway and the North Atlantic countries, the response drew on WWII experiences and innovations, while the new realities of the Cold War quickly led to government decisions that had profound impact on both terrestrial and marine environments. In the southern countries around the North Sea, the conditions of a depressed post-war market caused industries to either revert to pre-war fishing strategies or leap to completely new strategies. The decisions made at this time to a large degree determined the environmental impacts of the fishing industry between 1945 and 1975.

The war had severed Norwegian and North Atlantic fishing communities from their traditional markets, and the experience of the

³³ <http://www.simrad.com/www/01/nokbg0240.nsf/AllWeb/43E008132CFB7504C12570BA00525273> (accessed February 15, 2013).

war and the necessities of the early Cold War had made it clear to national governments that it was important to keep the landscapes above the Arctic Circle populated. This was particularly obvious to the Norwegian government, which was confronted with the Soviet Union in the Finnmark region. The region had suffered terrible devastation in the last year of the war. Reconstruction was shaped in the mould of forced modernisation. The German-planned factories were of excessive size for the market and reverted to state ownership. The freezing technology helped secure jobs in areas that would otherwise likely have suffered from depopulation. The technology was seen as the future, but only survived thanks to massive subsidies throughout the 1950s. Thanks to this 'forced transformation' and corporatism, Norway built up a large-scale freezing sector, which was operated at huge deficit. In the long run, however, the industry not only secured the population of the landscape but also proved its worth by being ready for the supermarkets and refrigerated commodity chains of the 1960s.³⁴ Historical contingency turned the long shadow of the war into a new business adventure for Norwegian fishing.

In Greenland, the Danish government was anxious to prove its worth vis-à-vis the US authorities. The rapid expansion of the fishery during the war prepared authorities for large-scale post-war modernisation plans. The open market of the war was perpetuated by means of forced modernisation after the war in the form of a state investment programme in the fisheries. The long-term effects of the Second World War were in some respects similar to Northern Norway, but in the case of Greenland modernisation worked against human landscapes. Small, dispersed settlements in Greenland were moved to larger "towns" in order to develop economies of scale, and

³⁴ B.-P. Finstad, "Freezing Technology in the Norwegian Fish Processing Industry, c. 1930-1960", in *Studia Atlantica* 3, Fiskeri- og Søfartsmuseet, Esbjerg 1997. Similar wartime investment in freezing technology in Newfoundland was initiated by the British government. The technology used was in both cases largely under patent by the British-Dutch Unilever company (M. Wright, "The Politics of Technology: State Funding of Fisheries Technologies in Newfoundland, 1940-1966", in *Studia Atlantica* 3, Fiskeri- og Søfartsmuseet, Esbjerg 1997).

the focus was on extracting more resources out of the marine environment to increase living standards.³⁵

Modernisation was also on the agenda in Iceland. Shortly after its declaration of independence from Denmark in June 1944, the Icelandic Government embarked upon an extensive programme of general economic reconstruction, including a modernisation of the fishing fleet. The huge incomes of the war had made the potential of a full-scale focus on fisheries obvious to the government. More than a hundred motorboats for inshore fishing were built or renovated and 28 steam trawlers and two diesel trawlers were commissioned from British contractors. Another twenty trawlers were added to the fleet in the next few years. Iceland's growth was sustained by a reorientation on new markets for frozen fish in the US and for salted herring and fish meal in the Soviet Union.³⁶ However, the Icelanders soon found themselves confronted with returning British and German trawlers. The scene was set for a dispute over fishing rights that was to remain high on the agenda for the next twenty years.

In the Faroe Islands there was less focus on building new vessels. Merchant houses had earned good money shipping Icelandic fish and after the war focused on resuming the old saltfish production for the Mediterranean markets. They invested in old English and Icelandic trawlers, which soon proved unprofitable due to high coal prices. The ensuing bankruptcy of the major bank, Sjóvinnubankin, led to economic recession. The Faroese economy of the 1950s seemed trapped in old practices, and many Faroese Islanders shipped on board of Icelandic, Norwegian, and German trawlers.³⁷ In this case, the War had not triggered innovation but rather cast a long shadow on the islands.

In continental Europe, the challenge facing the post-war fishing industry was the collapse of the German market. While catches were high, prices were low. The Danish industry had its large fleet replenished by vessels that had defected during the war and had now returned

³⁵ A.K. Sørensen, "Fishing by the Greenlanders", in *Studia Atlantica 1*, Fiskeri- og Sofartsmuseet, Esbjerg 1995.

³⁶ Thor, *British Trawlers and Iceland 1919-1976* cit.

³⁷ Joensen, *The Fisheries of the Faroe Islands* cit.

from British ports. With large herring landings on hand from the newly opened mid-North Sea grounds and no buyers, Danish skippers were faced with economic disaster in 1947 and looked for new ventures. In this case, the shadow of the War came in a different form, which did not affect the nature of production designs or political trajectories. The Danish fishery had survived the War almost unimpacted and extremely affluent. Now it was exposed to the sudden shock of market collapse, and dramatic decisions needed to be made. Some skippers relocated to Greenland, but most decided to invest in fish-reduction technology. While there had been some fishmeal production in North Sea countries prior to the war, mainly as a means of disposing of unsold, decaying fish, the technology was now used to process fresh fish, especially herring. In the interwar period, Danish skippers had prided themselves on delivering the best quality fish for the European market and shunned the idea of trawling, as they had developed the seine for small but high-value catch. Now they decided to go for limitless quantities of fish, which could be landed in almost any state of decomposition. Fishmeal, mainly used as animal fodder at the time, fetched far lower prices than fish sold for human consumption. Nevertheless, the decision made economic sense, as herring shoals were extremely abundant and prices of fish for human consumption remained depressed. Skippers pooled capital to buy fish-reduction technology to establish a fishmeal production in several ports from 1948 onwards.³⁸

The reduction industry became the most controversial and destructive fishery in the North Sea. Once introduced, it was sustained by extremely high catches during the 1950s and 1960s, first of herring and later of other species such as sprat, sandeel and whiting. As early as the 1950s, reduction fishery was identified as a major ecological threat and gave rise to international fisheries negotiations, which proved ineffective. Whiting showed signs of overfishing by the late 1950s, while the herring stock sustained huge extractions until it eventually collapsed in 1975. The environmental effects of the fishmeal industry were not confined to the sea. Urban environments

³⁸ P. Holm, S. Byskov, S. Toft Hansen, *Proteiner fra havet: Fiskemelsindustrien i Esbjerg, 1948-1998*, Fiskeri-og Søfartsmuseet, Esbjerg 1998.

were quickly impacted. The pollution of the harbour water and, even worse, smoke from the chimneys marked the city of Esbjerg, the leading Danish North Sea port, for decades. The abominable smell from the fishmeal factories became notorious and gave the city a negative image, which is only now slowly beginning to fade away, despite the closure of the factories years ago.³⁹ In terms of assessing the impact of WWII on Danish fisheries, while the fishmeal industry was certainly not foreboded by the war, the momentous decision to develop the fishery would have been unlikely without the collapse of the market and the desperation Danish skippers had fallen in by 1947.

In the UK and continental countries, the focus after the war was very much on restoring the pre-war order of steam trawlers to return to the old fishing grounds in the North Atlantic with much more powerful technologies. While Germany had brought huge capital destruction upon itself, the country quickly began a process of reconstruction. In 1948 Germany had only some 140 steam fishing vessels, but added another 90 over the next two years. Importantly, the country began introducing motor-vessels in its fleet,⁴⁰ soon set the industry standard for trawling, and by the 1950s had become highly competitive in the North Atlantic. In other countries, recovery was slowed down by lack of access to steel. The Dutch government initiated a rebuilding programme as early as 1945, but scarcity of building material held back construction and the Dutch fleet struggled through the 1950s to regain its former lead.⁴¹ French recovery was similarly protracted. UK recovery after the war largely involved the return of the old coal-burning trawlers of the 1930s. New oil-burning and later diesel-electric trawlers did make their way into the fleet, but a full-scale modernisation of the fleet did not begin until the mid-1950s.⁴²

³⁹ V. Bruhn, P. Holm, *Havneby og storkommune. Esbjergs Historie, 3, 1910-1998*, Rosendahl, Esbjerg 1998.

⁴⁰ Bulletin Statistique 1945-1952, Part II, Table 9.

⁴¹ F. Loomeijer, "The Beamtrawl Industry. Fifty Years Dutch Inshore Fishery", in *Studia Atlantica 3*, Fiskeri-og Sofartsmuseet, Esbjerg 1997.

⁴² Thor, *British Trawlers and Iceland 1919-1976* cit.

Distant-water trawling was, however, increasingly at odds with the rest of society as new urban lifestyles developed in the post-war years. The British fishing communities especially were locked in a mode of production that by the late 1950s looked increasingly alien to the rest of society. The sociologist Jeremy Tunstall presented a merciless picture of human degradation in the fishing district of Hull around Hessle Road. When he carried out his research, trawler fishing was still adhering to patterns established in the early years of the twentieth century, but its decline as a result of lack of investment was clearly just around the corner.⁴³ The port communities of Grimsby, Hull and Aberdeen were increasingly seen as sociological exceptions in post-war Britain. An industrial formula prioritising quantities of low-quality iced fish for the cosmetics of batter in the fish 'n' chips shop was not the response to consumer expectations in the post-war period. Nor were North Atlantic fishing banks able to provide the expected quantities. The urban ecology of these ports did not last through the 1960s, when they were confronted with diminishing economic returns when technology eventually could not wring any more out of the North Atlantic ecosystem.

In environmental terms, the marine and terrestrial effects of World War II were palpable. The reprieve from fishing during the war was followed by a powerful release of fishing effort after the war, encouraged by initial bonanza catches. Environmental effects depended on national trajectories, technological innovation, state policies and cultural adaptation or resistance. Landscapes and settlements north of the Arctic Circle were fundamentally changed in continuation of forced modernisation during the war. In the North Sea, the collapse of the market helped introduce a new extremely wasteful fishing practice, which became the bone of contention for

⁴³ J. Tunstall, *The Fishermen. The Sociology of an Extreme Occupation*, MacGibbon and Kee, London 1962. P. Holm, "The Modernisation of Fishing: The Scandinavian and the British Model", in *The North Sea: Twelve Essays on Social History of Maritime Labour*, L.R. Fischer, H. Hamre, P. Holm, J.R. Bruijn (eds), Stavanger Maritime Museum/The Association of North Sea Societies, Stavanger 1992, pp. 197-210.

decades. In the old leading fishing nations, particularly the UK, the trawling industry went back to old fishing grounds with ever more powerful vessels, thus increasing competition with ever more confident North Atlantic local governments. All these developments set the stage for what was perhaps the most important consequence of the war, ocean management.

Politics

Well into the twentieth century, and arguably until WWII, the use of the oceans by Western countries was governed by the principle of *Mare Liberum* (The Free Sea), laid down by the Dutch lawyer Hugo Grotius in 1609. Grotius held that the sea is an inexhaustible, common property and that all should have open access to it. During the nineteenth century, a 3-nautical-mile (5.5 kilometers) limit was increasingly accepted as national territorial waters. The Hague Convention of 1882 established exclusive fishing rights for national fishermen within this boundary, whereas all other waters were to remain open to anyone. The Convention was signed by all North Sea countries and by the Anglo-Danish treaty of 1901 also extended to Denmark's North Atlantic dependencies of the time – the Faroes, Iceland and Greenland.

By around 1900, however, concerns about overfishing caused nations to engage in international negotiations. The establishment of the International Council for the Exploration of the Seas in 1903 was in direct response to the realisation that overfishing did take place in open waters and that all nations would benefit from some form of regulation.⁴⁴ Such was the persuasive power of the findings of the Great Fishing Experiment after WWI that the International Conference on the North Sea Plaice Fisheries in 1925 recommended a simulation of the beneficial effects of a moratorium by closing zones of the North Sea to fishing. However, the Conference recog-

⁴⁴ H.M. Rozwadowski, *The Sea Knows No Boundaries. A Century of Marine Science under ICES*, University of Washington Press and ICES, Seattle/London 2002.

nized that it might be “impracticable” to secure the backing of all governments to such a measure and suggested as a possible other way forward the introduction of limits to mesh sizes of fishing gear to allow smaller fish to escape. The Conference also realized “the importance of securing the goodwill of the fishermen concerned” and expressed the hope that they might be convinced to accept the measures proposed.⁴⁵ This hope, however, turned out to be a pious one: by the outbreak of the war, management of the North Sea fisheries had made few steps forward in real terms.

Negotiations were resumed after the war in the awareness that replenished fish stocks might soon need conservation. In 1946, a North Sea Convention was agreed. The Convention focused on technical measures such as minimum mesh and fish sizes. These regulations reflected the advice of biologists in the 1930s and turned out to be inadequate for the new fishing practices after the war. As the Convention was being ratified, reduction fishery for herring and later other species developed rapidly. The Convention was only enforced by 1954, when it was all too late to conserve the fish dividend of the war. Even worse, countries agreed to an opt-out clause, which effectively granted any member a right to veto regulations.⁴⁶ Despite repeated and ever more heated protests by the British against the catch of whiting by Danish trawlers for reduction, the Convention did little to conserve fish stocks. It may therefore be said that by the end of the 1950s the North Sea countries were still in early twentieth-century mode as far as fisheries management was concerned, and WWII had had no other effect than to delay negotiations. It effectively took a herring crash in 1975 for the European Community to develop a Common Fisheries Policy.

In the North Atlantic, developments before the war were similarly slow. In response to declining CPUE in Icelandic waters, Iceland raised

⁴⁵ *International Conference on the North Sea Plaice Fisheries*, available on the web at: www.vliz.be/imisdocs/publications/135290.pdf (accessed February 15, 2013).

⁴⁶ M. Karnøe Søndergaard, *Dansk fiskeri i det internationale spil – et fiskeripolitisk studie 1946-63. Sjøkølen 2004*, Esbjerg (Fiskeri-og Søfartsmuseet) 2005, 27-44.

concerns about diminishing cod stocks in Faxa Bay near Reykjavik as early as after the First World War, and in 1936 proposed to close the Bay to trawling. The Second World War interrupted international discussions and although these were subsequently resumed, in 1949 all countries except Scandinavia rejected the proposal. Norway similarly wished to enforce protection along its extended coastline against British trawling, but the UK took the matter to the International Court of Justice in 1935. The case rested until 1951, when the court found in favour of Norway.⁴⁷ While both cases were an expression of the wish of coastal states to protect the immediate near shore, neither went beyond the framework of established principles.

While World War II may be said to have only delayed negotiations and management concerns on the North Atlantic scene, events in the aftermath of the war outside of the North Atlantic greatly sped up matters. In September 28, 1945, U.S. President Harry Truman claimed wider rights to economic interests on the North American continental shelf in two proclamations, one dealing with natural resources on the continental shelf and the other with fisheries. The second declaration was directed against a possible resumption of Japanese salmon fisheries off the Alaskan coast. The declaration read: "In view of the pressing need for conservation and protection of fishery resources, the Government of the United States regards it as proper to establish conservation zones in those areas of the high seas contiguous to the coasts of the United States wherein fishing activities have been or in the future may be developed and maintained on a substantial scale".⁴⁸

The repercussions were immediate. Chile and Peru claimed a 200-nautical-mile (370 kilometres) exclusive fishing zone off the coasts against U.S. tuna fishers, and in the North Atlantic Iceland soon followed suit with claims to exclude British fishers from Icelandic waters. In 1958, the United Nations called the first International

⁴⁷ 5.17 "Fiskerigransesaken mellom Norge og Storbritannia", available on the web at: <http://www.regjeringen.no/nb/dep/fkd/dok/nouer/2008/nou-2008-5/6/17.html?id=499956> (accessed February 15, 2013).

⁴⁸ <http://www.ibiblio.org/pha/policy/1945/450928a.html> (accessed February 15, 2013).

Conference on the Law of the Sea to establish a new consensus on sea law. The conference extended territorial limits to 12 nautical miles (22 kilometres), but failed to settle the issue. A second conference called in 1960 made little progress. During the 1960s and 1970s positions changed dramatically. It became evident that the supplies of fish stocks were limited and that depletion was looming. Attempts to manage resources through international bodies had proved largely ineffective. Many coastal states, both developed and developing, felt increasingly threatened by the large fleets of distant-water states off their coasts. By the 1970s, the so-called cod wars between Iceland and the UK brought matters to a head. Iceland had replaced its post-war side-winding trawlers with a new generation of stern-trawlers with much greater capacity and wanted exclusive fishing rights. In 1976 a 200-mile Exclusive Economic Zone was accepted in principle by both parties.⁴⁹ The repercussions of the immediate post-war reaction to problems in pre-war Pacific fisheries had come to an end.

While the War had seemingly ended with a return to business-as-usual in ocean politics, events outside the North Atlantic triggered by war concerns had actually changed ocean management for ever. The International Law of the Sea was finally laid down in 1982. Paradoxically, USA has signed but not ratified the treaty, which therefore remains to this day in the shadow of post-war conflicts, with considerable implications of uncertainty for ocean management.

Conclusion

The Second World War cast a long shadow on the development of post-war fishing patterns and ocean management in the North Atlantic. The War brought temporary reprieve for ocean life and allowed commercial stocks of cod, haddock and plaice to replenish after heavy fishing pressures during the interwar period. Baltic cod, on the other hand, became the target of commercial fishing for the first time.

The immediate postwar years defined and triggered the Great Ac-

⁴⁹ Thor, *British Trawlers and Iceland 1919-1976* cit.

celeration of fisheries between 1945 and 1975. New marine technologies were put to commercial use and increased fishing power.

Countries by the Arctic Circle sustained the 'forced modernisation' of fisheries by means of heavy state subsidies. In the North Sea, increased catches as a result of the temporary reprieve and the post-war slump of fish prices caused fishermen to introduce a reduction fishery that brought not only a dramatic increase in environmental pressures but also a major change in urban and industrial culture.

The War increased pressure on fish stocks, which gave rise to immediate management concerns. European politicians resumed negotiations of fishing conventions on the basis of interwar experiences. While these negotiations were largely inconsequential, the new principle of exclusive economic zones proved to be a long-term game changer. The principle was introduced immediately after the War in the Pacific. It took all the years of the Great Acceleration until 1975 for the principle to work its way into European politics, by which time major collapses of herring and cod stocks in the North Atlantic had occurred.