B. REGIONAL REVIEWS

B1. NORTHWEST ATLANTIC

FAO Statistical Area 21

by Ross Shotton *

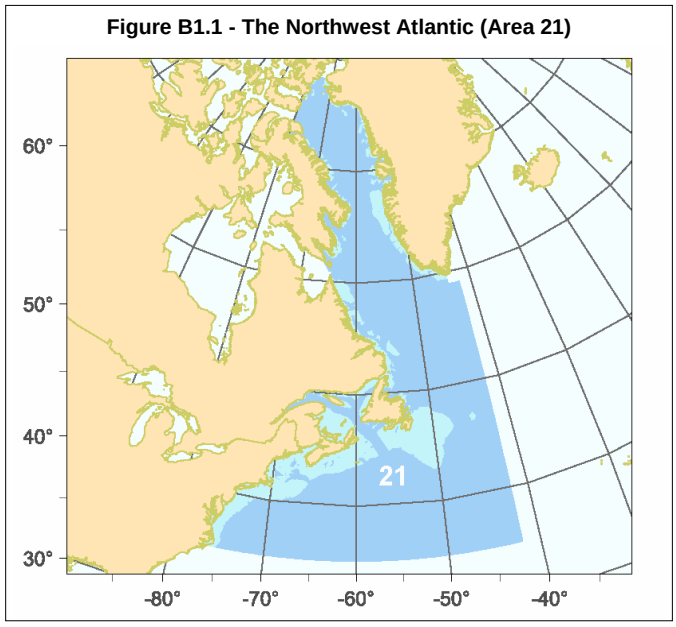


Figure B1.1 - The Northwest Atlantic (Area 21)

INTRODUCTION

The commercial fisheries of the Northwest Atlantic, particularly those for cod, have been important for five centuries. Area 21 has a total surface area of 6.26 million km^2 of which 1.29 million km^2 is shelf area. The region's (Figure B1.1) marine environment is dominated by the cold Labrador Current, which flows southward to the Grand Banks, and by the warm Gulf Stream, which flows north-eastwards from Cape Hatteras, seaward of the continental shelf; it supplies relatively warm water to West Greenland. The freshwater influence from the St Lawrence River is also important. The major fisheries resources occur on the broad continental shelves, particularly Georges Bank, the Scotian Shelf, the Gulf of St Lawrence and the Grand Banks of Newfoundland. While the principal grounds are under the national jurisdictions of Canada, the United States, Greenland and France (for St Pierre and Miquelon), the Flemish Cap and the "nose" and "tail" of Grand Bank lie in international waters.

Most of the demersal resources which long supported the major Northwest Atlantic fisheries were severely depleted in the late 1980s and early 1990s by a combination of heavy fishing, cold conditions linked to stronger Labrador Current flows and other factors, such as poor feeding conditions, lack of capelin (*Mallotus villosus*), seal predation and low oxygen concentration. In 2002, many demersal fisheries remain either closed or operating under strict regulatory limitations, even after almost 10 years of such management. In contrast, the lobster (*Homarus*

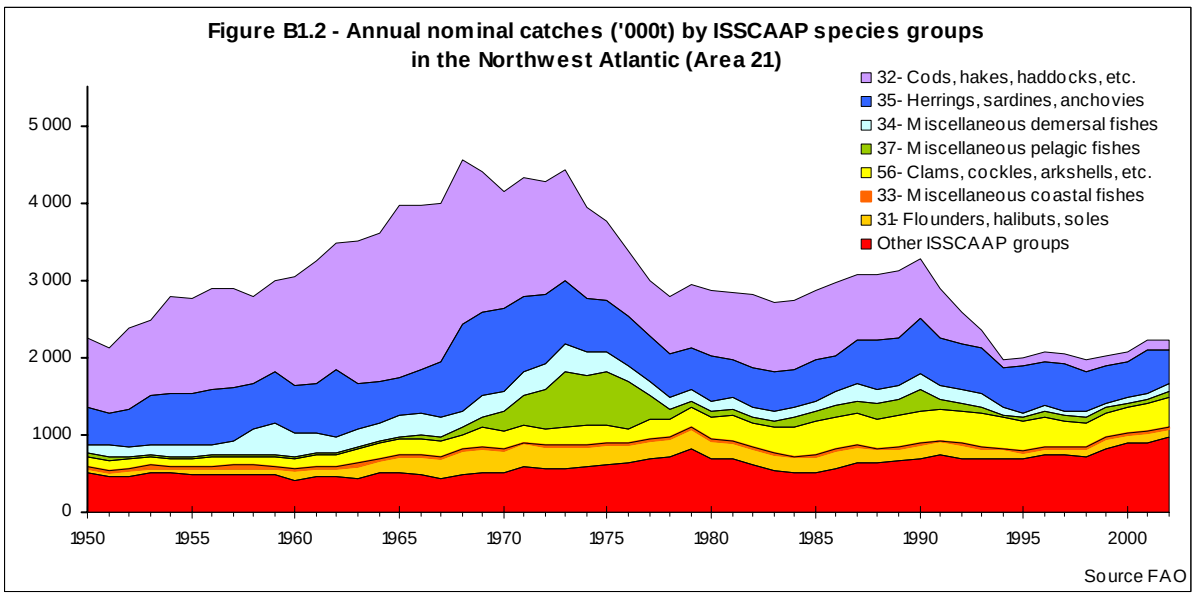


Figure B1.2 - Annual nominal catches ('000t) by ISSCAAP species groups in the Northwest Atlantic (Area 21)

* FAO, Marine Resources Service, Fishery Resources Division

americanus) resources expanded in the 1980s, supporting catches not seen in the previous hundred years. On Georges Bank, the declining gadoid resources that were replaced by dogfish (*Squalus acanthias*) and skates (*Raja* spp.) in the 1980s, have begun to recover. Similarly, yellowtail flounder (*Limanda ferruginea*) have also begun to recover. Off Newfoundland, shrimp (*Pandalus borealis),* also known as northern prawn, and snow crab (*Chionoecetes opilio*) resources expanded in the late 1990s, supporting catches which drove total landed values to record highs, despite the loss of the traditional demersal fisheries. Other resources, such as scallops (*Placopecten magellanicus*) and herring (*Clupea harengus*), continue to support healthy fisheries in some areas. Georges Bank herring, at last, recovered from the overfishing of the 1970s.

PROFILE OF CATCHES

Nominal catches in the Northwest Atlantic doubled from 2.3 million tonnes in 1950 to 4.6 million tonnes in 1968 (Figure B1.2 and Table D1). Catches decreased rapidly from 4.4 million tonnes in 1973 to 2.8 million tonnes in 1978, they remained relatively stable around 2.7 million tonnes until 1984 when they started to increase slowly, reaching 3.3 million tonnes in 1990. Catches subsequently decreased steeply, as a result of the groundfish collapse off Eastern Canada, to about 2 million tonnes in 1994. A slight recovery has been evident since 1998, when 1.96 million tonnes were reported, to 2.24 million tonnes in 2002.

Figure B1.3 - Annual nominal catches ('000t) of selected species in ISSCAAP Group 32, Northwest Atlantic (Area 21)

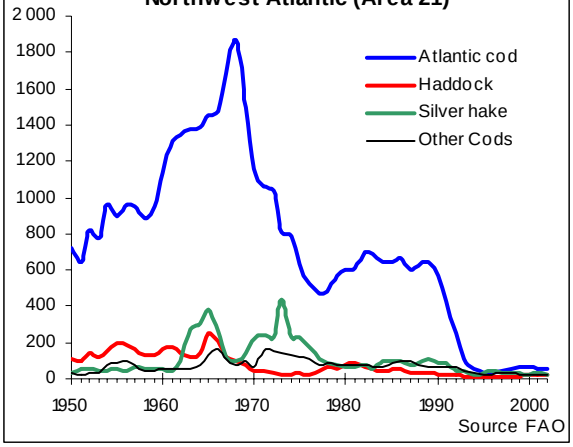
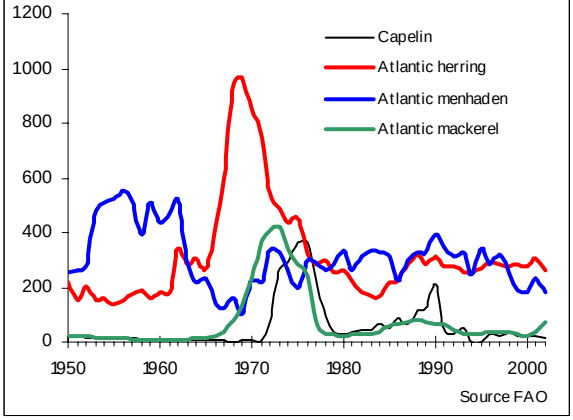


Figure B1.4 - Annual nominal catches ('000t) of selected species in ISSCAAP Groups 35 & 37, Northwest Atlantic (Area 21)



The development of the fishery in the Northwest Atlantic after 1950 followed a pattern of pulse fishing with groundfish, mostly cod (*Gadus morhua*) but also haddock (*Melanogrammus aeglefinus*) and silver hake (*Merluccius bilinearis*), being the first target (Figure B1.3) followed by herring and mackerel (*Scomber scombrus*) (Figure B1.4). Flatfishes catches peaked at 303 000t in 1968 (Figure B1.5), they then declined slowly and irregularly to 189 000t in 1992, then more than halved to 78 600t in 1995. By 2002 catches of these fishes had recovered to 116 400t, just over half of which consisting of Greenland halibut (*Reinhartius hippoglossoides*), for which new fisheries have developed in the early 1990s. Fisheries for invertebrate have fared better (Figure B1.6) showing increases from the mid 1970s to the early 1990s when more than 600 000t were caught. Catches of sea scallops, ocean quahog and surf clams decreased during most of the 1990s, but have increased during the last part of the decade. Shrimp and lobster catches have generally increased. Total catches in 2002 were again above 600 000t. In 1998, catches of snow crab passed those of American lobster for the first time, and in 2002 snow crab catches were 30 percent higher than those of lobster.

Greenland

Both East (FAO Statistical Area 27) and West Greenland are included in this description. Northern prawn continues to be the major species in Greenland with 2001 catches being an all time high of 85 450t or 51.7 percent of reported catches. Greenland halibut catches in 2001 were almost 21 000t, a sizeable decrease from the maximum of nearly 40 000t reported in 1999. Catches of capelin of 18 600t were also substantially lower in 2001 compared to that reported in 2000, a 24.4 percent reduction. These three species comprise 75.4 percent of total

reported catches. Catches of cod in 2001 (5 614t) show a considerable increase over the 2000 all time recent low of about 3 000t, but this remains well below catches in the recent past, e.g. almost 110 000t in 1989. The presence and abundance of cod in offshore waters off Greenland is believed to be related to environmental conditions, and periodically to influx of larvae from Iceland that subsequently migrate back to Iceland to spawn (Buch, Horsted, and Hovgård, 1994).

RESOURCE STATUS AND FISHERY MANAGEMENT

Canada

For most of the past five centuries, the predominant fisheries in what are now Canadian waters produced exclusively salt cod, the fish usually being caught by hook-and-line from small vessels and salted ashore. The adoption, by the Canadian industry, of trawler technology, producing frozen fish from a wider variety of target species, has largely occurred in the last fifty years. Indeed, fixed-gear demersal fishing remains important in many areas. However, the most significant event for the resources, in recent decades, was the arrival of foreign factory-trawler fleets, beginning in the late 1950s. The resulting overfishing provoked the extension of national jurisdiction in 1977. At that time, there was considerable optimism that Canadian catches would increase substantially through better fishery management and the replacement of foreign fishing effort with a national one. Some improvement in stock status was seen up to the mid-1980s but thereafter a combination of expanding fishing capacity (which drove increased effort despite the supposedly-conservative management system) and a succession of weak year-classes in many stocks led to increases in fishing mortality and decreases in stock sizes. Most of the demersal fisheries, including some of the world's most renowned, were closed in 1992 or 1993, while others saw sharp reductions in catch quotas (Murawski *et al.*, 1997).

The drastic management measures have had mixed results (further information on stock status and fishery management in the Canadian area can be found at http://www.dfompo.gc.ca/csas/Csas/English/Index_e.htm). In their 2003 report to the Minister, the Fisheries Resource Conservation Council noted that spawning biomass of the cod stock in NAFO Divisions 2J3KL continued to be very low, with low recruitment, high mortality from seals and exposure to bycatch. Grand Bank substocks comprised only 3 percent of 1980s biomass with few fish older than 5 years old. Cod stocks in Scotian Shelf and Bay of Fundy (Div. 4VsW), under a moratorium since 1993, show the lowest spawning biomass ever recorded, with recruitment, growth, condition and age structure below average. The stock of Division 4Vn (May-November), closed to fishing since 1993, shows little sign of recovery, largely due to weak recruitment. For 4X5Y cod stock, recruitment has improved starting with the 1998 yearclass and although biomass has increased since the late 1990s, it remains low. Gulf of St. Lawrence cod stocks (Div. 3Pn4RS) show further decline in the spawning stock biomass, with age 3 cod showing a historic low. Natural mortality remains high – with seals attributed as the major cause – though energetic condition and growth have improved (Fisheries Resource Conservation Council,

Figure B1.5 - Annual nominal catches ('000t) of selected species in ISSCAAP Group 31, Northwest Atlantic (Area 21)

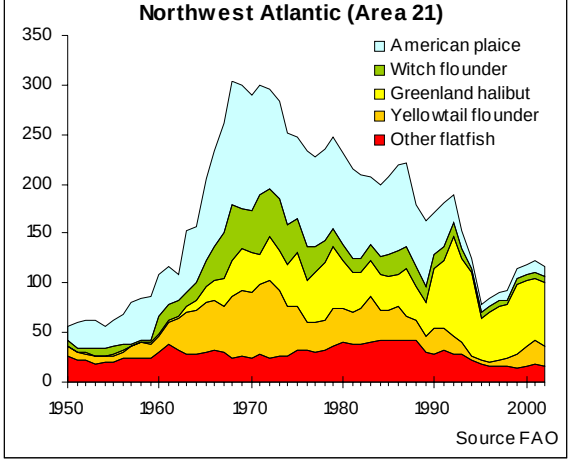
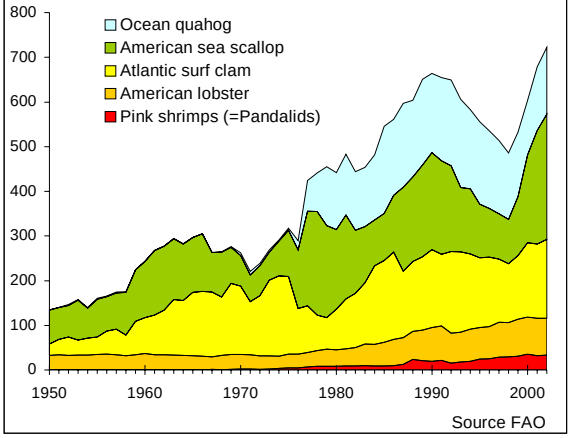


Figure B1.6 - Annual nominal catches ('000t) of selected species in ISSCAAP Groups 43, 45, 55, 56, Northwest Atlantic (Area 21)



2003a,b,c). Thus it is unsurprising that on 24 April, 2003, the Government of Canada announced the fishery closure of three cod stocks in the Gulf of St. Lawrence and north-east of Newfoundland and Labrador. In addition, on 2 May, 2003, two populations of the Atlantic Cod were designated as threatened and endangered following assessments by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). The population units used by COSEWIC do not correspond to those used traditionally for fishery management. As a result, the Laurentian North population of the Atlantic Cod was assessed as threatened because, although cod remains abundant in the eastern part of the region (southern coast of Newfoundland), they have declined substantially in the northern Gulf, where the fishery is now also closed. The Maritimes population of the Atlantic Cod remains in the *special concern* category (http://www.cosewic.gc.ca/eng/sct7/sct7_3_1_e.cfm), even though the 4VsW cod stock is at the lowest spawning biomass recorded, as indicated above.

The failure of most East Coast cod stocks to recover in the more than 10 years since they collapsed has puzzled and disappointed those working on and interested in these fisheries. When the moratoria were placed on these stocks in the early 1990s, some expected that they would recover quickly. However, some of the collapsed stocks were smaller than ever seen before and thus had far to rebuild. Other stocks had been as low before but this time the recovery failed to occur. A number of likely explanations have been proposed by a recent review organized by the Canadian Department of Fisheries and Oceans (http://www.dfompo.gc.ca/media/backgrou/2003/cod(3)_e.htm).

The environment: Cod in Northern Atlantic Canada have lower productivity than cod further south or in the eastern Atlantic Ocean because they live in colder environments. During at least the first half of the 1990s, the ocean climate was unusually cold, which was particularly unfavourable to the stocks' productivity, and therefore, to recovery.

Fish growth and survival: The harsh environment in the 1990s reduced survival and growth. When the fishing moratoria were applied in the early 1990s, most of the cod were small for their age and in poor condition with little energy reserves to survive the winter months or critical stages of their life cycle. The energetic condition of cod following spawning was particularly low in the early 1990s, perhaps low enough to cause high mortality in some of the cod stocks. In addition, reduced cod stocks being preyed upon by an increasing number of seals, sufficient to have affected recovery. In the Gulf, increasing abundance of mackerel and herring may also have resulted in high predation on cod eggs and larvae. Taken together, environmental conditions and increased predation resulted in poor growth and poor survival for cod.

Reproduction: When the cod stocks collapsed, they had few older fish and a high proportion of first time spawning fish. This contributed to a reduction in the reproductive potential in cod stocks. In view of the high mortality experienced on many cod stocks, this condition has continued. In certain cases, there was a severe reduction of the size of some spawning components or a reduction of the area where spawning occurs. Also, the spawning biomass on many cod stocks was so low that the number of young fish was much lower than in the past contributing to continued low production.

Fishing: While catches from fishing have been reduced in comparison to the 1970s and 1980s, in some stocks, they appear to have remained sufficiently high to generate significant mortality. There was also evidence of under-reporting or non-reporting of cod catches, discarding small fish and poaching.

In summary, the lack of recovery was concluded to be the result of several factors working simultaneously or in turn that affected fish growth, reproduction and fish survival. Taken together, these factors strongly suggest that there will not be a prompt recovery in any of these stocks in the near future.

As opposed to cod, lobster, which is the mainstay of inshore fisheries in much of Atlantic Canada, supported near-record catches in the 1980s after being depleted for half a century. It seems that ecological changes led to the increased production, though there is no agreement as to the specific cause and increased fishing efficiency is also believed to have played a role. Lobster catches, managed through 40 Lobster Fishery Areas in Atlantic Canada, reached a peak of 48 500t in 1991, declined through the following decade, climbed to 51 400t in 2001 and declined again to 45 111t in 2002.

United States

The fisheries of the Northeast United States have a long tradition based on the highly productive demersal fisheries of Georges Bank and, to a lesser extent, the lobster fishery of the Gulf of Maine. There have also been significant fisheries for many other species, some of which were more prominent in earlier years while some have become important only in recent years (further information on stock status in the US area can be found at http://www.nefsc.noaa.gov/nefsc/saw/ and information on fishery management can be found at: http://www.nefmc.org). A variety of fishing gears including otter trawls, gillnets, traps, and set lines have been employed, but otter trawls are the preferred gear. Except for a period of intense distant water fleet fishing from the early 1960s until the mid 1970s, the fishery in United States waters has been domestic. The distant water fleet fishery, conducted mainly by Eastern European factory trawlers on Georges Bank, can best be characterized as a pulse fishery which sequentially targeted and then severely reduced the abundance of species such as haddock (peak in 1965), silver hake (peak in 1965), herring (peak in 1968), and mackerel (peak in 1973).

Fishery management since the establishment of a 200-mile exclusive economic zone (EEZ) by the United States in 1977 initially achieved limited success. Since the mid 1990s, particularly with the adoption of the Sustainable Fisheries Act and the adoption of stronger management actions, fishing mortality has been reduced substantially on most groundfish stocks, and some have started to rebuild relatively quickly (Groundfish Facts & Figures at http://www.nefmc.org).

Demersal species

Demersal species have been the traditional mainstay of the fisheries off the United States Northeast coast. About 35 species/stocks are included in this category, dominated by gadoids, flounders, goosefish (*Lophius* spp. also known as monkfish), spiny dogfish (*Squalus acanthias*), and skates in the New England area, and by summer flounder (*Paralichthys dentatus*), scup (*Stenotomus chrysops*), goosefish (*Lophius americanus*) and black sea bass (*Centropristis striata*) in the Mid-Atlantic region. The average yield over the last decade of the principal groundfish and flounders group, which includes species in the cod family, such as cod, haddock, silver and red hake (*Urophycis chuss*), and pollock (*Pollachius virens*), yellowtail flounders (*Pleuronectes ferrugineus*), summer and winter flounder (*Pleuronectes americanus*), witch (*Glyptocephalus cynoglossus*), windowpane (*Scophthalmus aquosus*), and American plaice (*Hippoglossoides platessoides*), averaged 61 218t (37.5 percent flatfish, 62.5 percent gadids).

This amount is less than one-third of their combined long term potential yield. Overall abundance of these principal groundfish and flounders, as measured by the National Marine Fisheries Service (NMFS) research vessel bottom trawl survey catch-per-tow indices, declined by about 70 percent between 1963 and 1974 as a direct consequence of distant water fishing. Some recovery occurred in the late 1970s following catch and effort reductions implemented by the International Commission for the Northwest Atlantic Fisheries (ICNAF) prior to 1977 and the establishment of the United States EEZ in 1977, but was short-lived owing to increased fishing pressure by United States fishermen. Overall abundance reached a record low in 1992.

However, since the mid 1990s, as a result of stringent management measures (including a moratorium on new vessel entrants, drastic reductions in days at sea for trawl and gillnet vessels, increased mesh sizes, several year-round large closed areas), fishing mortality rates have been drastically reduced and stock biomass rebuilding begun for stocks such as haddock on Georges Bank, yellowtail flounder on Georges Bank and Southern New England, and summer flounder. United States catches for most of these species have declined substantially since about 1994 and, for cod, were the lowest on record in 1997 (12 982t). By 2001 there had been a slight recovery to 15 100t, but catches dropped again to 13 128t in 2002. Haddock catches had recovered to 7 553t by 2002, up from 328t in 1994.

Pelagic species

Abundance of Atlantic herring and Atlantic mackerel has been monitored using spring survey data, since both species occur primarily within the boundaries of the survey area in March and April, when this survey is conducted. In general, survey catch-per-tow data for these species have been more variable than those for principal groundfish and flounders, although the aggregate index adequately depicts overall trends. The index dropped in the mid-1970s, reflecting

pronounced declines in abundance of both herring and mackerel (including the collapse of the Georges Bank herring stock). Since 1983, the index has markedly increased with the 1994 value the highest in the time series. This trend is supported by virtual population analyses (VPA) which indicate high abundance of both the coast-wide herring stock and the north west Atlantic mackerel stock in recent years. There is also evidence for recovery of the Georges Bank herring stock, (http://www.nefsc.noaa.gov/sos/agtt/). Herring and mackerel were heavily exploited by distant water fleets in the late 1960s and early 1970s and abundance of both species declined in the early 1980s before subsequently rebuilding in the absence of intensive fisheries. Catches of mackerel in 2002 were 70 456t (61.2 percent Canada, 38.8 percent United States), while at the high end for the decade, remain still far below the long-term estimated potential of 383 000t. Total US catches of herring from the coastal stock complex (Gulf of Maine, Georges Bank, and Nantucket Shoals stocks) reached a peak of 106 600t in 2001 then declined abruptly to 67 652t in 2002, the lowest recorded catch since the 1994 low for the decade of 48 700t. US catches comprised 26.1 percent of total herring harvest in 2002, the remaining being taken by Canada.

Anadromous species

This is a diverse group including river herrings such as alewife (*Alosa pseudoharengus*) and blueback (*Alosa aestivalis*), American shad (*Alosa sapidissima*), striped bass (*Morone saxatilis*), Atlantic salmon (*Salmo salar*), Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*) and shortnosed sturgeon (*Acipenser brevirostrum*). The composite average yield from 2000 to 2002 is only about 3 978t, far below the historic maximum of 32 443t in 1959. All of these species, except striped bass, are overexploited and their abundance is low.

Commercial catches of striped bass peaked at 5 900t in 1973 (estimates of recreational catches were not available until 1981), but dropped steadily to only 63t in 1987. Combined commercial and recreational catches reached a record low of 423t in 1989. Because of low stock abundance and poor recruitment, highly restrictive regulatory measures were imposed in the mid 1980s. Stock rebuilding followed the recruitment of several improved year classes, and the stock was declared restored in 1995. The 2002 catches of striped bass were 2 847t.

The last two decades mark a period of decline in stock status for all Atlantic salmon populations of the North Atlantic. Indices and complete measures of population abundance indicate that overall survival plummeted as much as fivefold for some stocks during these years. This has intensified concern over the additive effects of natural mortality in the marine environment and habitat issues that persist in U.S. rivers. The US Atlantic Salmon Assessment Committee produces an annual report that includes an index of minimum documented returns to US rivers. In 1999, only 1 452 adults returned to US rivers, one of the lowest returns in a time-series that dates from 1970. At present, these data provide the best index to US stock abundance. This value is dominated by returns to the Penobscot River, which typically comprise more than 60 percent of total returns on an annual basis (http://www.nefsc.noaa.gov/sos/spsyn/af/salmon).

Invertebrate species

Offshore fisheries for invertebrate species including lobsters, surfclams (*Spisula solidissima*), ocean quahogs (*Arctica islandica*), longfin squid (*Loligo pealeii*), shortfin squid (*Illex illecebrosus*), sea scallops, northern shrimp and red crab (*Chaceon quinquedens*) are among the most valuable in the Northeastern United States. Fisheries for invertebrate species in nearshore and estuarine waters such as blue crabs (*Callinectes sapidus*), oysters (*Crassostrea virginica*), hard clams (*Mercenaria mercenaria*), sea urchins (*Strongylocentrotus* spp.), softshell clams (*Mya arenaria*), sea worms (including primarily sandworm *(Nereis virens)* and bloodworm *(Glycera dibranchiata*)) commonly harvested for use as bait in recreational fisheries, conchs (*Busycotypus canaliculatus, Busycon carica, and Busycon sinistrum*), and blue mussels (*Mytilus edulis*) provided additional income for this fishery.

United States catches of lobster, the most valuable species of this group, underwent an almost steady increase since 1940, reaching a peak of 37 730t in 2000, declining only slightly to 32 390t in 2001, and increasing again to 37 309t in 2002. These recent increases in catches have resulted from both increased effort as well as apparent increases in abundance due probably to favourable environmental conditions.

However, fishing mortality rates are 2 to 3 times in excess of overfishing definitions, and catches are almost totally dependent on newly-moulted and sexually-immature animals. Consequently, there is a need to greatly reduce fishing mortality rates, but recent regulatory measures (i.e. limits on the number of traps per fishermen) may not be sufficiently stringent to achieve this.

Since 1982, the Atlantic Sea Scallop Fishery Management Plan (FMP) has regulated the fishery for scallops throughout the range on the Atlantic coast of the U.S. Initially the major regulations required vessels to land scallops that averaged less than 35 to 40 meats (i.e. the adductor muscle) per pound or if landed in-shell, to have a minimum shell width of 3 to 3½ inches (about 7.5 to 9.0 cm). Fishing effort increased to unsustainable levels in the late 1980s and 1990s, prompting the New England Fishery Management Council (NEFMC) to develop Amendment 4 that became effective in 1994. Amendment 4 radically changed the management of the sea scallop fishery to achieve a maximum fishing mortality threshold equal to $F_{5\%}$, a reference point believed to ensure recruitment by attempting to keep spawning stock biomass above five-percent of virgin conditions, a biomass thought to be sufficient to prevent a recruitment-caused stock collapse for a fecund species like sea scallops. Implemented with this management change were limited access permits, annual day-at-sea allocations, dredge ring-size minima, restrictions on gear configuration to improve escapement of small scallops and a minimum top mesh size to improve finfish escapement. US Sea scallop catches from the Georges Bank - Mid-Atlantic area, averaged 88 896t during the last decade with a high of 186 336t in 2002, indicating a recovery of the stocks. The large areas closed to protect groundfish stocks have also greatly contributed to the recovery of sea scallops.

Surfclams and ocean quahogs, regulated by an individual transferable quota (ITQ) system implemented in 1990, are harvested by dredges primarily in the Mid-Atlantic and Southern New England region and are currently underexploited. Catches of both species have remained relatively stable in recent years, with catches of 175 709t and 149 767t, respectively in 2002 (decadal averages were 159 965t and 163 367t respectively).

Domestic fisheries for longfin and shortfin squid, although existing since the 1800s primarily to supply bait markets and generating catches of about 1 000t or less per year for each species until the 1970s, expanded greatly in the 1980s and 1990s in response to growing human consumption markets. Longfin squid are fished primarily between Cape Hatteras, North Carolina and the Gulf of Maine, while shortfin squid have been fished from Cape Hatteras to Newfoundland and are assumed to constitute a unit stock throughout that range. Distant water fisheries for these two species existed between 1964 and 1986, with catches from United States waters peaking for longfin squid at 36 500t in 1973 and for shortfin squid at 24 700t in 1976. Catches of shortfin squid from Canadian waters between Nova Scotia and Newfoundland, primarily by distant water fleets, rose sharply to a peak of 162 100t in 1979 before collapsing in the early 1980s. The decadal average yields of squid for 1992-2002 were 17 796t for longfin and 13 197t for shortfin. But, by 2002, catches of *Illex illecebrosus* were down to 2 750t.

NAFO area

Resources beyond the EEZ of the three countries in the region are managed under the aegis of the North Atlantic Fisheries Organization. Summary information on the status of the stocks in their area (which includes redfish, yellowtail flounder, American plaice, witch flounder, cod, Greenland halibut and capelin) is given in their annual report (NAFO, 2001) and through their web site (http://www.nafo.ca/publications/annrep/AR01.pdf). Given the concern over the status of cod, it is of interest to note that in the case of the single NAFO stock of the Flemish Cap, the fishery was closed in 1999, though non-contracting countries continued to exploit these stocks. The biomass at the beginning of 2000 remained low, consisting mainly of fish of 6 and 7 years of age. Younger fish were scarce due to low recruitment during the period 1995-1999 and it was recommended that there be no directed fishery for this species.

REFERENCES

B Buch, E., Horsted, S.A., & Hovgård, H. 1994. Fluctuations in the occurrence of cod in Greenland waters and their possible causes. *ICES mar. Sci. Symp*. 198: pp. 158-174.

Fisheries Resource Conservation Council. 2003a. 2003/2004 Conservation Requirements

for Groudnfish Stocks on the Scotain Shelf and in the Bay of Fundy (4VWX5Z), in Subareas 0, 2 + 3 and Redfish Stocks. Report to the Minister for Fisheries and Ocreans. *FRCC R.1*. January 2003. 107p.

Fisheries Resource Conservation Council. 2003b. 2003/2004 Conservaton Requirements for 2J3KL Cod Stocks. Report to the Minister for Fisheries and Ocreans. *FRCC R.2*. March 2003. 18p.

Fisheries Resource Conservation Council. 2003c. 2003/2004 Conservation Requirements for Groundfish Stocks in the Gulf of St. Lawrence. Report to the Minister of Fisheries and Oceans. *FRCC R.3.* April 2003. 47 pp.

Murawski, S.A., Maguire, J.-J., Mayo, R.K. & Serchuk, F.M. 1997. Groundfish stocks and the fishing industry. pp. 27-70 *In* Boreman, J., Nakashima, B.S., Wilson, J.A. & Kendall, R.L. (eds.) *Northwest Atlantic Groundfish: Perspectives on a fishery collapse.* American Fisheries Society, Bethesda, Maryland: xxii+242p.

NAFO. 2001. Annual Report of the Northwest Atlantic Organization (NAFO) 2000. 216p.