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Canadian Research Report for 2002

Part A - Central and Arctic Region

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PART A

SUBAREA 0

A. Status of the Fisheries

a) Shrimp

See report by Newfoundland.

b) Shellfish

Shellfish were fished year round in 2002 under exploratory licenses in the Qikiqtarjuaq (55 tons quota) and Iqaluit (5 tons quota) areas. Fishing logs for 2002 were lost. Therefore the exact catch is unknown but fishermen estimate the catch near 5 tons. Divers collect primarily truncate soft-shelled clams (*Mya truncata*) for sale. Some Greenland cockle (*Serripes groenlandicus*) is also taken for domestic consumption. 2002 saw the first sale of clams outside Qikiqtarjuaq. The Qikiqtarjuaq Diving Group has a contract for sale of their entire quota through the Northern Stores within the territory. License conditions prohibit the sale of shellfish outside of Nunavut.

c) Arctic Charr

Subsistence and commercial Arctic charr fisheries in the Baffin region are conducted in inshore lakes and rivers not in marine waters. Information on these fisheries can be found in the "Annual Summary of Fish and Marine Mammal Harvest Data for the Northwest Territories" published by Fisheries and Oceans Canada, Central and Arctic Region.

d) Greenland Halibut

Nunavut companies have a 1 000 ton inshore allocation for Greenland halibut in Subarea 0. The Cumberland Sound fishery began in 1987 and is the only inshore fishery that has operated on an annual basis. The total allowable catch (TAC) for the Cumberland Sound fishery has been set at 500 tons since 1994 but in recent years the TAC has not been reached. The fishery is exclusively a winter fishery (January to May) and the fishermen use long-lines set through holes cut in the land-fast sea ice. In 2002 exploratory fishing was conducted in the summer, open water season but was not successful in locating aggregations of Greenland halibut. Fishermen have experienced unstable ice conditions on the sea ice platform (1996 to 2002) and effort has decreased since the early-1990s. The fishery produced 106 tons in 2002.

Nunavut companies have a 500 ton quota in the Div. 0B offshore commercial fishery. In recent years they have also been allowed to transfer any surplus inshore quota to the offshore fishery. In 2002, Nunavut license holders in Div. 0B harvested 918 tons.

Since 1996 Nunavut companies have had exclusive access to an exploratory fishery license to harvest Greenland halibut in NAFO Div. 0A. Between 1996 and 2000 catches were less than 330 tons. In 2001 catches increased to 2 625 tons and in 2002 increased again 3 561 tons. There is 100% observer coverage for this fishery. Approximately 33 species or families of fish were listed as by-catch by the observers but most occurred in amounts less than 1 ton. Skate species dominated the by-catch with approx. 250 tons recorded, the majority of which came from the long-line gear (Table 1). Greenland shark (102 tons) was caught in 158 of 487 trawl sets and 49 of 816 long-line sets. Broadhead or Northern wolfish (11 tons) were caught in over half of all long-line sets (459 of 816). Roughhead Grenadier (*Macrourus berglax*) were also relatively abundant with almost 18 tons recorded as by-catch. Atlantic halibut (Hippoglossus hippoglossus) were recorded caught in only one long-line and one trawl set for a total of 9 kg. Atlantic cod (*Gadus morhua*) were recorded caught in 9 long-line sets for a total of 23 kg.

Table 1. Total weight (t) by gear of the most common species caught as by-catch in the Div. 0A Greenland halibut fishery.

Species	Trawl	Long-line	Total
Greenland shark (*Somniosus microcephalus*)	85.3	16.8	102.1
Skate unspecified	1.7	203.8	205.5
Thorny skate (*Amblyraja radiate*)		2.6	2.6
Arctic skate (*Amblyraja hyperborea*)	1.3	42.7	44.0
Spiny-tail skate (*Bathyraja spinicauda*)	0.6	0.4	1.0
Broadhead wolfish (*Anarhichas denticulatus*)	0.1	11.7	11.8
Spotted wolfish (*Anarhichas minor*)		0.1	0.1
Roughhead grenadier (*Macrourus berglax*)	1.7	16.1	17.8

B. Special Research Studies

1. Environmental Studies

No environmental studies were conducted.

2. Biological Studies

a) Nuclear DNA (Microsatellite) Analysis in Greenland Halibut

Microsatellite markers may be the best approach for the study of genetic stock structure in Greenland halibut. Microsatellites are widely distributed in large numbers in animal nuclear genomes. They have a higher mutation rate than mitochondrial DNA markers which is often more suitable for the examination of subtler genetic subdivision. In 2001 primers developed for microsatellite amplification in Atlantic halibut (*Hippoglossus hippoglossus*) and olive flounder (*Paralichthys olivaceus*) were tested in Greenland halibut. Nine loci were identified that are able to be cleanly interpreted and are highly polymorphic.

In 2002 analytical work continued in order to increase sample sizes in an effort to improve the data and to adequately test whether or not stock differences can be detected. This work is still ongoing and the results have yet to be reviewed to determine the next steps.

c) Age Validation for Greenland halibut

The C^{14} method of age validation is being examined for its applicability in the case of Greenland halibut. This work is being undertaken in collaboration with Dr. Steven Campana at the Bedford Institute and in cooperation with scientists from DFO Newfoundland and the Greenland Institute of Natural Resources. In 2001 an analysis of C^{14} in the core of otoliths from 4 Greenland halibut collected in Cumberland Sound in 1986 showed that whole otolith ages may be under-aging these fish. However, since the C^{14} signal recorded in deep-sea environments is different (delayed) from that of the surface marine waters, reference C^{14} values appropriate to the environment experienced during the period of otolith core formation must be used.

In 2002 work focused on collecting and analyzing samples of 0-2 year old Greenland halibut collected between 1959 and 1987. Over 30 samples have been assayed to determine C^{14} levels and to create a reference curve for Greenland halibut. We are awaiting results from a final set of samples for the reference curve and then will move into the validation phase of this project in 2003.

A tagging program for Greenland halibut from Cumberland Sound was conducted from 1997 to 2000 during the winter long-line fishery. One aspect of this tagging program was the marking of the otoliths using an injection of oxytetracyline (OTC). We now have three marked otoliths that have been returned, one 2 years, one 3 years and one 4 years since marking. The mark is visible on the sections of all otoliths as well as on the whole otolith for the one that has been at large for 4 years. Assessment of growth and determination of annuli is in progress. It is anticipated that these results will be presented together with the C^{14} results in 2004.

d) Marine Mammal Studies

Our lab has been studying the beluga and narwhal stocks within Cumberland Sound (NAFO Div. 0B) for a number of years. There is an important subsistence harvest for these whales by hunters in the community of Pangnirtung. In May, 2002, an unsuccessful attempt was made to tag belugas and narwhals at the floe edge in Cumberland Sound. In August, skin biopsies were collected from belugas on the west side of Cumberland Sound for genetic analysis. In March, 2003, an aerial survey for belugas was conducted from the floe edge to the mouth of Cumberland Sound. Bowhead whales were also counted. Additional reconnaissance transects were flown over the eastern end of Hudson Strait for bowhead whales.

e) Shellfish

Stock assessment of the clam beds near Iqaluit and Qikqitarjuaq were conducted in 2002. Equipment malfunctions prevented any substantive results in 2002. Studies to be continued in 2003.

PART B - Newfoundland and Labrador Region

Submitted by

D. Richards

SUBAREAS 0 AND 1

A. Status of the Fisheries

Nominal landings from 1990 to 2002 for fish stocks are listed in Table 1. Additional information on the status of the fisheries is as follows:

a) Shrimp - Div. 0AB

Between 1991 and 1996, the *Pandalus borealis* quota in Div. 0A was set at 8 500 tons. Between 1997 and 2001 the quota varied between 7 650 and 9 350 tons. During 2002, the quota was increased to 12 040 tons.

Annual catches of 4 800-7 500 tons were made between 1991 and 1994, but have since fluctuated between 500 and 6 250 tons.

Catches of *Pandalus borealis* in Div. 0B increased from about 2 800 tons in 1988 to 3 000 tons in 1989 but subsequently declined to 100 tons in 1993. The 1994, catch was less than 500 tons; however, catches increased substantially to about 3 600 and 3 200 tons in 1995 and 1996, respectively, and to more than 5 000 tons each year from 1997 to 1999. Approximately 5 900 tons were caught during 2001 while preliminary data indicate that 6 200 tons were taken in 2002.

Recent catches for the species have been estimated, in part, from the mixed fishery data for *P. borealis/ montagui* in the area east of Resolution Island but their accuracy is questionable. *Pandalus borealis* taken in the immediately adjacent areas of Hudson Strait, Ungava Bay and NAFO Div. 2G were included in the catches reported for Div. 0B. TACs remained at 3 500 tons from 1989 to 1996 but were increased experimentally to 5 250 tons for 1997 and 1998. In 1999, an additional 3 500 tons were provided for the area north of 63°N as an incentive for the offshore fleet to return to grounds not fished extensively since 1995. However, just over 100 tons were taken within this area in 1999. In 2000, the additional 3 500 tons were not included in the quota report, and accordingly the catch was not counted against the TAC for the south (5 383 tons). In 2001, the additional 3 500 tons were included in the quota report as an exploratory quota east of 63^{o}W. Approximately 5 800 tons were taken in the south during 2001, while preliminary data indicate that 5 600 tons were taken in Div. 0B during 2002.

The standardized annual CPUE showed an overall decline from 1988 to 1993. Catch rates increased sharply from 1993 to 1998 after which they remained stable. The model was standardized for year, month and vessel effects with effort weighting and accounted for 77% of the variance in data. The 1997-2001 indices were statistically similar ($P>0.05$) to the 2002 estimate while all estimates prior to 1997 were significantly lower than the 2002 estimate ($P<0.05$). Even though the commercial CPUE has been stable at a high level since 1997, it may not be reflective of stock status due to fishing constraints associated with the overlapping distributions of *Pandalus borealis* and *P. montagui*.

b) Greenland Halibut – 0B+1B-F

The Greenland halibut stock in Subarea 0+1B-F (offshore) is considered to be part of the same stock distributed in Subareas 2 and 3. Canada (NL) catches for 2002 were approximately 2 500 tons. The stock is managed jointly by Canada and Denmark (Greenland), with the TAC being split equally. Recent scientific information on this stock is limited, although new surveys were completed in Div. 0A and 0B in 1999-2001. NAFO Scientific Council and the Canadian Fisheries Resource Conservation Council (FRCC) recommended in 2001 that the TAC in 2002 should not exceed 11 000 tons, as in recent years. In June 2000, Scientific Council recommended an additional TAC of 4 000 tons for Div. 0A + 1A offshore based on recent survey results. No new information was available at the 2001 Scientific Council meeting to update this advice.

SUBAREA 2

A. Status of the Fisheries

Nominal landings from 1990 to 2002 for fish stocks are listed in Table 1. Additional information on the status of the fisheries is as follows:

a) Atlantic salmon

The commercial fishery remained closed for 2002. Approximately 8 100 salmon were retained or hooked and released in the recreational fishery. Preliminary information on food fishery catches indicated that about 16 tons of salmon were harvested in 2002.

b) Arctic charr

Commercial landings of Arctic charr in northern Labrador were 21 tons, 36% less than landings in 2001 and the lowest since 1996. Catch rates remained moderately high in the three primary stock complex areas. Over

the past 29 years (1974-2002), more than 2 700 tons of charr have been harvested from a limited stretch of the north Labrador coast, and attests to the capacity of this area to produce fish. No data are available on the amount of charr harvested for subsistence (food) purposes.

c) Shrimp

The shrimp fishery in Subarea 2 and the northern portion of Subarea 3 is divided into three management areas – Div. 2G, Hopedale and Cartwright Channels (Div. 2HJ), and Hawke Channel (Div. 2J) + Div. 3K.

Between 1998 and 2002, annual catches of approximately 8 000 tons were taken in Div. 2G from 8 320 tons TACs. The standardized and unstandardized fishing effort and catch per unit effort indices have fluctuated without trend since 1991, reflecting stability in the resource. Historically, the fishery has been concentrated north of 60^{o}N in an area noted for producing high catch rates of large, high-quality shrimp. During 1998, a separate quota was created for the area south of 60°N to reflect the existence of high concentrations of shrimp along the shelf slope. The new quota resulted in a southward shift in fishing effort. Overall, the stock remains healthy as evidenced in continued high catch rates for female shrimp and expansion of the resource.

Catches in Hopedale and Cartwright Channels (Div. 2HJ) have increased from 7 500 tons during 1994-1996 and have since doubled due to TAC increases. Over the past ten years, fishing effort has remained relatively stable even though the TAC doubled. Standardized catch rates, within Hopedale and Cartwright Channels were relatively stable between 1986 and the early-1990s, increased from 1993 through to 1998 and then stabilized at a high level. The 1999-2001 catch rates were statistically similar ($P>0.05$) to 2002 while all others were lower than 2002 ($P<0.05$). The high CPUE is being maintained over a relatively broad area indicating that the stock is healthy.

The research survey biomass/ abundance estimates showed an increase since 1998. The 2001 multispecies research trawl survey biomass and abundance indices for Hopedale Channel were substantially higher than those observed over the 1997-1999 period. The 2002 survey covered only Cartwright Channel; biomass and abundance indices remained similar since 1996.

The fishery in Hawke Channel (southern Div. 2J) + 3K began in 1987 with landings of approximately 1 800 tons. Catches increased to more than 7 800 tons in 1988 and ranged between 5 500 and 8 000 tons between 1989 and 1993. The first multi-year management plan for 1994-1996 set the annual TAC at 11 050 tons for the Hawke Channel, St. Anthony Basin, east St. Anthony, Funk Island Deep, and three exploratory areas on the seaward slope of the shelf. Catches increased to 11 000 tons in each of these years. Between 1997 and 2002 catches increased to over 63 000 tons reflecting the dramatic TAC increases over that period. The small vessel shrimp fishing fleet (<500 tons; LOA<100') has been exploiting this resource since 1997. The small vessel catch in 2002 was approximately 40 000 tons while the large vessel catch (>500 tons) was approximately 20 100 tons.

Autumn research surveys have been conducted since 1995 and indices of biomass/ abundance have been increasing since 1997. The lower 95% confidence intervals for the biomass indices averaged 496 200 tons (about 121 billion animals) during the 1998-2002 period. The resource in this area remains healthy with high biomass/ abundance of male and female components. The biomass and abundance of males should be maintained over the next few years, by recent strong year-classes (13-17 mm), while the female component should be maintained, over the next 2-3 years, as relatively strong year-classes (15-19 mm males) change sex. Exploitation rate indices (ratio of nominal catch/ lower 95% confidence interval of biomass index) have remained below 15% over the past 6 years and the fishery continues to cover a broad area. Therefore, fishery related impacts could not be detected from the logbook, observer or the research data. The fact that catch per unit effort for the large vessels has been maintained at a high level, and the fishing fleets are able to take their quotas over broad geographic areas, throughout the year further suggest that the stock is healthy.

The mandatory use of sorting grates, low groundfish abundance and avoidance of problem locations have minimized by-catch. Recent studies estimated that low numbers of redfish and Greenland halibut have been caught by the shrimp fishing fleets.

d) Cod – 2GH, 2J3KL

The catch from cod in NAFO Div. 2GH peaked at 90 000 tons in 1966. The stock collapsed in the late-1960s and early-1970s as a consequence of the high levels of mainly non-Canadian fishing. It was placed under a separate TAC in 1974. It retained the ability to produce some significant year-classes into the early-1980s, but increasing Canadian effort prevented any recovery, and by 1987 survey biomass had reached an extremely low level. Although Canadian research vessel survey coverage has been incomplete in recent years, there is no evidence of any recovery. The stock has been under a moratorium with respect to directed fishing from 1986 to present.

The northern cod (NAFO Div. 2J+3KL) commercial fishery reopened in the inshore in 1998 after six years of moratorium despite the lack of evidence of any recovery in the stock. Recruitment has remained extremely low and mortality rates appear to be very high given that there is no directed fishery in the offshore and only a limited inshore fishery. By-catches in the offshore occur in the turbot, yellowtail flounder and shrimp fisheries, and in the inshore in the lumpfish and blackback flounder fisheries, but accurate estimates are not available. In 2002 a TAC of 5 600 tons was in place for directed fishing in the inshore. Reported by-catches, sentinel survey catches and recreational/food fishery catches are all considered to be part of this TAC. Recent assessments have suggested that annual removals since the directed fishery reopened in 1998 have not been sustainable under current recruitment and mortality rates. High levels of mortality may in part be caused in part by unreported catches, but predation by harp and hooded seals is also considered to be a factor. The most recent Canadian assessment of this stock concluded that spawning stock biomass was well below the conservation limit reference point which, although not well defined at present, is considered to be above 300 000 tons. Deterministic projections indicate that the spawner biomass will decline if exploitation rates remain at the current levels and that, even in the absence of a fishery, the population growth over the next 10 years will be marginal at current stock productivity levels.

e) *American plaice* – 2+3K

There was no directed fishery on this stock in 2002. Analysis of data from annual fall multispecies research vessel trawl surveys indicates that recruitment, abundance, and total and spawning biomass remain low. The next assessment of this stock is scheduled for October 2003.

f) Redfish – 2+3K

There has not been a persistent directed effort on this stock since 1990 when 2 400 tons were landed. Landings declined to 280 tons in 1991, were less than 10 tons in each year from 1992-1999 and increased to an average of 35 tons from 2000-2002. Estimates of redfish by-catch discarded from shrimp fisheries in the Div. 2G to Div. 3K area since 1980 have ranged from 14 tons in 1983 to 665 tons in 1990. In 2002 an estimated 149 tons of redfish were taken in the shrimp fisheries within SA2+Div. 3K. Survey biomass estimates for Div. 2J3K from 1995-2002 (average 33 000 tons), are less than 5% of the average from 1978 to 1990 (775 000 tons). This is based on the conversion of Engel trawl results (standard trawl on surveys from 1978-1994) into comparable units of the Campelen trawl (standard trawl on surveys since 1994). Recruitment has been poor since the year-classes of the early-1970s. There are no indications that the status of the stock will change in a positive way in the foreseeable future.

g) Snow crab – 2J+3KLNO

Catches increased by about 6% to 49 900 tons in 2002 from 47 100 tons in 2001, while fishing effort (number of trap hauls) increased 10.5%. These increases were associated with a slight increase in TAC in 2002 primarily in inshore areas of Div. 3K and 3L. Fishery performance is monitored in through analyses of commercial logbook data, observer program data, and dockside monitoring. CPUE from logbook data generally remained at a high level in 2002, and had been declining in the north (Div. 2J+3K) between 1998 and 2001, remaining unchanged in 2002. The exploitable biomass index, which is projected from the fall multispecies bottom trawl survey of the previous year**,** decreased between 1999 and 2000 but has been generally stable from 2000 to 2002. Therefore the exploitable biomass for 2003 is expected to be generally similar to that of 2000. The projected pre-recruit index for >94 mm new-shelled males decreased during

1997-2000 and has been generally stable from 2000 to 2003. Recruitment prospects in the medium and longer terms are uncertain.

h) Iceland scallop - 2HJ

Inshore aggregations here were again fished in 2002 with nominal catches estimated at 253 tons round. The fishery is prosecuted by inshore vessels, typically under 45 ft (14 m), L.O.A. Except for exploratory surveys for presence/absence, there have been no directed scientific missions into scallop aggregations along the Labrador coast.

i) Greenland halibut - SA 2 + Div. 3KLMNO

Improved recruitment has lead to an increase in this stock up to 1999, after which it appears to have declined again. TACs in 2002 and 2003 have been set above scientific advice and appear not to have been reached. The most recent (2002) estimates of stock size from 3 independent survey series all indicate a further decline.

j) Witch flounder - Div 2J3KL

This stock remains at a very low level. SC recommended no directed fishing on this stock in 2002 and 2003, and that by-catches be kept at the lowest possible level. The relationship between witch flounder in Div. 3M with those in Div. 2J+3KL was examined. Scientific Council concluded that:

1. Witch flounder in Div. 3M in depths less than 730 m do not appear to be strongly linked with witch flounder in Div. 2J and 3KL.
2. Witch flounder in the deep waters of Flemish Pass (>730 m) are likely to be closely associated with witch flounder along the slope of the Grand Bank in Div. 3L.
3. Almost no witch flounder were observed in the northwestern part of Div. 3M in depths greater than 550 m.

B. Special Research Studies

1. Biological Studies

a) *Groundfish and Shellfish*

Biological and oceanographic data from fall multi-species research vessel surveys were collected from Div. 2GHJ to conduct distribution and abundance studies and detailed biological sampling. Stomach analysis is usually conducted from specimens of Greenland halibut caught during the fall surveys. In 2002 there were no stomachs collected in order to process a backlog of samples from previous surveys.

b) Arctic charr

Samples were obtained for food and feeding, age, sex, and length distributions from commercial landings from 6 north Labrador Subareas. Following a long term decline in mean weight of charr harvested in north Labrador, analyses of recent data show that mean weight has increased, or generally stabilized in each of the three primary stock complex areas during the past four years (1998-2001). Besides the long term effects of fishing on stock characteristics, recent analyses have identified a possible environmental component contributing to some of the variation in stock characteristics. In addition, analyses of food and feeding patterns have demonstrated major diet shifts occurring over an 18-year interval and have been related, in part, to changes in the size of charr in some areas. Diet studies continued in 2002 with samples obtained from six separate Subareas.

SUBAREA 3

A. Status of Fisheries

Nominal landings from 1990 to 2002 for fish stocks are listed in Table 1. Additional information on the status of the fisheries is as follows:

a) Squid – Subarea 2+3.

Following a peak catch in 1979 of about 88 800 tons, the Subarea 3 catch declined regularly to 5 tons in 1983. Catches remained lower than 5 000 tons during the thirteen-year period 1983 to 1995. They increased since 1995 to about 12 700 tons in 1997 before declining sharply to about 800 tons in 1998 and about 20 tons in 1999. They remained low, at about 300 tons, in 2000, decreased to only about 20 tons in 2001, and increased to about 200 tons in 2002. Increases in catches in 1996 and 1997 were associated with environmental warming and increase in squid abundance at the northern extreme of their range. The recent very low catches during 1998-2002 reflect low squid abundance in Canadian waters, despite persistence of a warm oceanographic regime.

b) *Atlantic salmon* - Subarea 3

A moratorium on the Canadian commercial fishery has been in place since 1992. Landings at St. Pierre (Subdiv. 3Ps) totalled 3.6 tons in 2002. The 2002 recreational harvest, including both retained and hooked-and-released, was approximately 44 200 fish in insular Newfoundland.

c) *Shrimp* – 3LMNO.

Subarea 3 has been divided into two shrimp management areas – Div. 3LNO and 3M. The 3LNO shrimp stock is distributed along the edge of the Grand Banks mainly in Div. 3L. The fishery began in 1993 and catches were approximately 1 800 tons. Exploratory fishing from 1996-99 resulted in catches ranging from 179 to 795 tons. In 2000, the NAFO Fisheries Commission implemented a TAC of 6 000 tons, and fishing was restricted to Div. 3L. The catch in 2000 increased to 4 900 tons, 4 300 tons of which was caught by Canada. The remainder of the catch was taken by vessels from 7 other countries.

STACFIS estimated that the 2001 fishery took approximately 10 600 tons, with Canada taking just over 5 100 tons. However, reliable catch reports were not available for all countries in 2001. Similarly, estimates of catch in 2002 were not available for all countries. However, STACFIS noted that the total catch in 2002 was likely to be lower than that estimated for 2001, but that there was considerable uncertainty with estimates of catch in both years. Preliminary data indicate that Canadian vessels caught 5 400 tons of shrimp in Div. 3L during 2002.

Catch and effort data were available from fishing records from Canadian vessels in Div. 3L from 2000 to 2002. Unstandardized catch rates (both single and double trawl) for large vessels increased in 2001 and again in 2002.

The fishery for northern shrimp at Flemish Cap began in the spring of 1993 and has since continued with estimated annual catches (as estimated by STACFIS) of approximately 27 000, 25 000, 33 000, 48 000, 25 000, 30 000 and 43 000 tons from 1993 to 1999, respectively. The 2000 catch was 50 000 tons, the highest in the series. In 2002, 48 000 tons of shrimp were caught in Div. 3M. Vessels from as many as 16 nations have participated in this fishery since its beginning.

The use of a sorting grid to reduce by-catches of fish is mandatory for all fleets in the Div. 3LNO and 3M fisheries. By-catch of groundfish has been quantified, and consists primarily of redfish and Greenland halibut.

d) *Iceland scallop.*

In the Newfoundland area, Iceland scallops are fished in Div. 3LN and Subdiv. 3Ps and to a lesser extent along inshore waters off Labrador.

The Div. 3LN scallop fishery commenced in 1993. Aggregations over the eastern Grand Bank (Div. 3L) were first commercialized. In 1994 the fishery expanded into the Carson and Lilly canyons (LCC) and subsequently (1995) into the northeast of LCC between 45°30' N and 46°30' N. In 1996 a new aggregation was located and rapidly fished down. While some exploratory fishing occurs outside of these “boxed” areas, each with a catch limit, the areas around the LCC continue to attract the most effort. Nominal landings declined throughout, primarily because of effort diversion into shrimp and crab.

There was no directed fishery into aggregations in Div. 3L. Overall catch rates and meat counts here (no. of meats per unit weight) are low and the area is generally considered marginal for the fleet.

There was no directed fishery for Iceland scallops from the LCC box in 2002, the first time since aggregations were first exploited in 1994.

Elsewhere, over the Grand Bank (Div. 3LN) no commercial activity was recorded in 2002.

The Iceland scallop fishery on St. Pierre Bank commenced in 1989 and is now separately managed as two zones: (a) the trans-boundary stock, along the northern edge co-managed by France (70% of annual TAC) and Canada (30% of TAC) and (b) the large area to the south that remains entirely under Canadian jurisdiction. Total removals in 2002 increased slightly compared with the previous year (484 tons *vs*. 479 tons). Off-shore aggregations accounted the total removals from this area. There was no directed effort for Iceland scallops in the trans-boundary area, an area within NAFO Subdiv. 3Ps co-managed by Canada and France.

e) *Capelin* – Subarea 2 + Div. 3KL

Inshore capelin catches in Subarea 2 + Div. 3KL are taken during the inshore spawning migration. Catches decreased from 18 900 tons in 2001 to about 10 200 tons in 2002. Resource status has not been determined since 2000.

f) *Snow crab* – 3Ps.

Catches in Subdiv. 3Ps in 2002 (7 970 tons) were similar to those of 2001 (7 840 tons). CPUE increased steadily through the 1990s to 1999. It declined markedly between 2000 and 2002, due to an apparent reduction of commercial-sized males and a high prevalence of soft-shelled crabs. Bottom trawl surveys are unreliable for indicating resource status because they are carried out in spring when mating and molting occur and the population is incompletely available to the survey trawl. Therefore, resource status and prospects are uncertain.

g) *Cod* – 3NO and 3Ps.

The cod stock in NAFO Div. 3NO has been under moratorium to all directed fishing both inside and outside the Regulatory Area since February 1994. In the last assessment of this stock (2001) fishing mortalities in the range of 0.5-0.6 on the fully recruited ages were estimated for 2000, raising considerable concern about the rising levels of by-catch mortality and the implications for the recovery of the stock. Recent Canadian spring and fall research bottom trawl surveys confirm that the stock size remains at an extremely low level. Long-term projections indicate a very low probability of stock recovery under current levels of low recruitment and high levels of by-catch mortality.

The cod stock NAFO Subdiv. 3Ps was placed under moratorium in August 1993. Stock assessments estimated a growing spawner biomass and the fishery reopened in 1997 with a TAC of 10 000 tons, which was increased to 20 000 tons in 1998 and to 30 000 tons in 1999. From 2000 onwards the TAC has covered the period 1 April to 31 March. Although the 2000/2001 TAC was reduced to 20 000 tons based on stock assessment results which indicated that spawner biomass was declining, the transition in the TAC year resulted in a calendar year catch of 25 100 tons in 2000. The TAC has remained constant at 15 000 tons for the 2001/2002-2003/2004 fishing seasons. The most recent assessment (2002) estimated that spawner biomass should increase under this TAC level. However, concern was expressed regarding very high exploitation rates in a portion of the stock area (Placentia Bay), given uncertainty regarding stock structure.

h) *American plaice* - 3Ps

An assessment of this stock was carried out in October 2002. Since 1992, research vessel surveys indicate that the stock has been at a very low level. There has been a slight increase over the 1992-2002 time period in both biomass and abundance indices but average biomass over the last 3 years is only 20% and abundance 30% of the 1983-87 average. The female SSB index showed a large decline from the mid-1980's to the early-1990s and has shown a slight increase since 1997. The SSB index from 2000-2002 is 26% of the 1983-1987 average. Analyses of recruitment from survey data indicated that cohort strength declined from

the 1979 to the 1995 year-class. Since then cohort strength has generally increased. Catch/biomass ratio declined rapidly after 1990 as catches decreased, and reached a minimum in 1995. Catch to survey biomass ratios indicate that exploitation rate has been increasing since the mid-1990s. In the next few years the weak 1994-1997 year-classes will be moving into the age range of the biomass subject to the by-catch fishery. This will likely result in a decrease in exploitable biomass. At current levels of catch this should result in a further increase in fishing mortality. More recent year-classes appear stronger but these will not contribute to the exploitable biomass or SSB for several more years.

i) *Witch flounder* - 3Ps

Landings from this stock over the last 20 years have fluctuated between 300 tons and 1 000 tons annually. The main directed fishery is prosecuted by offshore otter trawlers complemented by a nearshore Danish seine fishery. However, in recent years it appears to be a mixed American plaice and witch flounder fishery by otter trawlers. During 2000-2002 the American plaice by-catch rates in the otter trawl directed witch flounder fishery ranged from 93-143% compared to less than 5% by Danish seiners. Although survey stock size indices since 1983 have been highly variable, the survey biomass index during recent years suggests that the biomass is on average about 75% of the 1983-90 average when catches were around 800 tons. The age and size structure observed in this stock since the early-1980s also appear to have remained stable with little change in growth pattern. Geographic distribution has not changed appreciably since 1983 except during the early- to mid-1990s when fish disappeared from the 51-100 fath. depth zone coincident with extremely cold sea bottom water temperatures. In recent years the distribution appears to be returning to a more normal pattern. No measurable change in recruitment has been observed over the past 20 years.

j) *Yellowtail flounder* – 3LNO

Since the fishery for this stock reopened in 1998, stock size has continued to increase and the TACs recommended for 2001 and 2002 were 13 000 tons in each year, increasing to 14 500 tons in 2003 and 2004. In addition to the annual spring stratified-random survey in 3LNO and the fall multispecies bottom trawl survey, joint DFO-Industry surveys have been conducted since July of 1996. Two such surveys were conducted in 2002. The objective of these Fisheries Products International-DFO surveys is to develop a commercial-type index of abundance and to determine distribution of yellowtail flounder within a zone traditionally fished by commercial fleets. Evidence from the commercial fishery and various surveys indicates that the range of this stock has increased along with stock size since the mid-1990s.

k) *American plaice* – 3LNO

Recruitment continues to be poor, and no good year-classes have been observed since the mid-1980s. Biomass is very low compared to historic levels and a moratorium on fishing remained in place during 2001, with a recommendation that it continues for 2002 and 2003. By catches in other fisheries continue to increase in recent years, and fishing mortality in 2001 was near $F_{0.1}$. At or above current catch levels, the stock size is likely to decline further.

l) *Redfish* – Unit 2 (3Ps4Vs, 3Pn4Vn-June to December, 4Wfgi) and 3O.

Redfish in the Canadian Atlantic within NAFO divisions 3P4RSTVWX were redefined into three management units in 1993. Redfish in UNIT2 was last reviewed in November 2001. The assessment planned for 2002 was cancelled in order to produce analyses to evaluate all redfish stocks under a terms of reference for a species at risk, as determined by the Committee On the Status of Endangered Wildlife in Canada (COSEWIC).

Unit 2 Canadian landings in 2002 totalled approximately 7 300 tons and approximately 3 300 tons was caught by Can(N). Total Canadian catches have declined steadily from 27 000 tons in 1993 matching reductions in TACs. Current management regulations include a closure related to peak spawning in May and June, and a minimum size restriction at 22 cm. The current stock status was determined from stratified random surveys and sampling of the commercial fishery. Sampling of the 2002 fishery suggested year-classes born after 1980 (which were dominated by the 1988 year-class) represented about 28% of the catch in numbers and 15% of the catch in weight, with the remainder being dominated by the 1980 year-class (fish 33-36 cm). The 1988 year-class is now fully recruited to the fishery. Its future contribution will not likely be as great as the 1980s year-

class, which has supported the fishery for the past 12 years. The 2002 DFO survey and the 2001 industry survey measured the presence of the 1994 year-class and also detected the 1998 year-class. In the 2002 DFO survey, these year-classes represented 42% of the survey abundance and are not of sufficient size to be vulnerable in the fishery. Biological characteristics suggest both these year-classes and the 1988 year-class are predominantly *S. fasciatus*, a shallower water species. The strength of year-classes of *S. mentella* since the 1980 year-class are apparently very weak, yet it continues to be the target of the fishery.

Canadian catches of Div. 3O redfish have increased dramatically from less than 200 tons annually from 1983-91 to 7 000 tons in 1996 and have fluctuated between 2 000 tons and 9 000 tons since then due to a varying market for redfish sizes near the small fish protocol limit of 22 cm which predominate in Div. 3O. Total catches since 1998 have exceeded 12 000 tons partly due to increased foreign activity outside the 200 mile limit. About 19 000 tons have been taken in 2002 with Can(N) accounting for all but 12 tons of the 3 000 tons Canadian catch. Resource status has been determined from spring and fall stratified random DFO surveys in Div. 3O. The spring index suggests that the stock may have increased since the early-1990s, but has stabilized at around 100 000 tons between 1994 and 1999. The fall survey generally supports this pattern. The 2002 survey information for both spring and autumn continues to indicate that stock status has not improved, and may be declining somewhat. Historically, the surveys catch fish in the 10 cm to 25 cm range. Prior to 1998, the surveys were considered to have sampled different size groups than the commercial fishery because the commercial catch was generally comprised of fish greater than 25 cm. Beginning in 1998, there has been greater overlap in the size distributions of the surveys and commercial fishery because the fishery has been targeting size groups that have recently surpassed the small fish protocol (22 cm). Although recruitment to the stock was detected in the both the autumn 2001 and 2002 surveys, there is considerably uncertainty regarding its relative strength.

B. Special Research Studies

1. Environmental Studies

Physical oceanographic observations are routinely collected during fish assessment and research surveys in the Newfoundland and Labrador Region. The enhanced Atlantic Zonal monitoring program (AZMP) initiated in 1998 continued during 2002. This program was established to include biological and chemical oceanographic sampling at a fixed coastal site (Station 27) at biweekly intervals and along offshore sections at seasonal time scales. The Newfoundland and Labrador Region conducted three annual physical/biological oceanographic surveys during 2002 along several cross-shelf NAFO and AZMP sections from the Southeast Grand Bank to Nain Bank on the mid-Labrador Shelf. These surveys were conducted during mid-spring, summer and during the fall. The main objectives were to establish the seasonal temporal and spatial distribution and abundance of plant pigments, nutrients, microzooplankton and mesozooplankton in relation to the physical environment. Physical, biological and chemical variables being monitored include temperature, salinity, dissolved oxygen, ocean currents as well as measures of primary and secondary production and biomass, species composition of phytoplankton and zooplankton and nutrients. The oceanographic monitoring program currently conducted on the Newfoundland and Labrador Shelf should allow an understanding of changes in ecosystem productivity and changes in ecosystem structure over time.

a) Plankton studies

The enhanced Atlantic Zonal Monitoring Program activities in the Newfoundland and Labrador Region have permitted a number of general observations concerning the chemical and biological conditions in the Newfoundland and Labrador Region. As previous workers have suggested, there is a south-to-north progression in the onset of the spring bloom. The concentration of all nutrients at depths of 100 m or more tends to show an increase during the summer and into the fall period, preceding the fall increase in the surface layer that is associated with the breakdown of stratification. Phosphate and silicate concentrations in the surface layer show a seasonal cycle similar to that of nitrate but the former rarely appear to reach depleted levels (near zero concentrations), with the exception of silicate concentrations on the Grand Banks. Finally, the inshore and offshore arms of the Labrador Current are generally marked with shallow nutricline and relatively high concentrations of chlorophyll relative to other areas

of the shelf, suggesting that variations in current speed and shear may influence the flux of nutrients into surface layers during the summer months.

The seasonality of chemical and biological variables at Station 27 and along the major AZMP sections was similar to previous years (1999-2001). The timing of events on the Newfoundland Shelf (south of Seal Island) was once again similar to conditions observed in the early part of the AZMP but in contrast to 2001 when the onset of the spring phytoplankton bloom was delayed. However, satellite information indicates that the relative delay in the onset of the spring bloom remained as one moved further north.

It is becoming clear that interannual variations in the seasonality of vertical mixing and water column structure plays an important role in the seasonal phytoplankton cycle along the Newfoundland Shelf. In 2001, the delay in the onset of the spring bloom was associated with persistent deep mixing of the water column. Although wind stress remained high in 2002, the overall impact on the water column may have been somewhat lessened by the relative timing and intensity of wind events such that the mixed layer depth shoaled more progressively in 2002, thus allowing an earlier spring bloom.

Variations in the physical environment since the inception of the AZMP may also be contributing to a gradual increase in the magnitude of the spring phytoplankton bloom. Since 2000, there has been a gradual intensification in the overall productivity and standing stock of phytoplankton during the spring. The gradual rather than abrupt shoaling of the mixed layer may have provided sufficient light and high nutrient availability to permit the development of denser phytoplankton population, mainly composed of diatoms, than in previous years. However, in addition to the factors that regulate the vertical structure of the water column, there is a preliminary indication that interannual variations in incident light may also have contributed to the increase in the overall intensity of the spring phytoplankton bloom. Although intercalibration of observations from the Northwest Atlantic Fisheries Centre with those collected by the Canadian Meteorological Service has yet to be completed, the first indications are that incident radiation in 2001 and 2002 are at the upper extreme of light levels observed in the past three decades at St. John's airport.

In 2001, the deep nutrient inventories (>50 m) observed at Station 27 showed a 30-50% decrease over conditions in previous years but the change was not observed along any of the standard sections. The condition at Station 27 persisted in 2002 but there are some indications that the depletion of the deep nutrient pool may have expanded onto the inshore and mid-Shelf portions of the Bonavista Bay section, where a notable decrease in deep nutrient levels were observed in 2002, but the magnitude is considerably less than has been observed at Station 27 (seasonally averaged decrease of 10% *versus* 30% over the 2000-01 period).

The relationship between silicate and nitrate concentrations in the upper layer (0-50 m) indicates that both nutrients are taken up by the phytoplankton community. During much of the year, nitrate appears to have a greater potential to limit phytoplankton production. However, there is also an indication that replenishment of silicate is more extensive than that of nitrate throughout much of the year.

The overall standing stock of phytoplankton on the NE Newfoundland Shelf was generally less during the summer and fall surveys than in previous years. Although stratification was less intense, which suggests that nutrient replenishment may have occurred more readily, the integrated temperature was also lower, suggesting that decreases in temperature may play an important role in limiting production on the Shelf. Alternatively, higher grazing pressure from a slight increase in the density of large calanoid copepods may have maintained standing stocks at low levels.

The decrease in the relative importance of Flagellates in the overall composition of the phytoplankton community observed in 2001 appears to have persisted into 2002. Although these organisms do not make up a substantial portion of the overall phytoplankton biomass, the decrease in their abundance may suggest a change in the dynamics of the microbial food web dynamics in the area. Further investigation is required.

The overall abundance of zooplankton at Station 27 was generally in keeping with previous observations, with the exception of the fall and winter of 2001/02 when high concentrations of *Oithona* sp. and

Pseudocalanus sp. were present. The overall increase in overwintering numbers of these two species did not result in a substantial increase in population densities during the subsequent spring and summer at this site, or along the sections further south. The most notable change in the zooplankton community structure at the fixed station has been in the increase in the abundance of cold water species of copepods. Although other taxonomic groups have fluctuated in abundance, copepodites of *Metridia* sp., *C. glacialis*, *C. hyperboreus* and *Microcalanus* sp. have become more frequent members of the community although the overall increase in their abundance has been modest. The warm water species, *T. longicornis*, whose abundance peaks during the fall, has shown a decrease in overall abundance but more importantly the relative frequency of occurrence at Station 27 appears to have decreased since 1999. The change in occurrence of cold and warm water species of copepods is relatively consistent with the changes in water mass characteristics which have taken place since the late-1990s.

The greater occurrence and abundance of large species of copepods such as *Calanus* and *Metridia* may have lead to an increase in the relative abundance of large calanoid nauplii on the mid- and outer shelf areas. Although small species of copepods, such as *Oithona* sp. and *Pseudocalanus* sp. still dominate the copepod community across much of the NE Newfoundland Shelf, the increase in the abundance of large species may have lead to an overall increase in the biomass of the zooplankton community, particularly within the core of the Labrador Current.

b) Oceanographic studies Subareas 2 and 3

Physical oceanographic studies were conducted on the Newfoundland and Labrador Shelf during 2002 in NAFO Div. 2J and 3KLNO. These studies were based on observations from Nain Bank on the mid Labrador Shelf to the Southern Grand Bank on the Newfoundland Shelf. Water temperatures measured off eastern Newfoundland at Station 27 during 2002 decreased compared to 2001 values, but remained above the long-term mean over most depth ranges. Water salinity measured at Station 27 increased over 2001 values to above normal and to the highest in 12 years. The cross-sectional areas of $<0^{o}$C (CIL) water were below normal along all sections from the Grand Bank (Flemish Cap section), to the Seal Island section off southern Labrador. Off Bonavista the CIL area was very similar to 2001, below normal for the 8th consecutive year and among the lowest observed since 1978. Bottom temperatures on the Grand Banks during the spring of 2002 ranged from near normal to above normal (up to 0.5^{o}C) over most areas. During the fall, bottom temperatures were generally above normal, except for the shallow waters of the southeast Grand Bank, where they were up to 2^{o}C below normal. Fall bottom temperatures in Div. 2J and 3K were above normal in most areas, up to 2^{o}C on Hamilton Bank and up to 1^{o}C on Funk Island Bank. In general, over all areas of the Newfoundland Shelf, the near-bottom thermal habitat continued to be warmer than that experienced from the mid-1980s to the mid-1990s. The below-normal trend in water temperature, established in the late-1980s, reached a minimum in 1991, moderated by 1996, reached a maximum in 1999 and has continued above normal up to 2002. Water salinities on the Newfoundland Shelf also reached near-record lows in the early-1990s, remained below normal throughout most of the 1990s and up to 2001. During 2002 however, there was a significant increase with surface values the highest observed in over a decade.

An oceanographic assessment study was conducted in NAFO Subdiv. 3Pn and 3Ps during 2002. Oceanographic data from this area during the spring of 2001 and 2002 were examined and compared to the long-term (1971-2000) average. Temperature measurements on St. Pierre Bank show anomalous cold periods in the mid-1970s and from the mid-1980s to mid-1990s. Beginning around 1996 however, temperatures started to moderate, decreased again during the spring of 1997 and returned to more normal values during 1998. During 1999 and 2000 temperatures continued to increase, reaching the highest values observed since the late-1970s in some regions. During the spring of 2001 and 2002 however, temperatures cooled significantly over the previous two years to values observed during the mid-1990s. However the 2002 values were slightly higher than those reported in 2001. The areal extent of the bottom covered by $<0^{o}$C water increased significantly from the mid-1980s to mid-1990s but decreased to very low values during 1998-2000. During 2001 however, this area increased to values observed during the mid-1990s, which decreased slightly during 2002. On St. Pierre Bank $<0^{o}$C water completely disappeared during the warm years of 1999 and 2000. It has since increased to between 20-30% during 2001 and 2002. In general, temperature conditions in this region during the spring of 2002 were cold on the banks but

increased slightly over values observed in 2001, while salinity values were fresher than those observed in 2002.

An oceanographic assessment study was also conducted during the summer of 2002 on the Flemish Cap in NAFO Division 3M. Oceanographic data from the summer of 2002 around the Flemish Cap area were examined and compared to the long-term (1971-2000) average. The cold near-surface temperatures (0.5^{o} to 2^{o}C below normal) experienced over the Cap from 1993-1996 had warmed to 0.5^{o}-1.5^{o}C above normal by July of 1997, which increased further to 2^{o}C above normal by the summer of 1999. Upper layer temperatures directly over the Flemish Cap during the spring of 2001 were generally below normal by up 0.5^{o}C which decreased further to 2^{o}C below normal during the summer of 2002. Intermediate depth temperatures over the Cap were generally above normal by up to 2^{o}C while bottom temperatures ranged from above normal over the shallowest water depths to near normal below 150 m depth, similar to that observed during 2000 and 2001. These values represent a decrease over the 1^{o}C above normal bottom temperatures in 1999. Salinities over most of the upper water column during the summer of 2002 were similar to the spring of 2001, generally saltier-than-normal (by 0.25-0.5). In the deeper water (>100 m) and near bottom, salinities were about normal. In general the colder than normal temperatures experienced over the continental shelf and on the Flemish Cap from the late-1980s up to the mid-1990s moderated by the summer of 1996 and continued to warm until 1999. During the summer of 2000 and into the spring of 2001 the data indicates a reversal in the recent warm trend in some areas of the water column with near normal temperatures in most areas. During the summer of 2002 most areas of the water column except for the near surface layer were either at or above normal. During 2002 and throughout most of the 1990s summer chlorophyll levels in the upper 100-m of the water column over the Cap were higher compared to the adjacent Grand Bank. Dissolved oxygen levels were about normal for the region with super-saturated values in the near surface layers reaching 105%. Both the measured currents and the geostrophic estimates, while showing considerable differences and variability between years, confirm the existence of a general anticyclonic circulation around the Flemish Cap.

c) Hydrographic Surveys Subareas 3 and 4

The hydrographic priorities for 2001-2002 in Newfoundland and Labrador were the northeast coast and selected ports on the Island of Newfoundland, and portions of the north and south coast of Labrador. Hydrographic surveys were completed in White Bay northwards along the east coast of the Northern Peninsula as required to collected new data to augment and replace existing historical hydrographic data obtained during British and French Surveys from the 1700s and 1800s. Three small hydrographic revisory surveys were also completed at Grand Bank, Lewisporte and Holyrood. In northern Labrador this year was the first year of a multi-year program to establish shipping corridors from Nain north to Cape Chidley Labrador. This area is currently covered by 14 charts which contain sparse reconnaissance sounding only. During the field season a new shipping corridor was established from Nain north through Manvers Run. Another corridor was also established from Nain north to Okak Bay as an "outside" corridor. An EM 3000 multibeam acoustic survey was also completed at Gilbert Bay in southern Labrador. This survey was in support of a joint project to acquire detailed bathymetric information for the Marine Protected Area initiative at Gilbert Bay. Data sets from these surveys will be used to produce new paper and electronic navigation charts meeting modern hydrographic and cartographic standards.

A Sailing Directions revisory survey was also completed throughout Newfoundland and Labrador. Information from this project was used to update the five Sailing Directions publications for the Region.

2. **Biological Studies**

a) Flatfish

A food and feeding study on Greenland halibut is being conducted based on annual stomach collections from trawl surveys in Subarea 2 and 3.

Analysis of sexual maturity data is conducted annually on American plaice, yellowtail flounder, Greenland halibut and other species. The most recent studies on Greenland halibut were presented to NAFO SC in 2001. Research on yellowtail age and growth is ongoing, using a variety of methods. The most recent analysis of age validation studies was presented to NAFO SC in June 2001.

A tagging program was begun on yellowtail flounder in Div. 3LNO in 2000. This is a co-operative project between DFO and Fishery Products International Ltd. This program is designed to run in May –June of each year from 2000 to 2004 inclusive. The objectives are to obtain estimates of exploitation and population size to improve the assessment of this stock; and to study movements and migrations, age and growth, mortality, and longevity of this species. These objectives will be accomplished by using two different tagging methods. In 2002, data storage tags were again used, along with the Petersen discs used in both 2000 and 2001.

Studies are continuing into the factors affecting the timing of spawning in American plaice in Div. 3LNO. There are also ongoing studies on the reasons for changes in maturity at age and size in American plaice Subarea 2 + 3K, Div. 3LNO, and Subdiv. 3Ps.

b) Seals

Multi-disciplinary studies on harp, hooded, and grey seal population dynamics and seal-fish interactions continued in 2002. The objectives of these studies were to develop a better understanding of seasonal distributions of seals, determine current population size of harp and grey seals, examine interannual changes in growth and reproductive status, and to estimate consumption of prey species by seals.

Consumption of prey by harp seals in NAFO Div. 2J+3KL is estimated by integrating information on individual energy requirements, population size, distribution, and diet composition. New information on the diet of harp seals in nearshore areas of NAFO Div. 2+3KL was collected during 2002. The stomach contents of harp seals collected between 1998 and 2001 were reconstructed to determine the diet of harp seals in nearshore areas. Uncertainty in the estimates of numbers at age, diets, residency in Div. 2J+3KL and the proportion of seals in nearshore areas, was incorporated into the consumption estimates. The proportion of cod in nearshore diets continued to vary significantly among years and seasons. The few samples obtained from offshore areas did not contain Atlantic cod. Further sampling of diets, particularly in offshore areas are required in order to improve estimates of consumption. However, estimates will likely remain highly variable owing to the strong temporal and spatial variation observed in diet composition.

c) *Capelin*

Studies to determine factors governing capelin survival during egg development and larval emergence from beach sediments continued at one beach site in 2002. In the same area, studies were initiated to assess and determine factors causing the high mortality of capelin eggs deposited at demersal spawning sites in 2001. An ongoing acoustic survey initiated in the spring of 2000 is examining capelin distribution, behavior, and feeding habits in Div. 3KL. Inshore surveys were conducted in the fall of 2002 to map the dispersal and distribution of larval capelin in Trinity Bay, Div. 3L.

3. **Miscellaneous Studies**

a) Fish Habitat Compensation Studies

Scallop Habitat Creation

PetroCanada, on behalf of the Terra Nova Offshore Oil Development Project, has undertaken a multi-year fish habitat compensation program associated with the creation of habitat for and increase in productive capacity of Iceland scallops in Paradise Sound, Placentia Bay. Scallop shell habitat was created in 2001 and 2002 in three locations, utilizing discarded scallop shells. The habitats were generally created at depths ranging between 7 to 20 m with 1-3 inches thickness of shells. Spat collectors set in 2001 were retrieved in the fall of 2002 and Iceland scallop spat were removed and used to seed the created habitats. Monitoring of the scallop habitat is scheduled to begin in 2003.

Artificial Reefs and Eelgrass Transplants

Husky Oil Operations Ltd., on behalf of the White Rose Offshore Oil Development Project, has undertaken a multi-year fish habitat compensation program associated with the creation of multi-species artificial reefs and eelgrass transplants. Husky Oil conducted baseline studies in 2002 to locate suitable sites for the placement of artificial reefs and transplanting of eelgrass. Habitat creation is scheduled to begin in 2003, with test transplanting of eelgrass in selected locations.

b) Environmental Effects Monitoring Studies (EEM)

Terra Nova Offshore Oil Project

The Terra Nova offshore oil field is situated on the Grand Banks, approximately 350 km east-southeast of St. John's and 35 km southeast of the Hibernia Oilfield. The Terra Nova Oilfield is being developed using a floating production, storage and offloading (FPSO) facility and a semi-submersible drilling rig. A total of 24 wells will be drilled through seven sub-sea templates, located in five glory holes to protect them from iceberg scour. Trenched and bermed flowlines connected to flexible risers will link the sub-sea installations to the FPSO.

An EEM program was designed, with input from DFO. A Baseline Characterization program was conducted in 1997 and the first year of the operational EEM program was conducted in 2000. The third year of the EEM program was conducted in the summer of 2002, the results of which have been submitted to Department and are currently under review.

White Rose Offshore Oil Project

Husky Energy (Husky) and its co-venturer, Petro-Canada, have been sanctioned to develop the White Rose offshore oilfield located approximately 350 km east-southeast of St. John's and 50 km from both the Hibernia and Terra Nova oilfields. Similar to The Terra Nova Development, the White Rose development will use a FPSO vessel to provide production facilities and a semi-submersible drill rig will be employed to drill up to 25 wells from up to four well heads.

In the fall of 2000 Husky undertook a Baseline Characterization Data Program to collect data to describe the baseline conditions prior to the White Rose development. The function of this program is to build the foundation of information for the drilling and production phase associated with the development of an EEM program. The Baseline Characterization Data Report was submitted to the Department in October 2001 and a thorough review was conducted. DFO will continue to contribute to the development and review of the White Rose EEM Program.

Newfoundland Transshipment Terminal

The Newfoundland Transshipment Terminal (NTT) was constructed to serve as a temporary storage and transshipment facility for crude oil from the Newfoundland offshore. The marine facilities for this project include a causeway, tug basin, approach trestle, jetty with berthing and two loading platforms with marine topside facilities (crude transfer and control system).

The first operational EEM field program was conducted in August 2000. After submission of the 2000 EEM report, it was determined that the second and third years of the post-operational EEM Program would be postponed until 2002 and 2003 respectively, based upon the actual and projected reduction in vessel traffic to the terminal in 2001. It was agreed by all regulatory agencies that information gained from the 2002 and 2003 monitoring seasons would be more reflective of routine facility operations. Results from the 2002 monitoring will soon be submitted to DFO for review.

c) Marine Classification (Subareas 2 and 3)

Marine Environment and Habitat Management (MEHM) Division has been developing a marine habitat classification system that will provide a standardized approach for conducting environmental assessments on projects having potential impacts on fish and fish habitat. A literature review and compilation of information on the habitat requirements of a variety of marine species (finfish, shellfish

and invertebrates) occurring in Newfoundland and Labrador has been undertaken, with major emphasis on those species supporting commercial, recreational and/or aboriginal fisheries or providing important food sources for such species. Following this, methodologies and descriptions to characterize the biophysical environment of coastal areas were formulated. Most recently, a field ground-truthing program was conducted to determine the effectiveness of these habitat description procedures.

d) Seismic (Subareas 2 and 3)

Building on a literature review conducted by MEHM in 2001, an Environmental Studies Research Fund (ESRF) project is currently underway in DFO Newfoundland and Labrador Region, to identify and map key spawning and nursery areas for 12 commercial finfish species on the Newfoundland Grand Banks (specifically NAFO areas Div. 3LMNO and Subdiv. 3Ps). Spawning times will also be identified. This initiative stems from increased petroleum exploration activity in the Newfoundland offshore area. For environmental assessment processes and ocean planning in general, the atlas will be useful to scientists, habitat managers, regulators, industry, consultants and fishers. It is anticipated that work will be completed by mid-2003.

Currently, there is scientific uncertainty associated with potential impacts of seismic testing on the marine environment. Habitat managers are lacking a nationally consistent scientific basis for evaluating the potential environmental consequences of seismic surveys. To help address this point, a DFO National Science Advisory Meeting was held in March 2003, to develop a science-based decision framework for assessing seismic survey referrals. A national list of factors to be considered was developed for the seismic referral review process however, more work is required before the decision framework is operable. It is anticipated that an additional meeting will be held during this fiscal year to further develop the framework. Workshop proceedings are currently being developed and will be published as a DFO Technical Report. This Report will identify research needs.

e) Aquaculture

A series of *National Aquaculture Site Application Guides*, including i) Interim Guide to the Application of Section 35 of the *Fisheries Act* to Salmonid Cage Aquaculture Developments; ii) Interim Guide to Information Requirements for Environmental Assessment of Marine Finfish Aquaculture Projects; and iii) Interim Guide to Information Requirements for Environmental Assessment of Marine Shellfish Aquaculture Projects were presented across the country in February 2002. To facilitate the introduction of these national guides, MEHM consulted with other sectors within DFO, the aquaculture industry, and the Provincial Department of Fisheries and Aquaculture (DFA). These consultations, coupled with a literature review funded by the Aquaculture Collaborative Research and Development Program (ACRDP), for NL aquaculture operations enabled MEHM to better adapt the national guides to the NL marine environment. These information requirements have since been fully integrated into the provincial aquaculture application system.

SUBAREA 4

A. Status of the Fisheries

Nominal landings from 1990 to 2002 for fish stocks are listed in Table 1. Additional information on the status of the fisheries is as follows:

a) *Snow Crab* – 4R

Catches in Div. 4R in 2002 (1 850 tons) increased slightly from 2001 (1 675 tons). The commercial catch rate has remained stable over the past 4 years at a lower level than in other divisions. There are no research data available from this Division.

b) *Iceland scallops* – 4R

The nominal catch from the Strait of Belle Isle (Div. 4R) in 2002 is estimated at 248 tons (round) against a TAC of 1 000 tons. CPUE in 2002 decreased by 13 % from the previous year. The fishery here continues to be

driven by the exploitation of an accumulated biomass consisting largely of cohorts of old, possibly well separated year-classes with little potential for further growth. No significant larval settlement or recruitment has been detected in recent years. Fishing activity in high density scallop aggregations causes high collateral mortality to scallop spat and appears to have had a significant effect on recruitment dynamics in the area.

SUBAREAS 2 + 3 + 4

A. Status of the Fisheries

Nominal landings from 1990 to 2002 for fish stocks are listed in Table 1. Additional information on the status of the fisheries is as follows:

a) *Lobster*

Landings declined through the 1990s to 1 756 tons in 2000 from a long-term high of 3 207 tons in 1992. Preliminary figures indicate increases in the past two years to 2 275 tons in 2002 primarily in Div. 4R LFAs and LFA 11 in Subdiv. 3Ps while in most LFAs around the island landings remain low following the recent downward trend. The fishery is monitored at a few localized sites through co-operative arrangements with harvesters to complete logbooks and conduct at-sea sampling of commercial catches. The fishery is characterised by high exploitation rates and a size limit that is small in relation to growth rate and size at maturity. Yield per recruit analysis demonstrates growth overfishing with potential substantial increases in yield through reduction in exploitation rate or an increase in size limit. Egg per recruit analysis indicates a sufficiently low level of egg production under the current management regime to suggest a high risk of recruitment failure under unfavourable environmental-ecological conditions. While egg per recruit has been increased substantially as a result of the 1.5 mm carapace length size limit increase implemented in 1998, the doubling objective of the 1998-2002 Management Plan has not been achieved. The limited at-sea sampling indicates that v-notching has not been practiced in the fishery overall to the extent expected in the plan. With a strong environmental-ecological influence on recruitment and a system limited by low egg production, fluctuations in annual landings will be especially subject to environmental variability. Future landings can be expected to be lower, on average, and less stable than under a management regime with a lower level of exploitation.

B. Special Research Studies

1. **Sentinel Surveys**

The Sentinel Surveys, initiated in October 1994, were continued in 2002. Data collected were tabled at regional stock assessments in the autumn of 2002 for Subdiv. 3Ps and at the zonal cod assessment in February 2003 for 2J+3KL. Sites in 2J+3K3L, 3Ps and 3Pn4Rs were sampled by inshore fish harvesters using traditional fishing gears based on historic fishing patterns. The objectives of the program are: to develop a reliable inshore catch rate, length frequencies, sex, maturity, and otolith series for use in resource assessment; to incorporate the knowledge of inshore fish harvesters in the process of resource assessment, to describe temporal and spatial inshore distributions; to establish a long-term physical oceanographic and environmental monitoring program of the inshore area; and to provide a source of biological material for other researchers for genetic, physiological, food and feeding, and toxicological analyses.

2. **Gear and Selectivity Studies**

a) *Comparative trawl studies: Canadian and Spanish Campelen survey trawls*

Comparative fishing studies were conducted on the southern Grand Bank in 2002 with EU-Spain to determine the efficiency of the Canadian Campelen bottom survey trawl and the Spanish Campelen bottom survey trawl. Two vessels were involved in the comparison, the new Spanish research vessel, *R/V Vizconde de Eza* and the Canadian vessel *CCGS Wilfred Templeman.*

Eighteen side-by-side parallel hauls were completed. But the analyses have not been completed. Further comparative fishing will occur in 2003.

b) *Herding efficiency of the Canadian Campelen survey trawl*

Experimental fishing trials were carried out in 2002 to measure the herding (bridle) efficiency of the Campelen 1800 shrimp trawl which is used during the annual bottom trawl surveys of the Grand Bank. At each of 9 stations in Div. 3N three fishing tows were made over the same ground with the trawl rigged with varying bridle lengths (20 m, 40 m and 80 m in a randomized fashion) using the alternate haul method. Only American plaice and yellowtail flounder were present in sufficient quantities. Preliminary analysis shows that there is no difference in the catch rates of either species, although it should be kept in mind that the number of sets are small. Further trials will be carried out in 2003 and expanded to include cod.

OTHER RESEARCH INFORMATION NOT SPECIFICALLY DELINEATED BY SUBAREA

A. Oceans Management

In 1997, the federal government adopted the *Oceans Act*, which committed the Department of Fisheries and Oceans to prepare an Oceans Management Strategy. The Government of Canada publicly released Canada's Oceans Strategy on July 12, 2002. Based on the authority and direction set out in the *Oceans Act*, Canada's Oceans Strategy sets out the policy direction for modern oceans management in Canada. The strategy is based on the principles of sustainable development, integrated and collaborative management, and the precautionary approach and is supported by three main programs - Marine Protected Areas, Integrated Management, and Marine Environmental Quality.

a) Marine Protected Areas Program

Currently three sites in the region have been identified as Areas of Interest (AOIs), or candidate sites, in the Marine Protected Areas (MPA) Program.

i) Proposed Eastport Marine Protected Area (Subarea 3)

The waters surrounding Round Island and Duck Islands (approximately 2 km^2) off the Eastport Peninsula in Bonavista Bay were proposed as potential MPA sites by the Eastport Peninsula Lobster Protection Committee and were collectively announced by the Minister as an AOI in October 2000.

In 2002 multilateral consultations were held with stakeholder groups including local municipalities, the Kittiwake Economic Development Association, FFAW, Provincial Department of Fisheries and Aquaculture, and Parks Canada. A Steering Committee was formed to work with DFO in the further evaluation and development of the sites.

A Seabed Imaging and Mapping System survey was conducted within the proposed MPAs to identify and quantify critical habitat. This system utilizes a towed underwater video system which obtains geo-positioned imagery of the seabed, and software is used to classify the images according to substrate and biota.

Following a review of existing biophysical and socio-economic information and a technical assessment of the merits of the proposed sites, a Recommendation was prepared with the support of the Steering Committee suggesting that a MPA was the most suitable management option. The Minister approved the Recommendation in March 2003, and the project will now proceed with management planning as per Step 4 of the National Framework for Establishing and Managing MPAs (1999).

The Joint Project Agreement between the Department and local fishers was also renewed for another five years. This will ensure continued interim protection for commercial species through area closures while the MPA management plan and regulations are being developed, and maintain the lobster management area boundary.

ii) Proposed Leading Tickles Marine Protected Area (Subarea 3)

The Leading Tickles – Glovers Harbour Fisherperson's Committee and the Town of Leading Tickles proposed that the surrounding area in Notre Dame Bay (approximately 50 km^2) on the northeast coast be considered in the MPA Program.

In June 2001, the site was officially announced as an AOI. A Steering Committee was formed following bilateral consultations with potential stakeholders including the Exploits Valley Economic Development Corporation, Provincial Department of Fisheries and Aquaculture, and the Lewisporte Yacht Club. This committee is co-chaired by DFO and a fisher, and will further evaluate the site's potential as a MPA under the *Oceans Act* and develop a management plan.

Oceans staff conducted groundtruthing of QTC View 4 substrate data collected previously during a multibeam bathymetric survey in partnership with the Canadian Hydrographic Service (CHS). Clusters of sites from various acoustic classes were sampled for similarities using underwater video, aquascope, and benthic grab samples. This information is being used to classify and map habitat within the proposed MPA and identify critical habitats and species associations.

In March 2003, the Steering Committee held a Strategic Planning Session to develop the framework for a management plan. Several species were identified for protection, including lobster (*Homarus americanus*), Atlantic herring (*Clupea harengus harengus*), capelin (*Mallotus villosus*), and winter flounder (*Pleuronectes americanus*). Proposed closed area boundaries and gear restrictions were also identified. The Steering Committee intends to pursue the implementation of these closures with the Department using the Fisheries Act to provide interim protection while the MPA is being developed.

iii) Proposed Gilbert Bay Marine Protected Area (Subarea 2)

Gilbert Bay is located on Labrador's southeast coast, approximately 300 km from the town of Happy Vally-Goose Bay. The geophysical configuration of the bay contributes to its unique character through semi-isolation from the Labrador Sea. Gilbert Bay is approximately 60 km^2 in area.

Since 1996, scientists from Memorial University of Newfoundland have been studying the cod (*Gadus morhua)* found in Gilbert Bay. They discovered a resident sub-population of Northern cod that are genetically distinct from other Labrador cod. Tagging and tracking of this reddish-brown cod has been used to identify spawning and rearing areas of the cod and has confirmed that the species remain in the bay year round.

The communities of Port Hope Simpson and Williams Harbour (with the support of local fisheries committees) submitted a proposal asking DFO to establish a MPA in Gilbert Bay, and following a favourable review, the site was identified as an AOI in October 2000.

In 2002, the Gilbert Bay AOI Steering Committee completed analysis of the biophysical and socio-economic assessments and concluded that a MPA was the best management option for the site. A Recommendation to the Minister was prepared suggesting that the project move ahead with management planning and proceed to Step 4 of the National Framework for Establishing and Managing MPAs (1999). The Minster subsequently approved the recommendation in March 2003, and the Steering Committee has begun drafting a management plan including a regulatory package.

DFO partnered with the Labrador Metis Nation to hire a community coordinator in February 2003. The coordinator will provide assistance to the Steering Committee and develop a public awareness program for the area.

Scientific research conducted in Gilbert Bay during 2002 was a continuation of research initiated in 1998. Primary research activities involved conducting a tag/recapture program, collection of cod eggs, larva and pelagic juveniles, and the collection and analysis of zooplankton. Based on this research scientists from DFO and Memorial University of Newfoundland were able to estimate the population of Gilbert Bay cod. The results of this analysis has been peer reviewed and will be published a Canadian

Science Advisory Secretariat document. In October 2002, a multi beam survey was completed in Gilbert Bay through a partnership with the Canadian Hydrographic Service.

b) Integrated Management Program

The *Oceans Act* calls for the Minister of Fisheries and Oceans to lead and facilitate the development and implementation of plans for the Integrated Management (IM) of all activities or measures affecting estuaries, coastal and marine waters. IM is a proactive approach towards sound ocean management. It is an ongoing and collaborative planning process that brings together interested parties, stakeholders, and regulators to reach general agreement on the best mix of conservation, sustainable use, and economic development of coastal and marine areas for the benefit of all Canadians.

Considerable work has been done in relation to IM in the Region. In Conception Bay South, biophysical and socioeconomic overviews have been compiled, based on existing knowledge. A visual environmental profile has been drafted. Issues and potential conflicts have been identified and meetings with stakeholders have been conducted.

In the Bay D'Espoir/Connaigre Peninsula area, consultations with stakeholders have identified issues and concerns, which have been documented in a report as a basis for pursing IM planning on the area.

In the Placentia Bay area, an extensive bibliography of existing information has been compiled. Biophysical and Socioeconomic Overviews have been written and combined into one concise document entitled, *An Ecosystem Overview of Placentia Bay, Newfoundland*. The ecosystem overview demonstrates the linkages between the biophysical and socioeconomic components as well as highlights the ocean management issues and concerns in Placentia Bay. The identification of environmentally sensitive and significant areas in Placentia Bay has been conducted, based on traditional ecological knowledge of local fishers and DFO Fishery Officers. A brochure and an interactive CD-ROM have been drafted to visually display the information collected to date in Placentia Bay and meetings with stakeholders have been conducted.

i) Community Coastal Resource Inventories

DFO has been working with community groups throughout coastal Newfoundland and Labrador to document and map coastal resources since 1996. Information documented in these Community-Based Coastal Resource Inventories (CCRIs) is largely traditional ecological knowledge collected through an interview process with local community members who have knowledge of coastal resources based on their long-term interaction with these resources. The entire coastline of the island of Newfoundland has now been inventoried under this program as well as the coast of Labrador from the Quebec border to Smokey, including Lake Melville. Typically, information collected includes, but is not limited to, resource distribution (groundfish, pelagics, shellfish, aquatic plants, marine mammals and birds), infrastructure, culture, tourism and recreation, aquaculture and shoreline classification.

All information is maintained in a Geographic Information System (GIS) with associated databases.

ii) Coastal Management Areas (CMA) – Bay of Islands and Northern Peninsula

Bay of Islands

Oceans Management continued to foster the development of coastal management plans within western Newfoundland. Stakeholder consultations and information exchange have been used to identify issues and concerns with respect to integrated coastal management particularly within the Bay of Islands and the western half of the Northern Peninsula.

Within the Bay of Islands a productive partnership with the Atlantic Coastal Action Plan (ACAP) group located within the Humber Arm / Bay of Islands area continued. Since 1991, DFO has worked with ACAP Humber Arm Inc. and member stakeholders to develop the concept of integrated management planning. This has included development of an ecosystem overview, completion of a community coastal resource inventory, identification of coastal management concerns and opportunities, development and revision of a Comprehensive Environmental Management Plan, and the

development and implementation of coastal zone management education and information sharing initiatives. Activity within 2002/03 included working with ACAP and its member stakeholders to continue the development and implementation of community education and information sharing initiatives, the coordination of consultations with stakeholders to determine the requirement to revise the Comprehensive Environmental Management Plan (CEMP), a comparative analysis of the CEMP, and the procedural steps for integrated management as outlined within the "National Policy and Framework for the Integrated Management of Estuarine, Coastal and Ocean Areas".

Northern Peninsula

This is a community based coastal planning initiative which involves a partnership between the Department of Fisheries and Oceans, local economic development agencies, and their associated stakeholder groups. This initiative covers the western portion of the Northern Peninsula from Cape St. Gregory to Cape Bauld including communities from Trout River to Lanse aux Meadows located within Subdiv. 4Ra and 4Rb of NAFO Div. 4R.

The long term objective of this cooperative initiative is to encourage proactive, integrated management planning with key stakeholders to deal with issues related to coastal infrastructure requirements, fishing activity, increased coastal development, and multiple uses of coastal resources identify stakeholders and key coastal issues, and avoid potential conflict.

To date progress has been made with respect to the development of a community based coastal resources inventory of the area and a comprehensive list of stakeholders, and bilateral meetings/interviews with selected stakeholders to identify and discuss coastal planning issues and potential conflicts.

Work will continue on this initiative and it is anticipated that a coastal planning committee made of representatives from DFO, local stakeholders, interested parties, coastal communities and other government departments will be established. The role of this committee will be to educate and inform local groups as to the objectives and process of Integrated Management and to further guide the development of an integrated management plan for coastal activities within this portion of western Newfoundland.

iii) Sensitive and Significant Areas Identification and Mapping

Inshore

Investigations into sensitive and significant areas have been conducted in Placentia Bay and the Gulf of St. Lawrence to deal with concerns and issues for specific areas in Newfoundland and Labrador and to provide management options. Considerations for such undertakings include critical habitats such as spawning or juvenile rearing areas, feeding sites, important migration corridors, both the shoreline, nearshore and offshore areas, various fish and shellfish species, marine plants, marine mammals, and seabirds. The information collected has been compiled and stored in a format that will facilitate ready retrieval and display in a spatial or mapping format, and will complement the information that has already been collected through the CCRI program.

The information collected through the CCRIs and the investigations into sensitive and critical areas provides a basis for integrated management of coastal areas by identifying priority areas and engaging stakeholders in the communities. Additionally, the information is valuable for environmental assessment, sensitivity mapping for emergency response planning, and is used by coastal communities for sustainable economic planning.

Within western Newfoundland (i.e. NAFO Div. 4R) Oceans staff, in collaboration with personnel from Quebec and Gulf regions, have begun to evaluate and review available information on sensitive areas to identify and describe ecologically and biologically significant areas within the coastal and offshore areas of the Gulf of St. Lawrence. These ecologically and biologically significant areas represent marine spaces which through their physical, chemical, biological and geological characteristics offer

habitat important for one or more species of aquatic animals and that they appear to provide or represent:

- Areas of important /significant biodiversity and/or biological productivity;
- Particular ecological communities;
- Conditions suitable for the development, maintenance or general survival (e.g. spawning, feeding, nursery, etc.) of individuals in a population or species;
- Contain/support endangered species; and
- Contain/provide particular oceanographic conditions/mechanisms (e.g. underwater coastal shelves, coastal upwellings, etc…).

It is anticipated that the Ecologically and Biologically Significant Areas (EBSA) listing will provide information for use in the integrated management of coastal and offshore areas within the Gulf of St. Lawrence. In addition, the EBSA information will be used in the future identification of potential Marine Protected Areas within western Newfoundland and the Gulf of St. Lawrence.

Offshore

Under the *Oceans Act*, DFO is responsible for the conservation and protection of marine areas with high biodiversity and biological productivity. In the offshore, the Grand Banks were selected as a study area due to the increasing activity related to hydrocarbon exploration and development. Leases held by oil and gas industry have been overlaid on DFO data from the Newfoundland Fishery Observer Program and Groundfish Scientific Surveys. Eighteen commercially significant groundfish species are identified using data from 1980-2000. The extracted data will be spatially represented using SPANS GIS Software. Upon completion, resulting maps would be stored in several mediums including CD and web-based applications. Identifying these areas is an important step toward effective oceans planning and management in the offshore area.

c) Marine Environmental Quality Program

The overall objective of the MEQ program is to provide sound advice to decision-makers for ecosystem-based planning and management. Initially the program has focused on building an ecosystem knowledge base, and GIS tools, to assist in identifying relationships between the human activities we plan to manage, and environmental conditions that affect existing or intended uses of the marine environment.

i) Marine Environmental Quality Profiles

A generic MEQ profile has been developed for the region, providing background information on major issues, and a summary of the existing data that has been compiled for the region. Currently six draft profiles have been developed for sites of interest in the MPA and IM programs using this generic profile as a template.

ii) Contaminant Database

The identification and characterization of marine sewage outfalls in the region has been given a high priority. Considerable effort has also been focused on compiling an electronic database of chemical contaminants in marine sediments from hard copy reports collected by various government departments over the past 30 years, largely in association with harbour dredging programs. This database provides information on more than 38 chemical parameters in 119 harbours around Newfoundland and Labrador. The development of a database of potential point sources of contaminants has also been given priority, particularly for the IM and MPA sites.

GIS tools are under development to display MEQ data, and help to assess possible linkages between the condition of the environment (i.e. contaminant levels), potential threats (i.e. point sources of contaminants) and possible effects (i.e. shellfish closures or algal blooms) by superimposing relevant map layers. An MEQ atlas is being developed on a shared drive using Map-Info to display all the data collected for the MEQ profile as well as other relevant data such as fish resources and sensitive areas.

A draft CD has also been developed in partnership with Environment Canada using a simulated GIS software package to display MEQ data for the region.

As our understanding of our complex marine ecosystems continues to advance, the program will begin to focus on the establishment of MEQ objectives, indicators, and reference points in association with regional oceans management initiatives. Key activities will include the development and implementation of monitoring programs linked to specific management actions designed to ensure that the objectives are met.

iii) Marine Environmental Quality Demonstration Project

The *Oceans Act* initiated a new integrated approach to management of Canada's oceans, calling for consideration of the impacts of all human activities on marine ecosystems, and the establishment of guidelines, and objectives in relation to marine environmental quality (MEQ). The Bay of Islands was chosen as one of several *MEQ Demonstration Projects* initiated this year within the Gulf of St. Lawrence, to demonstrate the role of MEQ within integrated management planning. This project will initially focus on water quality issues in York Harbour and Lark Harbour, however as the project evolves, it is expected to address other areas within the Bay as well as other issues.

The short-term goals of this demonstration project include:

- Engage stakeholders and establish MEQ Objectives in relation to water quality issues.
- Identify and map specific *areas of concern* in relation to water quality within the Bay.
- Identify, characterise, and map sources contributing to water quality degradation, for each of the *areas of concern* within the Bay.
- Undertake a water/sediment quality monitoring program at *areas of concern* impacted by bacterial contamination, to assess the level of contamination, and differentiate sources.

The more long term objectives of the demonstration project which will be continued in 2003/04 include the following:

- For each *Area of Concern*, develop indicators and associated reference points which reflect existing and desired conditions in the local area.
- Identify specific management actions required to meet these objectives, which can be implemented if reference points (limit/targets) are exceeded.
- Establish a monitoring program to measure the performance of each indicator.
- Undertake the required management actions, drawing upon the relevant regulatory regime and stakeholders. Approach funding agencies for support, if necessary.

This is a collaborative project which intends to demonstrate how government agencies, community groups, and other interested individuals can work together - in an Integrated Management framework - to plan how to improve marine water quality in this case within Lark Harbour and York Harbour.

Table 1. Summary of preliminary catches for stocks within the DFO, Newfoundland and Labrador Region, 1990-2002.

			Catch (t)												
Subarea	**Species**	**Division**	**2002**	**2001**	**2000**	**1999**	**1998**	**1997**	**1996**	**1995**	**1994**	**1993**	**1992**	**1991**	**1990**
0+1	Greenland halibut	0B+1B-F	2,511	3,181	2,615	3,556	3,300	1,700	1,453	5,852	3,723	2,561	8,200	5,945	6,194
	Shrimp	0A	6,247	3,611	1,588	2,046	933	517	2,623	2,361	4,727	5,501	7,493	6,788	6,177
		0B	5,571	6,326	5,383	5,132	5,204	5,670	3,220	3,564	476	106	1,291	1,107	1,609
2	Cod	2GH	0	0	0	0	0	0	0	0	0	3	0	0	400
	Shrimp	2G (SFA 4)	7,944	8,195	7,206	7,961	8,051	5,217	5,160	5,104	3,982	2,723	2,706	2,561	2,945
		2HJ (SFA 5)	14,669	15,052	14,777	15,028	15,170	15,103	7,383	7,616	7,499	5,719	6,315	6,118	5,360
		2HJ3K (SFA 6)	59,943	52,599	63,074	51,028	46,337	21,246	10,923	10,914	10,978	8,035	6,609	5,500	5,598
	Crab	2J	3,522	3,756	3,794	5,448	4,061	3,166	3,090	3,178	2,978	2,275	1,529	989	645
	Iceland scallop	2HJ	253	179	194	701	1,295	1,027	360	167	340	401	103	7	50
2+3	Redfish	2+3K	35	41	28	2	3	4	2	1		2	9	161	1,806
	Greenland halibut	2+3KLMNO	6,292	8,235	10,637	4,124	4,081	5,877	5,891	3,229	2,928	4,899	6,933	6,664	9,129
	American plaice	2+3K	100	132	67	6	6	2	16	28	16	77	103	494	1,770
	Witch	2J+3KL	166	151	92	2	1	6	4	10	11	343	1,632	2,430	2,825
	Cod	2J3KL	4,196	6,887	4,817				350	330	1,309	3,938	24,356	120,135	204,900
	Grenadier	2+3	272	212	234	145	209	98	225	125	130	614	992	365	152
	Capelin	2J3KL (offshore)	0	0	0	0	0	0	0	0	0	0	0	450	57,170
	Squid	2+3	224	23	328	19	815	12,748	8,285	48	1,954	276	924	1,719	4,440
3	Redfish	3LN	48	24	32		7	19				46	657	362	958
		3M	0	0	0									1	
		3O	2,988	4,532	880	1,990	6,121	1,895	128	24	1,192	677	845	173	5,131
	Yellowtail	3LNO	9,958	12,240	9,425	5,540	3,536	1				6,265	6,369	6,257	4,754
	American plaice	3LNO	1,378	1594	622	269	204	71	47	65	59	7,454	9,663	22,510	22,344
		3Ps	1,011	877	607	542	405	213	112	80	112	723	2,380	3,982	3,880
	Witch flounder	3NO	26	12	4	24	4	18			437	3,971	4,093	2,457	2,499
		3Ps	518	444	331	461									
	Atlantic halibut	3	365	317	183	124	165	152	101	107	36	138	114	231	165
	Cod	3NO	424	506	172		306	289	54	31	3	3,719	5,232	5,456	7,222
		3Ps	12,234	12,818	19,652		15,664	7,518	520	337	574	13,519	21,845	24,693	23,048
	Haddock	3LNO	33	88	70		14	190	28	9	0	675	598	708	1,423
		3Ps	115	99	163		191	69	118	48	20	86	251	263	232
	Pollock	3Ps	486	808	710		428	592	435	248	59	113	437	1,188	1,060
	Capelin	3L	8,617	13,898	12,041	11,403	19,809	3,560	16,840	100	890	23,480	3,160	22,310	48,000
		3K	1,553	5,022	4,066	7,254	10,225	9,230	8,920	30	70	13,525	19,350	20,000	35,140
	Shrimp	3M	8	293	618	490	469	785	906	970	1,041	3,724			
		3L	5,445	4,983	4,025										
	Sea scallop	3KLNO	unavailable	0	0	0	6	20	27	9	10	9	6	13	5
		3Ps	398	333	85	70	266	9	8	418	534	483	0	167	289
	Iceland scallop	3LNO	0	39	335	138	1,310	3,986	9,454	6,501	3,941	817	22	-	-
		3Ps	484	479	1,148	1,197	2,792	5,367	608	1,061	440	667	5,967	755	507
	Crab	3K	16,352	15,277	15,431	21,470	16,788	14,830	14,190	12,245	11,039	9,760	7,295	7,675	4,253
		3LNO	30,058	28,154	26,857	32,725	23,533	22,185	16,656	13,790	12,237	8,979	6,652	6,394	5,211
		3Ps	7,636	7,843	7,917	7,909	6,615	4,753	3,047	1,853	1,590	704	121	176	596
	Atlantic salmon	2J3KLPs+4R	40	39	30	38	45	82	114	95	133	126	213	353	498
	Arctic Charr	2J3KLPs+4R	21	33	47	41	38	38	16	30	31	38	74	70	100
3+4	Redfish	3P+4V	3,289	2,506	4,439	5,335	4,101	3,825	4,566	3,978	7,594	9,350	4,635	6,628	6,227
4	Iceland scallop	4R	248	638	1,083	1,058	1,348	1,205	1,204	1,497	2,294	2,122	1,296	457	88
	Sea scallop	4R	unavailable	0	1	0	0	0	0	2	37	0	0	3	19
	Crab	4R	1,850	1,675	1,640	1,612	1,064	969	833	920	655	-	-	-	-

Note: Newfoundland and Labrador landings only