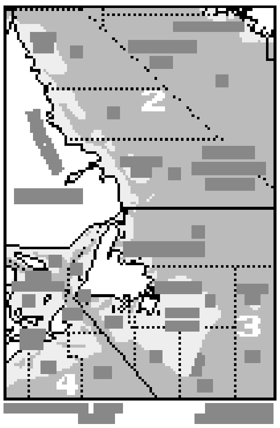
■ Case Study: The Shadow of the Past: An Historical Perspective on the Newfoundland Cod Fishery, 1950-1992*

PRELUDE

The waters off the coast of Newfoundland once held one of the richest fishery resources in the world (Map 7). Fifteenth-century European explorers first ventured across the stormy Atlantic in search of the riches of the orient, but soon realised that the cod found teeming off the coast of Newfoundland offered a different path to economic prosperity. Soon, the Atlantic cod became the central staple of a new international transatlantic economy.

Map 7. **The northern cod (areas 2J3KL) off the Canadian Eastern Shelf and Grand Banks was one of the largest fish stocks in history** Map shows the ICNAF/NAFO areas.



Cod were so plentiful in the three centuries following John Cabot's first voyage in 1497, they could be taken "not only with the net but in baskets let down with a stone" (di Soncino, 1983). Migratory fishers from England, France, and Spain began making annual pilgrimages to these fishing grounds. These nations competed, and sometimes fought, with each other for the best fishing areas and choice locations for curing fish on land. Indeed, the wars between France and England over trade and colonies in the latter half of the 17th century spilled over into Newfoundland. Under the 1713 Treaty of Utrecht, Britain held its claim to Newfoundland, but continued to allow French and other fishers to take fish off its coast. By the early 19th century, the rapidly growing resident population, comprised mainly of settlers from England and Ireland, was taking the majority of the cod landed off its shores. The fishery continued to provide the mainstay of the economy of Newfoundland, despite many political changes.

Britain's oldest colony received self-government in 1855, and became a province of Canada nearly 100 years later in 1949. After Newfoundland joined Confederation, the offshore fishing grounds once again became a site of intense international competition. These fishing grounds occur in one of the largest shelf banks in the American continent (Map 7). With the advent of the diesel-powered stern trawler and the factory freezer ships, European fleets joined Canadian vessels fishing for cod and other groundfish. Fishing capacity and effort in both the Newfoundland inshore and Canadian and international offshore fisheries continued to escalate throughout the 1950s, 1960s, 1970s, and 1980s. Centuries of dependence on the Atlantic cod by both European and North American fishers came to an end, however, as the stocks collapsed in the early 1990s. In 1992, the Canadian government declared a moratorium on fishing northern cod (the populations in the NAFO areas 2J3KL), followed by a moratorium on fishing cod on the south coast of Newfoundland and the Gulf of St Lawrence in 1993. Except for a limited re-opening of the south coast fishery in 1997, the moratorium remains in effect to this day. Overnight, over 40,000 fishers and plant workers lost their livelihoods, hundreds of coastal communities lost their ability to maintain their populations, and the entire Newfoundland economy was shaken to its core.

This paper will look at the changes in the nature of the fishery and changes in the resource itself off the coast of Newfoundland from the beginning of the intensification of the offshore fishery in the 1950s to the eve of the moratorium in 1992. In particular, it will examine the historic context behind the escalation of offshore fishing in the

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1950s and 1960s, and its impact on the resource as noted by contemporary Canadian fisheries scientists.

A LONG HISTORY OF OVERFISHING

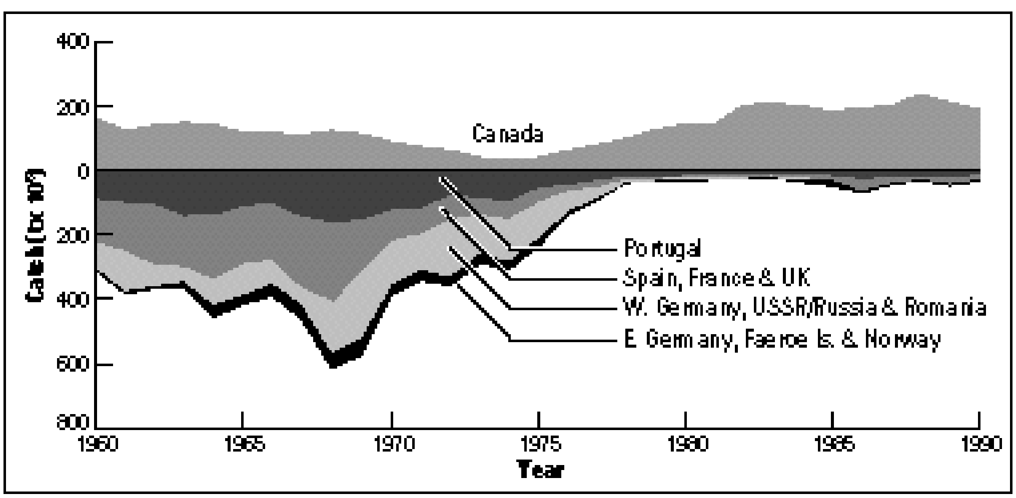
It is a common misconception that overfishing dates from the late 1980s and early 1990s. Indeed, the tendency in the past few years to focus on problems of fisheries management during the 1980s gives the erroneous impression that all the answers to the problems of the decline of the cod stocks lay in that period. Recent work by historians and fisheries scientists who have attempted to reconstruct cod landings over time, however, suggests that ecological problems in the Newfoundland fishery are much older, dating to at least the 19th century (Cadigan, 1995 and 1996; Hutchings and Myers, 1995).

When we look at historic landings for northern cod over the past 300 years, it is clear that the 1960s were a period of unprecedented fishing of the resource. In the 19th century, northern cod landings ranged from 100,000 t to 300,000 t (Hutchings, 1995). At the turn of the century, landings had stabilized at 300,000 t, increasing during World War I when prices were particular good. Decades of economic depression and technological limitations contributed to decreased effort in the fishery in the inter-war years. By the 1940s and 1950s, landings had fallen to 150,000-200,000 t.

PEAK AND DECLINE

The 1960s, however, reveal a much different picture. Total landings of northern cod – led by DWFNs – tripled between the mid-1950s and the late 1960s, reaching an all-time high of 810,000 t in 1968 (Figure 15). The record-breaking catches of the late 1960s were never to be repeated. Landings showed a steady decline from 1968 to 1977, when the international 200-mile fishing limit was declared.

Figure 15. **DWFs usually took the largest part of the northern cod catch, especially during the late 1960s when the stock was fished very hard. Canada gained control of the fishery in the late 1970s**



Hutchings and Myers (1996) argue that by 1977, “Northern cod were on the verge of commercial extinction”. In fact, they claim that between 1962 and 1977, fishable biomass had declined by 82 per cent, spawning biomass by 94 per cent, and numbers of recruits to the fishery by 84 per cent. Although landings recovered somewhat in the late 1980s, reaching highs of nearly 270,000 t, the recovery was short lived. In 1990, the biomass had fallen below 1977 levels. Even more ominous was the dramatic change in the age structure of the remaining population, most particularly the drop in the numbers of older (10-14 year old) individuals, which generally were the most productive spawners.

By 1992, the population had declined to the point where commercial fishing was no longer advisable, and the moratorium was declared. When viewed over the long term, Hutchings' figures regarding the declines in the northern cod biomass between 1962 and 1977 suggest that much of the "damage" to the stocks occurred much earlier than is generally believed. For this reason, a closer look at this earlier period, the introduction of new technology to the cod fishery in the northwest Atlantic, and its impact, is merited.

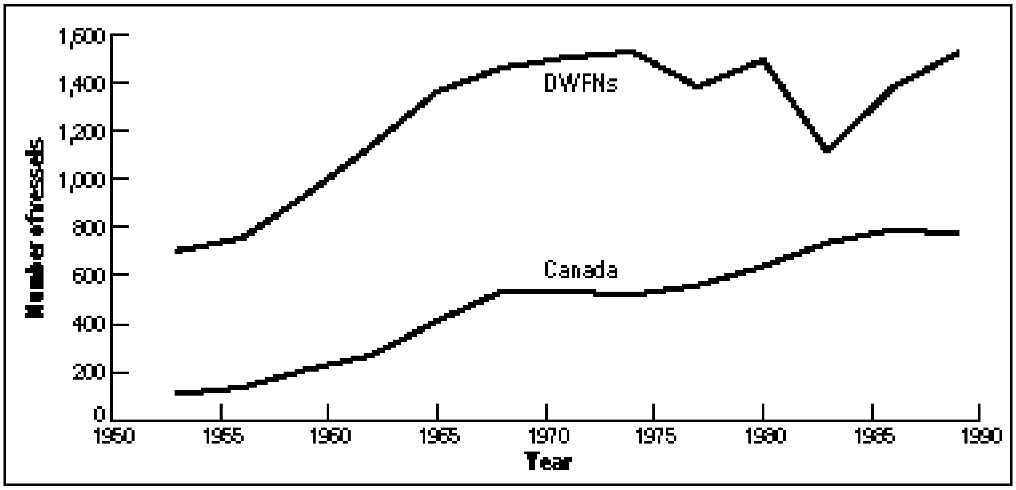
TECHNOLOGICAL CHANGE AND MARKET FORCES

The roots of the intensification of offshore fishing in the 1950s and 1960s lay in economic and technological developments following World War II, both in North America and in Europe. The most important technological developments for both continents were diesel-powered otter trawlers, factory freezer stern trawlers, which allowed the catch to be processed on board, and quick-freezing processing methods. These technologies set the groundwork for increased production of Atlantic cod. Developments in refrigeration, transportation, and marketing in the food sector also contributed to the expansion and industrialization of the fishing industry. In the United States, the New England fishing industry, which had been undergoing capital restructuring and consolidation, began to take advantage of these technological developments. Further fuelled by a growing population and increased demands for frozen food products, the New England and Nova Scotia fishing industries underwent a period of capital expansion. This in turn paved the way for increased production in Newfoundland, as the large New England firms that dominated the North American side of the Atlantic fishery turned northward in search of a steady supply of groundfish.

Events in Europe would also have a profound effect on the increased competition for the resource off the coast of Newfoundland. In the wake of World War II, many European countries began rebuilding their economies. Obtaining self-sufficiency in food, and finding a way to feed growing populations became an important consideration for these countries devastated by years of war. As Newfoundland cod had long been a feature of the European diet, building up capacity in the offshore fishery seemed a logical solution. By the early 1950s, Spain, Portugal, and France, which had fished off the Newfoundland coast for centuries, replaced their smaller, side trawlers, pair trawlers, and dory schooners with diesel-powered otter trawlers. By the end of the decade, they were joined by the USSR, East and West Germany, Italy, Norway, and Iceland. The factory freezer stern trawler was of particular value to these distant-water fleets, as vessels could stay on the fishing grounds for a much longer period. The USSR was the major employer of this technology in the early 1960s.

Collectively, the size of the fleets fishing in the northwest Atlantic increased dramatically (Figure 16). In 1953, there were 540 otter trawlers over 50 GRT fishing in the International Commission for Northwest Atlantic Fisheries (ICNAF) management area; by 1962, the number had risen to 975. (ICNAF was formed in 1949 and was the precursor to the Northwest Atlantic Fisheries Organization (NAFO), an international

Figure 16. **The distant water and Canadian fleets fishing in the ICNAF/NAFO area (all gears) grew at similar rates and showed little signs of a decrease in fishing capacity**



Data from ICNAF 1964 and NAFO 1992

body to regulate fishing in the North Atlantic from Greenland to the coast of the northeastern United States.) In 1968, the year cod landings reached an historic high, 1,398 otter trawlers were fishing in the northwest Atlantic. The sheer size of these vessels also expanded. In 1962, the total of vessels 50 GRT and over was nearly 500,000 GRT. By 1971, the total had nearly tripled, to 1.3 million GRT. This growth in fleet size and capacity was accompanied by a level of effort never to be seen again in the fishery. In 1970, vessels in the 1,000-1,999 GRT category put more than 8,000 fishing days together, a figure accounting for more than 60 per cent of the total otter trawl effort in the area. The size of the fleets of individual countries also grew rapidly. In 1962, the USSR had 344 vessels totalling 198,196 GRT fishing in the northwest Atlantic. By 1971, the Soviet fleet had increased to 502 vessels totalling 782,223 GRT. Other countries with substantially increased fishing capacity included Spain, Portugal, France, and West Germany. In relative terms, Canada's offshore fleet was small. In 1962, Canada had 272 vessels over 50 GRT, but they tended to be smaller and totalled only 34,525 GRT. Together, these fleets began fishing the waters with an intensity never known in the nearly 500-year history of the international fishery off the coast of Newfoundland.

Not only did the sheer amount of technology change in this period, there were significant changes in the way in which this technology was used (Hutchings, 1995). Between 1800 and 1959, the majority of fish taken off the coast of Newfoundland was landed by the small boat, inshore fishery, using such methods as hook and line and cod traps. It was a seasonal fishery, with most of the fish being caught between June and September. It was also physically restricted to the waters within a few miles of shore. The arrival of the diesel-powered otter trawlers changed both the time and place that fish was caught in the northwest Atlantic. The steel-hulled construction of the large vessels allowed fishing to take place all year round and in rougher weather, a considerable factor on the stormy North Atlantic. As well, the otter trawlers could advance to new offshore fishing grounds that had not previously been exploited to any great extent. The intensification of fishing off the coast of Labrador in the 1960s, particularly by the USSR, is just one example of the spread of fishing effort to areas with little previous fishing activity.

EARLY HINTS OF DECLINE

Perhaps not surprisingly, fisheries scientists working in the Newfoundland area began to notice changes in the fishery by the early 1960s, just a few years after the intensified offshore fishery began. Dr Wilfred Templeman, director of the Canadian government's fisheries research station in Newfoundland from 1944 to 1972, began talking about the impact of offshore fishing as early as 1962. At a fisheries conference sponsored by the provincial government in 1962, Templeman told the audience of assembled fishers and government officials that the populations of major commercial groundfish species – Atlantic cod, haddock, redfish, and flounder – were all subject to intense international competition (PANL, 1962). He claimed that as fishing continued, the catch per person, and the size of the fish would inevitably decline. Although he was reluctant to predict how long it would take before the Newfoundland fishery reached the point of exhaustion (he claimed it was like "witch doctoring into the future"), he had a rather bleak view of the ability of ICNAF to regulate fishing. He noted that the ICNAF countries were concerned mainly with obtaining the maximum sustainable yield, but he believed that those goals could conflict with the Canadian fishery.

In 1966, Templeman published a major report on the state of the marine resources in Newfoundland (Templeman, 1966). In this document, he talked more specifically about the impact of the intensified offshore fishing on the Newfoundland fishery. After just a few years since the arrival of the European fleets, it was clear that Newfoundland fishers were having trouble competing for the resource. Newfoundland's share of the total catch was falling, despite increased effort. In Sub-area 2 (Labrador), the Newfoundland inshore share of the total catch fell from 32 per cent in the years 1955-1958 to 9 per cent in 1961-1964 (Templeman, 1966). Likewise, in Sub-area 3, the Newfoundland fishery took 32 per cent of the catch in 1961-1964, down from 43 per cent in 1955-1958 (Table 12).

Table 12. **Average total landings by ICNAF countries (includes Newfoundland inshore landings)**

ICNAF division	Catch (t x10^3) 1955-1958	Catch (t x10^3) 1961-1964
2J	32	229
3K	79	114
3L	153	170

Part of the reason for this decline was that the European fleets were so much larger and more technologically advanced than the Canadian and Newfoundland vessels. Newfoundland's fleet of mainly smaller, less efficient side trawlers could barely compete with the newer stern trawlers and factory freezer trawlers from Europe.

Templeman also believed that the intensification of offshore fishing was having an impact on fish populations. Despite increased landings for many groundfish species, standing stocks were being reduced and the average size of the fish caught was declining – an indicator that the larger, older fish were being fished out (Templeman, 1966). Catch per unit of effort was also falling. Templeman argued that no major concentrations of "undiscovered" groundfish remained, meaning that henceforth, further declines in the populations could be expected. He warned that these trends would continue, as all ICNAF countries planned to increase their fishing activities in the coming years.

Templeman believed that for the Newfoundland inshore fishery, the increased offshore fishing posed a particular threat. Although the migration behaviour of Atlantic cod is not completely understood, a significant portion of Atlantic cod were believed to migrate from offshore grounds to inshore waters during the fishing season. The Newfoundland inshore fishery traditionally depended, to a certain extent, on the ability of offshore fish to make the migration towards shore. When inshore landings began to show dramatic changes from the mid-1950s to the mid-1960s, Templeman concluded that the intensified offshore fishing was partly to blame. Templeman made the rather startling observation that between 1956 and 1964, despite increases in the number of inshore fishers (53 per cent), vessels (57 per cent), and gear (traps 69 per cent; gill nets 1819 per cent), total inshore landings had remained relatively stable (Templeman, 1966).

Alister Fleming, another federal fisheries scientist based in Newfoundland, documented the fall in yields per fisher in the ICNAF Sub-areas 2 and 3 (PANL, 1964). Despite an increase in landings in Sub-area 2 after 1959, yields per fisher had fallen by 25 per cent from the 1954-1957 average. In Sub-area 3K, the number of fishers had remained the same, but landings and yields per fisher fell 40 per cent below the 1954-1955 level. Likewise, in Sub-area 3L, the number of fishers rose by 30 per cent while landings fell 20 per cent. Both Templeman and Fleming argued that, with continued offshore fishing, the only chance for the survival of the inshore fishery was through equipping it with more efficient gear and vessels to catch the increasingly scarce groundfish.

Templeman and others had evidence, however, that the impact of intensified offshore fishing in this period was uneven, with some areas affected more than others. The heavy offshore fishing in the Labrador area in the early 1960s had the potential to affect the inshore fishery. Templeman noted:

“With this great development of the European offshore deep-water fishery, Newfoundland landings from the coastal fishery off Labrador (Sub-area 2) declined from about 100 per cent of the total in 1950 to 32 per cent in 1955-1958 and to 9 per cent in 1961-1964. The new offshore fishery affects the inshore fisheries of Labrador and northern Newfoundland by reducing both quantities and sizes of cod” (Templeman, 1966).

Bonavista, on the northeast coast of Newfoundland (ICNAF Sub-area 3L), also experienced problems. In the early 1950s, the federal government established an experimental longliner fishery when excellent deep-water grounds were discovered 20 miles from shore (Templeman, 1966). Longliners, near-shore vessels typically between 15 and 20 m in length, had not previously been used in the Newfoundland fishery. After several successful years, landings for the Bonavista-based longliners declined rapidly. By 1960, the average catch for these vessels had fallen to 40 per cent of earlier landings. The average size of the fish landed by the longliners decreased by 5 cm. The local inshore fishery also experienced declines, with cod trap landings falling by two-thirds in the same period. Several otter trawlers and a large fleet of longliners from Norway and the Faeroe Islands that joined the Bonavista longliners on the fishing ground beginning in 1956 were widely blamed for these difficulties. As landings for the Europeans also declined in the early 1960s, they eventually left the area. The incident, however, alerted fishers and fisheries scientists alike to the potential impact of intensified offshore effort on the groundfish stocks.

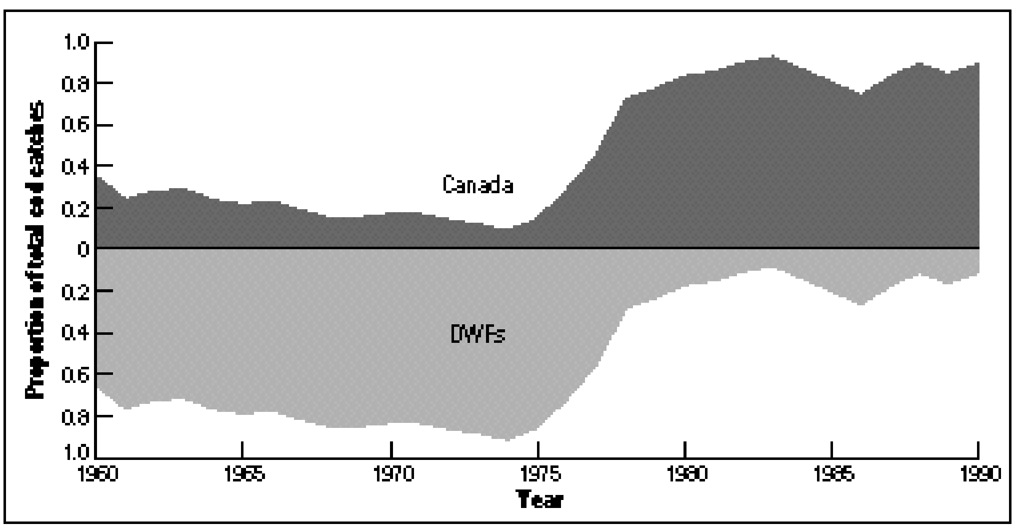
THE DOMINION STRIKES BACK

These changes began sending alarm bells throughout the Newfoundland fishery. Not only were the scientists concerned about the changing fishery, but Newfoundland frozen fish company owners, inshore fishers, and provincial Department of Fisheries officials feared the implications of intensification of offshore fishing (Wright, 1997). By the early 1960s, increasing pressure was put on the federal government to address the issue. The government began taking tentative steps towards implementing a 12-mile fishing limit in an attempt to decrease foreign fishing on inshore fishing grounds (Wright, 1997a).

The federal government also took a renewed interest in increasing the technological capacity of the Newfoundland fishery, particularly the offshore sector. With several hundred European trawlers regularly fishing just a few miles from Canadian shores, the federal Minister of Fisheries vowed to equip the Canadian offshore fishery to compete with the more technologically endowed Europeans, promising to double the number of Canadian offshore vessels. In 1966, the Fisheries Development Act was created to provide loans and financial assistance to the frozen fish industry for the acquisition of processing plants and trawlers, the first federal programme to do so. In the years that followed, the Newfoundland offshore fleet increased significantly.

Unfortunately, if the exploitation led by DWFNs in the 1960s was unsustainable, the Canadianization of the fishery (Figure 17) did not bring much relief to the Atlantic cod. After the 200-mile fishing limit was declared in 1977, and Canada effectively gained control over the larger portion of the northern cod stock, the Canadian fleet expanded steadily to fill the void left by the European fleets (Figure 18). Between 1977 and 1986, the number of vessels over 50 GRT grew from 561 (128,007 GRT) to 795 (158,754 GRT).

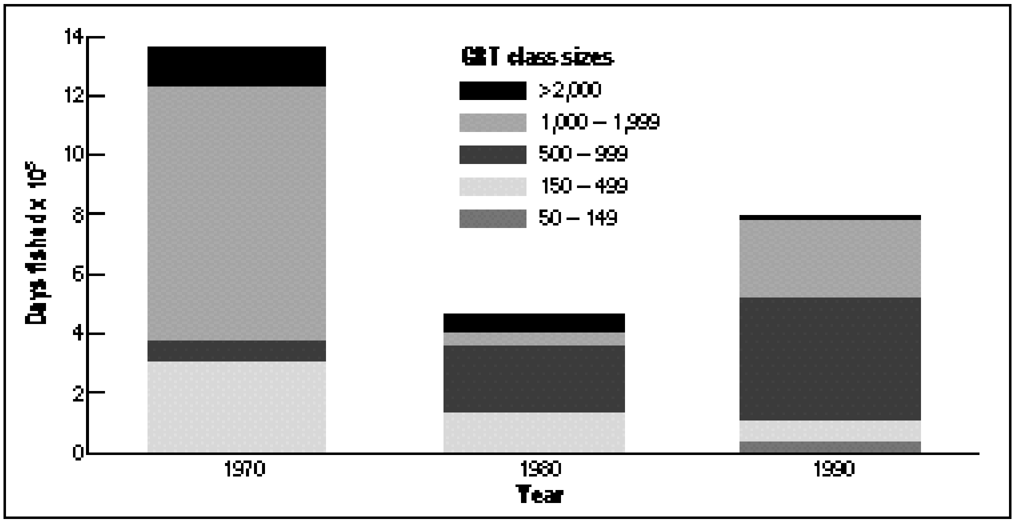
Figure 17. **The Canadianization of the northern cod fishery occurred after declaration of the EEZ regime in the late 1970s**



INSHORE FISHERY PERSPECTIVES

The early 1960s also marked the beginning of over 30 years of increasing technological and vessel capacity in the Newfoundland inshore fishery. Researchers with the Traditional Ecological Knowledge section of the Eco-Research Project at Memorial

Figure 18. **Otter trawl effort in areas 2J3KL decreased in the 1970s only to grow again in the 1980s**



Data from ICNAF/NAFO Statistical Bulletin, various years

University of Newfoundland interviewed fishers from the Bonavista/Trinity Bay area on the northeast coast of Newfoundland in an attempt to document fishing people's understanding of the resource and the changes that had occurred over the past decades (Neis et al., 1996). Fishers from a variety of age groups were interviewed, from those who began fishing in the 1920s, to relatively recent entrants to the fishery. To track increases in technology and technological capacity, interviewers asked fishers to report the vessel size, capacity, horsepower of the engines, and the type and amount of gear used throughout their fishing careers.

The interviews showed that overall catchability per boat, along with vessel capacity and the horsepower of the engines, increased between 1950 and 1990. The numbers of cod traps and gill nets soared, particularly in the 1970s and 1980s, while mesh sizes declined. With the growing use of electronic fish sounders and heightened overall skill in catching fish by the late 1980s, the inshore fishers were more highly technologically equipped than ever before. This increase in technology has not meant a corresponding increase in landings, however, as the inshore catch remained relatively stable and catch rates actually declined. Indeed, the dramatic changes in the resource have meant that inshore fishers of the 1970s, 1980s, and 1990s have used the technology simply to catch the same amount of fish as their counterparts had generations earlier with relatively simple vessels and gear.

WHO'S FAULT WAS IT?

When the northern cod stocks collapsed in the early 1990s, fisheries scientists and other observers were left scrambling to offer an explanation. Despite strong evidence that human predation had been the main cause of the decline, other theories focusing on environmental change have gained some support. One such hypothesis is that unnaturally high mortality owing to colder than average ocean water temperatures in the North Atlantic in early 1991 precipitated the collapse of the Atlantic cod stocks (de Young and Rose, 1993; Lear and Parsons, 1993). Although this explanation was particularly attractive to government fisheries managers (it absolves humans from blame), others have challenged these findings. Myers and Cadigan (1995) found little evidence of increased adult natural mortality in 1991, but substantially more evidence of increased mortality due to fishing. Likewise, Hutchings and Myers argued there was no clear relationship between poor recruitment (the ascendance of 3-year-old fish to the stocks) and environmental factors, either water temperature or salinity (Hutching and Myers, 1994). From an historical standpoint, the “cold water theory” is difficult to sustain as extremely cold water temperatures have been recorded in the past without causing the collapse of the stocks.

Another issue bearing on this debate is whether or not the “collapse” of northern cod stocks in the early 1990s was as sudden as Department of Fisheries and Oceans officials would lead one to believe. Newfoundland inshore landings, particularly for fixed gear such as gill nets, suggest that the final decline in biomass began in 1985, long before the most extreme cool water temperatures were recorded in the early 1990s (Myers and Cadigan, 1995). As well, the tendency for Department of Fisheries and Oceans scientists to rely on commercial catch data for doing stock assessments may have led to an overestimation of stock size for many years (Finlayson, 1994). The difficulty with commercial catch data – specifically trawl landings – is that it fails to take effort into account. Increasing or stable landings over time may not be indicative of a growing or stable population, but of increased effort and efficiency in fishing.

Although most scientists would admit that many factors may have contributed to the disappearance of northern cod, the evidence pointing to years of overfishing remains cogent. The long-term declines in catch per unit of effort in both the inshore and offshore fisheries from 1962 onward, the dramatic changes in the age structure of the cod populations, the declining size of cod, and spatial shifts in fishing activity over time all point to human, rather than environmental factors (Hutchings and Myers, 1994). In all likelihood, the intensified fishing effort that took place in the 1980s put increased pressure on a population that was already weakened by the fiercely competitive international fishing activity that took place between 1962 and 1977. The resource, which had fed so many for centuries, was finally unable to sustain itself.

LESSONS FOR THE FUTURE

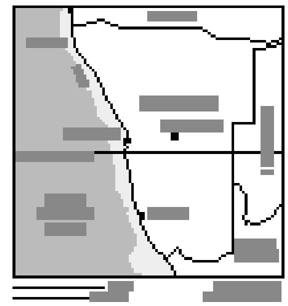
This evidence suggests that we need to look more closely at the link between changes in the resource over the past, the escalation of technology, and how these changes are connected to the larger ecological crisis in the northwest Atlantic fishery. Technological and international economic developments in the 1950s led to the exploitation of the resource in the late 1950s and early 1960s on a scale never known before. Very early in this process, fisheries scientists such as Wilfred Templeman noticed that fish populations were being affected, and that Newfoundland fishers would have to arm themselves with even greater amounts of technology if they were to compete in this changed environment. Throughout the 1960s, 1970s, and 1980s, fishing capacity in the Newfoundland inshore and offshore fishery continued to escalate. As Hutchings has argued, the effect of this technological build-up, and the constant shifting of effort from lower-yield areas to higher-yield areas, has been to “mask” the full impact on the populations of northern cod, both inshore and offshore (Hutchings, 1995). Although we still have much to learn about the reasons for the collapse of one of the richest fishery resources in the world in the early 1990s, this historical perspective demonstrates that unprecedented fishing by DWFNs in the pre-200-mile EEZ days, and by Canadian fishermen afterwards, set the stage for one of the most dramatic fishery collapses in the northern hemisphere.

■ Case Study: DWFs off Namibia

ECOSYSTEM

Environmental Conditions

Namibia has an extensive coastline spanning 1,572 km. The marine environment off the coast of Namibia is dominated by the northerly Benguela current system which extends some 200 km along the west coast of southern Africa, from Cape Town to about 15° S. The upwelling area is bound by the warm currents of Agulhas in the south, and Angola in the north. This is an eastern boundary current upwelling system driven by prevailing southerly longshore winds. The system is somewhat larger during winter than during summer. There are three major distinctive upwelling cells: the most extensive and frequent occurs off Luderitz, the Agulhas cell is the southernmost, and the Cunene cell is the northernmost (Lutjeharms et al., 1995). During summer, the major upwelling occurs off Luderitz and Cape Columbine, in South Africa, while in winter Cape Frio reaches the maximum upwelling (Mann and Lazier, 1991). Reportedly, primary production in the Benguela system ranges between 0.04 and 1.0 g C m^{-2} h^{-1} (Painting et al., 1993; Estrada and Marrase, 1987).



Map 8. **Namibia only emerged as an independent country and as an important fishing nation in 1990**

Food Chain

The Benguela system is dominated by small pelagic fish, mainly *Sardinops ocellata* and *Engraulis capensis*. The former species dominated the system and supported catches of up to 1.3 million t (1968). More recently, the sardines have been replaced by anchovies which are now the most important small pelagic species. Dense populations of horse mackerel (*Trachurus trachurus capensis*) are also important. The demersal ecosystem is dominated by the valuable stocks of hakes (*Merluccius capensis* (shallow water Cape hake) and *Merluccius paradoxus* (deep water Cape hake). The interactions between the main species in the food web include predator-prey relationships between Cape hake and horse mackerel, and cannibalism in hake (Konchina, 1986). Kinglip (*Genypterus capensis*) is also an important predator of Cape hake. The main food web in the ecosystem includes seals as the top predator, hakes, squid, snoek, and chub mackerel as the piscivorous species and horse mackerel, round herring, saury, pilchard, and anchovy as the main pelagic prey, and lightfish, lanterfish, and goby as the main demersal prey (Shelton, 1992).

THE COASTAL NATION

Namibia is mostly a desert country with a hot and dry climate. Rainfall is sparse and erratic, thus there are very limited natural fresh water resources. The Namib Desert lies along most of the coast, whilst the Kalahari Desert lies in the east of the country (Map 8). Namibia is a young country that only attained independence on 21 March 1990. The Namibian economy is heavily dependent on the extraction and processing of minerals for export (diamonds, copper, uranium, gold, lead, tin, lithium, cadmium, zinc, salt, vanadium, natural gas). Mining accounts for almost 25 per cent of gross domestic product (GDP). Namibia is the fourth largest exporter of non-fuel minerals in Africa and the world's fifth largest producer of uranium. Rich alluvial diamond deposits make

Namibia a primary source for gem-quality diamonds. Half of the population depends on agriculture (largely subsistence agriculture) for its livelihood, but Namibia must import some of its food. The main agricultural products are: millet, sorghum, peanuts, and livestock. Prior to independence in 1990, the country effectively did not have an EEZ along its 200-mile coast, one of the richest in the world. The result was overfishing as foreign vessels which fished in Namibian waters were completely free of quota restrictions, although the South African-controlled administration had jurisdiction within a 22-kilometre coastal limit. Upon independence, the new government immediately took steps towards a recovery of the fish stocks and set a new policy of "Namibization" of the fisheries sector. The number of licences granted to foreign trawlers to fish Namibian waters is now limited and joint ventures between foreign and local interests are encouraged. In addition, new deep-water fisheries have developed in Namibia as a result of the change to independence (Beaudry et al., 1993). The fish catch potential of Namibia is calculated over 1 million t, and perhaps as high as 1.3-1.5 million t (Jurgens, 1991)but is not being totally fulfilled (CIA, 1997). Namibia has no ship-building capabilities but it has dry-dock facilities for foreign vessels in Walvis Bay. Ironically, Namibia has become a DWFN itself. Vessels based in Walvis Bay fish for the lucrative toothfish (*Dissostichus eleginoides*) in the Antarctic Ocean.

The Distant Water Fishing Nations

A large number of DWFNs used to fish off Namibia when this country was under South African rule and the 200-mile EEZ had not been declared. The most important DWFNs operating in Namibian waters since in the early 1960s were: the former USSR and Spain (since 1964); Japan, Bulgaria and Israel (since 1965); Belgium and Germany (since 1966); France (since 1967); Cuba (since 1969); Romania and Portugal (since 1970); Poland (since 1972); Italy (since 1974); Iraq (since 1979); Taiwan (since 1981); and the Republic of Korea (since 1982). Reportedly, in the years prior to independence, more than 300 mid-water and bottom trawl vessels were operating off the Namibian coast (Beaudry et al., 1993). According to one report (AED, 1993), the former USSR had a 32 per cent market share in the country's fish, followed by Spain with 26 per cent, and South Africa with 7 per cent. Hake stocks declined by more than half, whilst the pilchard stock fell to only 2 per cent of its previous level between 1976 and 1986. As soon as the independent government announced the EEZ regime in 1990, there was a drop of more than 90 per cent in the number of unlicensed foreign vessels fishing in the area.

The Fishery Resources and Fishing Sectors

The four main fishery resources of Namibia in terms of weight are pilchard, horse mackerel, and hake, and to a lesser extent anchovy. Exploitation of fisheries in Namibia began in 1948 concentrating on pilchards (Jurgens, 1991), then moved to horse mackerel and anchovy as pilchard declined. The main fishing gears used for these stocks are bottom trawl and longlining for hake, purse-seining for pilchard and anchovy, and mid-water trawl for horse mackerel.

There are two species of hake in Namibia: *Merluccius capensis* (shallow water, 100-200 m), and *Merluccius paradoxus* (deep water, 200-400 m). MacPherson and Gordoa (1995) report on survey-based biomass estimates for these two species off Namibia during 1983-1990. These varied depending on the season of the surveys at 0.25-2.0

million t for *M. capensis* and 0.1-1.0 million t for *M. paradoxus*. The hake population suffered a recruitment collapse in 1993-1994 apparently due to anoxia-induced mortality in shelf bottom waters (Blatt, 1998).

Soviet research indicated overfishing effects (decreases in mean length and truncation of age structure) in Cape mackerel stocks (Chuksin and Kuderskaya, 1991). Polish vessels exploited hake and horse mackerel off Namibia at least in the period 1973-1987 and probably beyond this. Polish research suggested that the state of the hake stock was still satisfactory just before independence, although abundance has declined visibly (Wysokinski and Czykieta, 1989).

Lasch (1994) provides estimated maximum sustainable yield levels for the most important fishery resources of Namibia. These are: 450,000 t for horse mackerel, 350,000 t for Cape hake, 250,000 t for pilchard, and 150,000 t for anchovy. However, the pilchard population off Namibia is currently severely depleted (Anon., 1998a).

Other Fishery Resources

There are other fisheries which are minor in volume but increasingly important in economic terms. Among these are monkfish (*Lophius vomerius* and *L. vaillanti*), the deep-sea red crab (*Chaceon maritae*) (peak catch of 10,000 t in 1983), and spiny lobsters (*Jasus* spp.). More recently, new fishery resources have been targeted by the expanding and diversifying fishing industry of Namibia. Probably the most important new fisheries are for orange roughy (*Hoplostetus atlanticus*), alfonsino (*Beryx splendens*), and oreos (*Allocyttus* spp., *Pseudocyttus* spp., and *Neocyttus* spp.). Most of these fisheries aim for the export market. The growth of the new fishery for deep-sea fish is remarkably rapid (Table 13).

Table 13. **Catches (t x 10^3) of important deep-sea fishes off Namibia**

Species	1994	1995	1996
Orange roughy	0.16	6.83	12.46
Alfonsino	-	1.08	1.73
Oreo	0.02	0.08	0.05
Cardinal	-	0.07	0.65

HISTORICAL CATCHES

Catches of the Coastal Nation

The record of fisheries catches of Namibia as a nation start only in 1990. Statistics on catches for the major stocks are presented in Table 14 (Economist Intelligence Unit, 1998a). Mackerel has been the major fishery since independence followed by hake and a slowly rebounding pilchard fishery.

Catches of the DWFs

Data on DWF catches off Namibia prior to independence are not readily available, so that the information presented here is fragmentary. Hewitson (1988) and Hewitson et al. (1989) report on the catches of the three main fishery resources for 1987 and 1988.

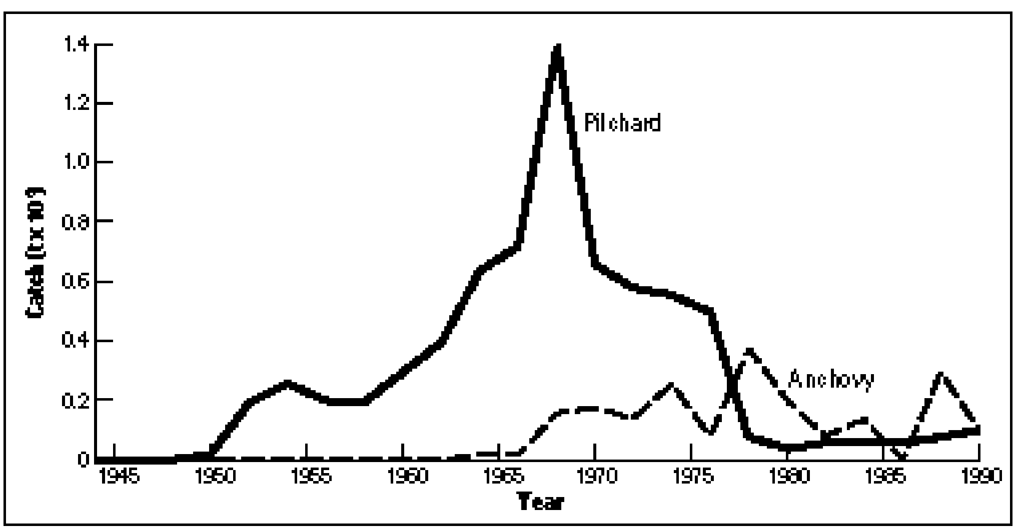
Table 14. **Fish catch off Namibia by gear type and species**

Fishery and target species	1989	1990	1991	Catch (t x 10³) 1992	1993	1994	1995	1996
Purse seine net fishing								
pilchard	76	92	69	81	115	116	43	1
horse mackerel	31	85	83	116	74	34	51	1
anchovy	79	51	17	39	63	25	48	91
Trawling & coastal fishing								
hake	14	55	56	87	108	112	130	129
horse mackerel	1	93	353	311	401	328	260	230
Ring & bow net fishing								
crab	0.80	4.40	2.70	2.80	3.20	3.60	2.00	1.70
rock lobster	5.60	0.50	0.40	0.10	0.10	0.10	0.20	0.30

Adapted from Economist Intelligence Unit, 1998a and Anon., 1998a

According to their data, during 1987 fishing off Namibia was the highest since 1976, with pilchard catches of 65,500 t (which considerably exceeded the quota), anchovy landings of 376,000 t, which were the highest on record until then, and horse mackerel landings of 33,500 t. For 1988 the catches were: pilchard 62,000 t, anchovy 117,000 t, and horse mackerel 169,000 t. According to Beaudry et al. (1993) just prior to the independence of Namibia, the USSR and Portugal caught about 88 per cent of the hake off Namibia, and the USSR, Romania, Bulgaria, Cuba, Spain, and Poland caught 78 per cent of the horse mackerel. According to Goffinet (1992), the USSR fished so hard off Namibia that it caused the collapse of the hake stocks in the late 1970s. Horse mackerel catches peaked at 570,000 t in 1982, hake catches peaked at 800,000 t in 1972, and the pilchard catch is estimated to have reached 1.5 million t in 1968 (Stuttaford, 1994). The reported catches of pilchard and anchovy off Namibia before independence are shown in Figure 19.

Figure 19. **After heavy exploitation by DWFs in the 1960s, the pilchard fishery off Namibia declined and was partially replaced by an anchovy fishery**



FLEET CHARACTERISTICS AND NUMBERS

There is little information on the size of the DWFs fishing off Namibia before 1990. According to Stuttaford (1994), South Africa had two factory ships supported by about 28 purse-seiners fishing for pilchard since the mid-1960s. Although there are no statistics readily available, anecdotal accounts (Stuttaford, 1994) point to some 150-300 foreign trawlers fishing for hake off Namibia in the pre-independence days.

For the period after Namibian independence Beaudry et al. (1993) report 80 companies holding 95 concessions in Namibia during 1993. This amounted to 190 licensed vessels, up from 137 in 1991. Although 88 per cent of the demersal fleet was flagged in Namibia, 61 per cent actually carried their catch back to Spain or other foreign markets (freezer trawlers), while the rest of the fleet delivered iced product to the growing on-shore based processing industry. These authors also report that almost all of the mid-water trawling fleet (about 76 per cent of the total licensed fleet tonnage) were former Soviet vessels now chartered by local companies. In a similar way, all the tuna fleet is based in South Africa. During 1994, there were 40 pelagic purse-seiners of 100-500 GRT fishing anchovy and pilchard, 70 demersal trawlers targeting hake (about half of these are 180-960 GRT, the rest being 60-170 GRT and a few factory vessels of 1,300-1,800 GRT), and 45 Eastern European mid-water trawlers of 200-7,750 GRT fishing horse mackerel (Anon., 1994b). Overall, the fleets fishing off Namibia have grown from a total of 214 vessels in 1991 to 309 in 1996, with the proportion of Namibian owned vessels increasing from 50 per cent in 1991 to 76 per cent in 1996 (Anon., 1998a).

FISHERIES MANAGEMENT BY COASTAL STATE

After DWFs overfished many of the most important stocks off Namibia, strong management measures imposed by the independent government after 1990 allowed stocks to recover (Anon., 1994b). Table 15 lists a history of TACs determined by the Namibian government for the main fishery resources.

Namibia has relatively good monitoring capabilities to deter pirate fishing. Beaudry et al. (1993) report that over the period 1990-1993 more than ten Spanish fishing vessels operating illegally in Namibian waters have been seized, discouraging further illegal fishing.

BYCATCH

The Namibian government manages bycatch through bycatch fees. These are intended to avoid the complications of multiple quotas being necessary for any vessel. There is no specific information on the levels of bycatch by fleet and fishery.

FISHING AGREEMENTS

Currently, Namibia does not allow any foreign companies to fish in its EEZ. At least until 1993 Namibia had no fishing agreements with any country. The only way for foreigners to have access to the fishery is through investing in joint-venture companies in Namibia. Many local concessionaires sell their quotas to foreigners by chartering foreign-owned and operated vessels. Some of the main countries having set up joint ventures in Namibia are: Norway and Spain, for demersal fishing; Norway and South Africa in pelagic fishing; Russia and Spain in horse mackerel fishing; and South Africa in tuna fishing (Beaudry et al., 1993).

Table 15. **Total allowable catches for main fishery resources off Namibia**

Year	Pilchard	Horse mackerel	Hakes
1991	60	465	60
1992	80	450	90
1993	115	450	120
1994	125	500	150
1995	40	400	150
1996	20	400	170
1997	25	350	110

Source: Namibia Brief, 1997

BENEFITS

The benefits of the new system of "foreign fishing" in which former DWF interests are now partners with Namibian entrepreneurs in joint-venture companies has proven very successful for Namibia and presumably is still beneficial to the DWFNs.

Fisheries have acquired an increasingly important role in the Namibian economy since it became an independent state. The growth of the fisheries sector was from 7.6 per cent of total exports to 22.9 per cent by 1995, making it the second largest export earner after mining (Anon., 1998b). Fish products in 1994 contributed about 28 per cent to total goods exported and 7.6 per cent to the GDP. Gross value of exports for 1994 was estimated to be more than US$365 million, an increase of 35 per cent from the previous year (IPS, 1995). Pescanova, one of the largest fishing companies to build a processing factory in Namibia, exports most of the production. Most fish is now processed on land, and Pescanova employs more than 1,000 people.

Investment is also up in the fisheries sector of Namibia as a result of its joint venture policy. In 1991-1995 some N$300 million was invested in new processing capacity, largely for hake and principally at Walvis Bay, the main fishing industry centre, with a further N$200 million invested in locally owned fishing vessels. One of the largest developments by Spain's Pescanova involved a N$100 million investment in expanding a hake factory complex in Luderitz, while during 1995-1996 most fish factories were upgraded at a cost to the industry of around N$80 million to meet stringent EU hygiene requirements for fish exports (Economist Intelligence Unit, 1998b).

Foreign aid has helped Namibia build respectable capabilities for controlling and monitoring foreign fishing. The main countries providing assistance in this area are Norway – which funnelled at least US$4 million in aid to the fisheries sector for training Namibian personnel and reducing the dependency on expatriates – and the United States. Iceland has also provided technical assistance.

CONFLICTS

Namibia has effectively closed access to DWFs through its licensing policy which does not allow foreign-based DWFs. Instead, most deep-water and mid-water concession holders charter foreign-owned or operated factory ships, mainly from Russia and Spain.