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Canadian Research Report for 2004

PART I. Newfoundland and Labrador Region submitted by **D. R. Osborne,** Fisheries and Oceans, Newfoundland and Labrador Region, P. O. Box 5667, St. John's, NL A1C 5X1

PART II. Central and Arctic Region prepared by **Margaret Treble, Larry Dueck and Sue Cosens**, Department of Fisheries and Oceans, 501 University Crescent, Winnipeg, Manitoba R3T 2N6

PART I. NEWFOUNDLAND AND LABRADOR REGIONAL

SUBAREAS 0 AND 1

A. Status of Fisheries

Nominal landings from 1994 to 2004 for fish stocks are listed in Table 1. Additional information on the status of the fisheries is as follows:

a) ***Greenland Halibut* – Subareas 0 + 1** (except Div. 1A inshore)

The Greenland halibut resource within Subareas 0+1 is considered to be part of a common stock distributed in Davis Strait and south to Subarea 3. The resource within the area, with the exception of Div. 1A inshore, is managed jointly by Canada and Denmark (Greenland), with the TAC being split equally. Since 2000, NAFO Scientific Council has provided separate TAC advice for offshore areas of Div. 0A+1A based on the unresolved relationship with the remaining areas. In 2003, the Scientific Council advised that Div. 1B be included in the management area with Div. 0A and Div. 1A, based on the bathymetry of Baffin Bay and its proximity to the NAFO boundaries of Div. 0A, 1A. The subsequent advice from the NAFO Scientific Council was a catch in 2004 of 8 000 tons for 0A+1AB offshore and 11 000 tons for 0B+1C-1F. Canada (NL) catches for 2004 were approximately 4 000 tons; with 2 300 tons taken by otter trawls, 1 400 tons taken with gillnets and 300 tons taken by longline. Recent scientific information on this stock is limited. The most recent surveys were completed in Div. 0A and 0B in 2001 and Div. 1C and 1D in 2003. In 2004, Scientific Council advised for 2005 a TAC of 8 000 tons for Greenland halibut in Div. 0A+1AB and 11 000 tons for Div. 0B and 1C-1F.

b) ***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. The quota increased to 12 040 tons during 2001, to 14 167 tons during 2002 and subsequently to 18 417 tons during 2004. The 2004 quota will remain in effect through 2005. Annual catches of 4 800-7 500 tons were made between 1991 and 1994 and have since fluctuated between 500 and 6 700 tons.

Catches of *Pandalus borealis* in Div. 0B increased from about 2 800 tons in 1988 to 3 000 tons in 1989, but had declined to 100 tons by 1993. The 1994 catch was less than 500 tons. Annual catches increased to over 3 600 by 1995 and more than 5 000 tons over the 1997-1999 period. Subsequently, annual catches have fluctuated between 4 200 and 6 000 tons.

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 3500 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°W. This quota for *Pandalus borealis* was maintained in 2003 and 2004 while a new exploratory quota of 2000 tons was allotted for *P. montagui*. The exploratory quota for *P. montagui* was to be fished within the Nunavut Settlement Area (NSA).

CPUE models are not produced for this management area because their utility would be compromised by changes in resource management plans and fishing patterns, as well as the high degree of overlap in distribution of *Pandalus borealis* and *P. montagui*.

SUBAREA 2

A. Status of Fisheries

Nominal landings from 1994 to 2004 for fish stocks are listed in Table 1. Additional information on the status of the fisheries is as follows:

a) ***Atlantic salmon*** **– Subarea 2**

The commercial fishery remained closed for 2004. Approximately 9 700 salmon were retained or hooked and released in the recreational fishery. Preliminary information on food fishery catches indicated that about 31 tons of salmon were harvested in 2004.

b) ***Arctic charr*** **– Subarea 2**

Commercial landings of arctic charr from north Labrador in 2004 were approximately 19 tons, essentially the same as those in 2003. Catch rates have remained moderately high in the three primary stock complex areas. Over the past 31 years (1974- 2004), more than 2700 tons of charr have been harvested from a limited section of the north Labrador coast, and attests to the capacity of this area to produce fish. Preliminary information on the amount of charr harvested for subsistence (food) purposes in 2001, 2002, and 2003 are: 6 tons, 13.3 tons, and 9.6 tons, respectively and are believed to be underestimates of the full extent of subsistence harvesting.

c) ***Cod*** **– Div. 2GH, Div. 2J+3KL**

The cod stock in Div. 2GH has been under a moratorium with respect to directed fishing since 1996. Landings (directed or by-catch) by Canada (NL) have been extremely low (<1 ton) since 1991.

The northern (Div. 2J+3KL) cod stock was closed to directed commercial fishing in 1992. A small directed commercial fishery was reopened in the inshore only during 1998-2002. In April 2003 the whole stock area was closed indefinitely to directed commercial and recreational fishing. Monitoring by means of limited fishing by fish harvesters at specific sites (sentinel surveys) continues. Reported landings during 2004 were approximately 520 tons of by-catch from commercial fisheries and 120 tons from the sentinel surveys, for a total of 640 tons. Most of the by-catch came from the winter flounder fishery in shallow inshore waters.

The Div. 2J+3KL cod stock was assessed in March 2005. The stock as a whole is at a very low level. In the offshore, the 2004 research bottom-trawl surveys during both spring (Div. 3L only) and autumn indicate that the biomass remains near the very low levels recorded during the mid-1990s. Prospects for recovery in the offshore remain very poor because of very low spawner biomass and extremely high mortality. In the inshore, the biomass of populations in the central area (Trinity Bay to Notre Dame Bay) increased from the start of monitoring in the mid-1990s to a peak in about 1998, but declined by about half from 1998 to 2003 as a result of fishing mortality, high natural mortality on adults, and weak recruitment. The biomass has increased during the most recent two years as a result of reduced fishing mortality and improved recruitment, but is still below the peak in the late 1990s.

d) ***American plaice* – Subarea 2 + Div. 3K**

The stock of American plaice in Subarea 2 + Div. 3K remains at a very low level. There was no directed fishery on this stock in 2004. By-catch has increased since 1999, due mainly to by-catch in the Greenland halibut fishery. The composition of the American plaice by-catch in this fishery is composed mainly of sexually mature females. Research vessel surveys indicate that the stock size is currently about 3-5% of the values measured in the early 1980s. Stock size has remained at this low level for several years following the closure of the directed fishery. Changes in the distribution of the fish were observed in the mid- to late 1980s, and size and age at maturity declined through the mid 1990s but has stabilized since then. Since the stock did not recover when catch levels were very low (mid to late 1990s), commercial catches do not appear to be a major contributor to the high mortality estimated in this stock. This is supported by recent catch/biomass ratios of less than 1%. Further, with no strong year-classes present in the population and relatively high mortality rates, the prospects for stock rebuilding continue to be extremely poor.

e) ***Redfish* – Subarea 2 + Div. 3K**

This stock has been under moratorium to directed fishing since 1997. Prior to this, there had 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 19 tons in each year from 1992-1997 and were between 12-190 tons for the period 1998-2000. Catch increased rapidly to 1 600 tons in 2001, with further increases to 3 200 tons in 2002 and 5 000 tons in 2003. The increases beginning in 2001 were from non-Canadian directed fisheries outside the 200-mile limit utilizing large midwater trawls. It is assumed these catches were from the pelagic stock of redfish that resides primarily in the Irminger Sea between Greenland and Iceland. This stock is managed by the Northeast Atlantic Fisheries Commission (NEAFC). In recent years mid-summer trawl-acoustic surveys of this Irminger Sea population, conducted by member countries of NEAFC, have measured a portion of the concentration within the Div. 2J+3K boundary in the NAFO Regulatory area. Canadian landings since the moratorium are by-catch from Greenland halibut fisheries and have been less than 40 tons annually. Based on observer data, 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. Since 2000, estimates have ranged from 60 tons (2002) to 231 tons (2003). Results from research vessel surveys in Div. 2J and 3K suggest the resource was at a historically low level in 1994. The survey biomass index increased by a factor of six from 1994 to 1998 then remained stable, the average from 2000-2003 was only 4% of the index averaged from 1978-1990. Although there has been an improvement in recruitment from the 1997, 1998 and 2000 year classes (fish less than 17cm), these are considered very poor in comparison to year classes of the early 1970s. Prior to the 1990s, a substantial portion of the stock was comprised of fish greater than 30 cm (fish 15 years and older). Since 1994 these older fish are not well represented in the survey abundance even though exploitation is assumed low. This stock remains at a very low level. There is little indication that the status of the stock will change in a positive way in the foreseeable future.

f) ***Witch flounder* – Div. 2J+3KL**

There has been no directed fishing on this stock since 1994. By-catch in other fisheries from the Newfoundland region amounted to 27 tons. Canadian autumn surveys since the late 1970s indicated that witch flounder were widely distributed throughout the shelf area in deeper channels around the fishing banks primarily in Div. 3K. By the mid-1980s, they were rapidly disappearing and by the early 1990s had virtually disappeared from the area entirely except for some very small catches along the slope in Div. 3L. The autumn 1998-2004 surveys indicate no change in this distribution pattern. For the three divisions combined, the biomass index declined from about 65 000 tons in 1984 to 1100 tons in 1995, the lowest in the time series. Mean weight per tow decreased from a maximum of near 6 kg/tow in 1984 to a low of 0.23 kg/tow in 1995. The small increase in biomass index and mean weight per tow observed between 1995 and 1996 was almost exclusively a result of inclusion of the deeper strata surveyed in Div. 3L. The estimates have remained the same since then. The stock size remains extremely low.

g) ***Greenland halibut*** **- Subarea 2 + Div. 3KLMNO**

The Canadian catch of Greenland halibut in 2003 in Subarea 2 and Div. 3KLMNO was reported to be almost 7 000 tons. This was about a 10% increase over the 2002 catch (6 300 tons), primarily due to increased otter trawl catches in Div. 2H, where removals increased over five-fold from the previous year. This was down by 1 400 tons from the catch in 2001, and about 3 600 tons lower than the catch in 2000. Reduced catches in the gillnet sector, primarily in Div. 3KL, were responsible for the decline. In 2004, as a result of the increased removals in Div. 2H, otter trawling accounted for the majority of the catch, although gillnet catches still comprise a substantial component. The catch at age in 2003 was dominated by the 1996 year-class (seven year olds), which accounted for 43% of the catch numbers and 33% of the catch weight.

TACs in 2002 and 2003 were above scientific advice and appear not to have been reached. In September 2003 at its annual meeting, the Fisheries Commission implemented a fifteen year rebuilding plan for this stock. It established TACs of 20 000, 19 000, 18 500 and 16 000 tons, respectively for the years 2004 to 2007. Subsequent TACs will be decided upon depending on the response of the resource to the reduced TACs.

The exploitable biomass (age 5+) was reduced to low levels in 1995-97 due to very high catches and high fishing mortality. It increased during 1998-2000 due to greatly reduced catches, much lower fishing mortality and improved recruitment. However, increasingly higher catches and fishing mortality since then accompanied by poorer recruitment has caused a subsequent decline. The 2003 and 2004 estimates are the lowest in the series. Recent recruitment has been below average, and fishing mortality has increased substantially in recent years.

h) ***Shrimp*** **– Subarea 2 + Div. 3K**

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

Between 1998 and 2002, annual catches of approximately 8 000 tons were taken in Div. 2G from 8 320 tons TACs. The 2003 TAC was increased to 10 320 tons and included a 1 125 tons allocation for northern shrimp research. In 2003, the Canadian shrimp fishing industry requested and was granted a change, in season, from a calendar year (January 1-December 31) to a fiscal year (April 1-March 31). An additional interim quota of 2 802 tons was set for the January 1-March 31, 2004 period. Thus the 2003-2004 fishing season was 15 months long and had a 13 122 tons TAC. The 2003-2004 (April 1-March 31) TAC (10 320 tons) was maintained for the 2004-2005 and 2005-2006 seasons. Preliminary data indicate that catches were ~11 000 tons in the 2004 calendar year.

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^{o}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. Standardized catch per unit effort declined since 2001 to the long-term average in 2004. In 2004, large vessels had a model CPUE index of 1928 kg/hr. Current status appears positive from fishery data, but future prospects are uncertain as the assessment is based solely upon fishery data. Autumn 1999 was the last time that a bottom trawl research survey was conducted in Div. 2G.

TACs in Hopedale and Cartwright Channels (Div. 2HJ) doubled from 7 650 tons during 1994-1996 to 15 300 tons over the 1997-2002 period. TACs have been taken in most years. In 2003, the TAC increased to 23 300 tons and included a 2 500 tons allocation for northern shrimp science research.

In 2003 the fishing season changed to April 1-March 31, and an additional interim quota of 9 787 tons was set for the period January 1-March 31, 2004. Thus the 2003-2004 fishing season was 15 months long and had a 33 087 tons TAC. The 2003-2004 fiscal year TAC (23 300 tons) was maintained for the 2004-2005 season. Approximately 26 000 tons of shrimp were caught during the 2004 calendar year. 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. Most model catch rates between 1997 and 2003 were statistically similar ($P > 0.05$) to 2004 (1 724 kg/hr) while indices previous to 1997 were generally the 2004 index ($P < 0.05$). High CPUEs are being maintained over a relatively broad area indicating that the stock is healthy.

There are no trends in the biomass and abundance indices, from autumn multi-species surveys. The lower 95% confidence intervals for the biomass indices averaged 111 000 tons (about 24 billion animals) during the 1998-2004 period. Note that annual autumn multi-species surveys were conducted in the northern part of SFA 5 (Div. 2H) between 1996 and 1999. Since then, SFA 5 was to be surveyed in its entirety during alternating years. However, due to ship borne difficulties, SFA 5 could not be surveyed during 2003. Instead it was surveyed during 2004.

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 throughout 1989-1993. 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. TACs were increased to 2 100 tons in 1997 as a first step toward increasing the exploitation of an abundant resource within the 1997-1999 Management Plan. Most of the increase was reserved for development of the small vessel fleet (<65 ft vessels). TACs more than doubled between 1997 and 1999, increased slightly to 2002 and further increased to 77 932 tons in 2003. An additional interim quota of 7 653 tons was set for the period January 1-March 31, 2004 to facilitate an industry requested change in fishing season from January 1-December 31 to April 1-March 31. Thus the 2003-2004 fishing season was 15 months long and had an 85 585 tons TAC. The 2004-2005 fishing season was 12 months and had a 77 932 tons TAC. TACs have been reached in most years; however, due to market constraints, small vessels have not always taken their entire allocations.

Large vessel catch rates, within Hawke Channel + 3K increased throughout 1990-1997 and have since fluctuated above the long-term average while the small vessel CPUE index increased significantly in 2004. The 2004 model CPUE indices for the large and small vessel fleets were 1 119 and 538 kg/ hr, respectively.

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 510 000 tons (about 123 billion animals) during the 1998-2004 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 large and small vessel fleets have been maintained at a high level, or are increasing, and they 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.

i) ***Snow crab* – Div. 2J3KLNO**

Landings decreased by 2% in 2004 to 49,450 tons from 2003 values of 50 650 tons due to decreases in TAC in 2004, primarily in Div. 2J. Fishery performance is monitored in through analyses of commercial logbook data, observer program data and dockside monitoring. Offshore CPUE from logbook data, which had been declining in the north (Div. 2J+3K) between 1998 and 2001, remained unchanged in Div. 3K during 2001-2003 but declined in both Div. 2J and 3K in 2004. It generally remained at a high level in Div. 3LNO, until 2003 with further declines in 2004. The exploitable biomass index, which is estimated from the autumn multi-species bottom trawl survey**,** declined between 1998 and 2003. It increased slightly in 2004 but remains at a low level. The pre-recruit index for greater than 94 mm new-shelled males also declined during 1996-2002 and remained low in 2003-2004. Recruitment is expected to remain relatively low in the short term in all divisions except Div. 2J while longer-term prospects are unknown.

j) ***Iceland scallop* – Div. 2HJ**

Inshore aggregations here were again fished in 2004, with nominal catches estimated at 393 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.

B. Special Research Studies

1. Biological Studies

a) ***Arctic charr***

Samples were obtained for food and feeding, age, sex and length distributions from commercial landings from six 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 five year interval from 1998 to 2002. Mean weights have fluctuated in recent years. 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 2003 and 2004, with samples obtained from various Subareas, while an analysis of latitudinal variation in fecundity was also completed.

b) ***Groundfish and Shellfish***

Biological and oceanographic data from autumn 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 autumn surveys. A food and feeding study on Greenland halibut is being conducted based on annual stomach collections from trawl surveys in Subareas 2 and 3 and an analysis of samples collected over the span of three decades is expected to be published in 2005.

Analysis of sexual maturity data is conducted regularly on American plaice. A project examining an alternative stock recruit model is ongoing for Div. 2+3K American plaice.

SUBAREA 3

A. Status of Fisheries

Nominal landings from 1994 to 2004 for fish stocks are listed in Table 1. Additional information on the status of the fisheries is as follows:

a) ***Atlantic salmon*** **- Subarea 3**

A moratorium on the Canadian commercial fishery has been in place since 1992. Landings at St. Pierre (Subdiv. 3Ps) totaled 2.8 tons in 2004. The 2004 recreational harvest, including both retained and hooked-and-released, was approximately 36 676 fish in insular Newfoundland.

b) ***Capelin*** **– Subarea 2 + Div. 3KL**

Inshore capelin catches in Subarea 2 + Div. 3KL are taken during the inshore spawning migration. Catches increased from 17 300 tons in 2003 to about 27 400 tons in 2004. Resource status has not been determined since 2000.

c) ***Cod*** **– Div. 3NO and Subdiv. 3Ps**

The cod stock in Div. 3NO has been under moratorium to directed fishing since February 1994. Total catch since 1994 has increased from 170 tons in 1995 to 4 900 tons in 2003. Canadian catches over this time period increased from 60 tons in 1995 to 800 tons in 2003. Total Canadian landings in 2004 were about 480 tons, with 440 tons of this amount being caught by Canada (NL). In the last assessment of this stock (2003), fishing mortality averaged over 2000 to 2002 for ages 4 to 6 is 0.32. This level of fishing mortality is comparable to that in earlier time periods during which substantial fisheries existed. Estimates of recent year-class size indicate that recruitment has been very low since the 1990 year-class. Low spawner biomass, low recruitment and high fishing mortality point to poor prospects for this stock in the future. Recovery will require a number of relatively strong year-classes that survive to maturity, rebuilding the spawner biomass. Recent Canadian spring and autumn research bottom trawl surveys confirm that the stock size remains at an extremely low level.

The cod stock in 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 2001/2002-004/2005 fishing seasons. The Canada (NL) share of the TAC is 84.5%, the remainder is allocated to France (SPM). A preliminary estimate of Canada (NL) catch in 2004 is 10 700 tons. The most recent assessment (October 2004) indicated considerable uncertainty in the absolute size of the stock, but estimated that spawner biomass is high and should show only a small drop under this TAC level. The outlook about the short-term productivity is not optimistic, as relatively poor year classes enter the fishery. Concern continues regarding the low age at maturity in this stock and the very high exploitation rates in a portion of the stock area (Placentia Bay).

d) ***American plaice*** **– Subdiv. 3Ps**

The last assessment of this stock was carried out in October 2002. This stock has been under moratorium since September 1993. By-catches in recent years have increased from 90 tons in 1995 to about 650 tons in both 1999 and 2000 and to over 1 000 tons in each year from 2001 to 2003. Preliminary estimates until the end of September 2004 are 535 tons.

DFO research vessel survey results indicate that this stock has remained at a low level since 1992. Biomass and abundance indices in the last 6 to 7 years are somewhat higher than those seen in the mid-1990s. However, the average biomass in 2000-2004 is only 19% of the 1983-87 average and abundance is 25% of the 1983-87 average.

Information is available from 1998 to 2003 from a survey sponsored by the Groundfish Enterprise Allocation Council (GEAC). Over this time period, this survey has shown the same overall trend as the DFO survey.

In the short to medium term there appears to be little prospect of significant rebuilding of this stock. Any removals from this stock will further delay recovery.

e) ***Witch flounder*** **-Subdiv. 3Ps**

Landings from this stock over the last 20 years have fluctuated between 300 tons and 1000 tons annually. In 2004 the catch from the Newfoundland and Maritime regions was 550 tons. 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. 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 appeared to have remained stable with little change in growth pattern. Aging has not been conducted on witch flounder in this region since the mid-1990s. 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.

f) ***Yellowtail flounder*** **– Div. 3LNO**

Since the fishery for this stock reopened in 1998, stock size has continued to increase and the TACs recommended for 2005 and 2006 were 15 000 tons in each year. In addition to the annual spring stratified-random survey in Div. 3LNO and the autumn multi-species bottom trawl survey, joint DFO-Industry surveys have been conducted since July of 1996. One such survey was conducted in 2004. 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. Fishing mortality is estimated to be relatively low and the stock biomass relatively high.

g) ***American plaice*** **– Div. 3LNO**

In 2004, biomass and abundance were updated for this stock; there was no change in stock size. Previous VPA analyses indicate that population abundance and biomass declined fairly steadily from the mid-1970s. Biomass has been relatively stable over the last number of years. The last full assessment indicated that F increased fairly steadily from 1995 to 2000. Average F on ages 11-14 in 2002 was 0.17, lower than in 2001, consistent with the decline in catch. SSB remains at a very low level at just over 20 000 tons. This is only 10% of the level in the mid 1960s and 16% of the level in the mid-1980s. Recruitment has been steadily declining since the 1986 year-class and there have been no good year classes since then. No good recruitment is seen below an SSB of 50 000 tons, the B_{lim} for this stock. Projections indicate that the stock will experience 5 times greater growth over the next 5 years at $F = 0$ compared to current levels of F. However, even at $F = 0$ the stock will not reach B_{lim} within 5 years. An analytical assessment will be carried out in 2005 for American plaice Div. 3LNO.

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

Redfish in the Canadian Atlantic within Div. 3P4RSTVWX were redefined into three management units in 1993. Redfish in UNIT2 was last reviewed in November 2001 and updated in 2004.

Total Canadian catches have declined steadily from 27 000 tons in 1993 to 8 000 tons in 2003, matching reductions in TACs. Unit 2 Canadian landings in 2004 totalled approximately 6700 tons and about 3 400 tons was caught by Canada (NL). Current management regulations include a closure related to peak spawning in May and June, and a minimum size restriction at 22 cm. The most recent Department of Fisheries and Oceans survey index (conducted from 1994-1997, 2000 and 2002) indicates stability to 2002. A corresponding survey index conducted by industry (from 1998-2001 and 2003) indicated a decline between 2001 and 2003 to the lowest in the time series. It is difficult to determine whether this decline is representative of a decline in stock abundance. The 2004 fishery was dominated by exploitable year-classes born after 1980, most notably the 1988 year-class. Current information suggests the 1988 year-class is not as strong as the 1980 that has already produced about 14 years of yield. There appears to be improved recruitment to the stock from the 1994 and 1998 year-classes but their absolute size is unknown. Biological characteristics suggest the 1988, 1994 and 1998 year-classes are predominantly *S. fasciatus*, a shallower water species, and the strong 1980 year class is predominantly *S. mentella*, a deeper water species. The strength of year-classes of *S. mentella* since the 1980 year-class is apparently very weak, yet it continues to be a significant portion of the fishery.

Canada has had limited interest in a fishery in Div. 3O because of small sizes of redfish encountered in areas suitable for trawling. Canadian landings were less than 200 tons annually from 1983-1991. In 1994, Canada took 1 600 tons due to improved markets related to lobster bait, but declined to about 200 tons in 1995. Between 1996 and 1999 Canadian catches have alternated between levels of about 8 000 tons and 2 500 tons based on market acceptability for redfish near the Canadian 22 cm size limit. From 2000-2003, Canada has averaged about 3 300 tons, with Canada (NL) accounting for more than 80% of the catch. The 2004 Canadian catch was about 2600 t. From 1974-2004, Div. 3O was under TAC regulation set by Canada within its jurisdiction, while catches were unrestricted in the NAFO Regulatory area of Div. 3O. In 2004, NAFO Fisheries Commission adopted TAC regulation for Div. 3O redfish at 20 000 tons for 2005, 2006 and 2007. Assessment of this stock has been primarily based on research vessel (RV) data due to variable commercial indices and fleets prosecuting different areas of the stock. Generally, the spring Canadian survey biomass index suggests the stock may have increased since the early 1990s, fluctuated over 100 000 tons from 1994 to 1999 and declined to 2002. The autumn Canadian survey, while more stable in the early 1990s, generally supports this pattern. RV surveys do not adequately sample fish greater than 25 cm which up to 1997 have generally comprised the main portion of the fishery. This makes it is difficult to interpret survey estimates in relation to what is happening to the stock as a whole. The fishery since 1998 appeared to target the relatively strong 1988 year class that has grown sufficiently to exceed the small fish protocol of 22 cm. There is concern that there has been little sign in recent surveys of size groups smaller than 17 cm despite using a shrimp trawl, which is very effective at catching small fish.

i) ***Witch flounder*** **– Div. 3NO**

There has been no directed fishing on this stock since 1994. By-catch in 2004 (NL region) was 49 tons. The data for Div. 3NO combined suggest an overall declining trend in stock size with the estimates for the spring 1998 survey at the lowest level observed since 1984. Since then, all indices have generally increased but remain variable. The 2003 spring survey estimates show an increase from 2002 (driven by one large set in Div. 3O), with wide confidence limits. The spring survey estimates for 2004 are lower than those for 2003, with wide confidence limits.

j) ***White hake*** **– Div. 3NOPs (Div. 3NO in NRA)**

The initial (2003) Fisheries Commission (FC) request for advice on white hake was specific for Div. 3N and 3O to the exclusion of NAFO Subdiv. 3Ps, formerly included in the stock management area for the Canadian assessment. In 2004, the FC subsequently requested scientific advice for the management of white hake in Div. 3NO. FC, by specifying advice for Div. 3NO implicitly set the stock management unit as Div. 3NO.

Prior to 1995, white hake was taken as by-catch in other demersal fisheries on the Grand Banks. Average estimated catch during 1985-1990 averaged ~5 000 tons. Annual catches in a new directed (Canadian) fishery on the Grand Banks, starting in 1995 and encompassing Div. 3NO and Subdiv. 3Ps averaged 460 tons. However, in 2001, a >10-fold increase in the catch of white hake Div. 3NO attributable to EU-Spain and EU–Portugal in the NAFO Regulatory Area. Given this large increase in catches in 2003, the FC of NAFO requested specific information on fishing mortality, abundance and distribution, reference points and conservation measures, size of fish and delineation of fishery areas with respect to white hake. That advice, to the extent of the available data was summarized in Kulka *et al.* (2004).

Between the 1970s and the early 1990s, the population of white hake on the Grand Banks (Div. 3LNOPs) peaked twice, in the late 1970s and the late 1980s. A good year class in 1999 resulted in high abundance in 2000. For the past 4 years, the stock has been declining due to an increase in fishing pressure and low recruitment. Studies on distribution and population trends have been done in recent years and studies on maturity, age and growth commenced in 2004.

k) ***Thorny skate* – Div. 3LNOPs**

Before the mid-1980s, non-Canadian fleets landed several thousand metric tons (t) of skate (mainly thorny) annually. An average of about 5000 tons was discarded annually by the Canadian fleet during the 1980s and early 1990s, while only a few hundred tonnes per year were recorded in Canada's landings statistics during that period. Although often kept by non-Canadian fleets, skates were taken only as by-catch until the mid-1980s. In 1985, EU-Spain targeted skate in a non-regulated fishery in the NRA. By-catches of thorny skate in other fisheries outside 200 miles (primarily Greenland halibut, *Reinhardtius hippoglossoides*) have also contributed significantly to skate catches. Catch per hour averaged 519 kg/hr in 1997 and 691 kg in 2000. Skates in Spanish catches were 30-85 cm TL with a mode of 48-49 cm in 1997 for unsexed skates, and modes of about 50-51 cm for males and 46-47 cm for females in 2000-2003. Skates of 42-49 cm TL dominated these catches. In 2000, Russia commenced a directed fishery for thorny skate with reported catches of 3 600 tons in 2000 and 2 600 tons in 2001. Skates in Russian catches were 25-92 cm TL, and primarily 32-60 cm. Mesh size varied widely over the two years reported: 136 cm in 2000 and 320 cm in 2001. Other countries, especially Portugal, continue to report skate catches to NAFO. However, these appear to be primarily by-catch. In 1993 and 1994, experimental fishing resulted in the first significant directed skate landings appearing in Canadian statistics. In 1995, Canada established a regulated skate fishery inside its 200-mile-limit with gear and by-catch policies, a licensing system, and Total Allowable Catch (TAC). The Canadian fishery includes otter trawl, gillnet and longline gear while the non-Canadian catches are taken by otter trawl.

The stock biomass indices, following a decline to their lowest historic level in the early 1990s have stabilized since the mid-1990s. However, a change in research survey gear (in the autumn of 1995) with different catch characteristics has created a discontinuity in the survey time series, preventing a comparison between two periods. The spring survey, previously used to estimate biomass and abundance may not include a substantial portion of the population, and thus represents only the portion of the stock that occurs within the surveyed area. On average (1990-2003), autumn survey estimates of biomass for the comparable area (NAFO Div. 3LNO) were 41% higher. Analysis of lengths taken during research surveys have covered a consistent range since 1985, with main modes occurring at 15-32 cm and 65-83 cm in both spring and autumn, the latter mode comprising mature skates. Since 1996, a single mode in the 30-60 cm range (a mix of mature and immature fish) has been observed. A recent increase in the proportion of larger skates in survey catches is noted. There is a linear relationship between female spawning stock and young of the year, demonstrating a stock-recruitment relationship. Production modeling suggest that a harvest exceeding 12 000 tons for 3LNOPs is not sustainable. Studies on distribution and population trends have been done in recent years and studies on maturity, age and growth will commence in 2005.

l) ***Shrimp* – Div. 3LMNO**

Subarea 3 has been divided into two shrimp management areas – Div. 3LNO and 3M. The Div. 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 1996-1999 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 lower than that estimated for 2001, but that there was considerable uncertainty with estimates of catch in both years. Canadian vessels caught 5 400 tons of shrimp in Div. 3L during 2002.

During November 2002, Scientific Council (SC) noted that there had been a significant increase in biomass and recruitment in Div. 3LNO shrimp since 1999. Applying a 15% exploitation rate to the lower 95% confidence interval of biomass estimates, averaged over the autumn 2000-2001 and spring 2001-2002 surveys, resulted in a catch of approximately 13 000 tons. Accordingly, SC recommended that the TAC for shrimp in Div. 3LNO in 2003 and 2004 should not exceed 13 000 tons. Over the period 2000-2003, catches were 4 900, 10 600, 7 000 and 12 000 tons, respectively. Preliminary data indicate that ~13,000 tons of shrimp were taken in Div. 3L during 2004.

During 2001, large (>500 tons) and small (<65 ft) shrimp fishing vessel catches were taken from a broad area extending from the northeastern border with 3K south east along the 200-500 m contours to the NRA border. The area fished contracted as large quantities of big shrimp were discovered in the northeastern corner of Div. 3L, near the Div. 3K border, and at the NRA border. The distribution of fishing activity is much lower than the distribution of the stock, therefore, the catch rate models should not be used as a proxy for shrimp biomass and abundance. Large and small vessel catch rates were modeled in order to describe fishing activities.

Large vessel catch rates were analyzed by multiple regression, weighted by effort, for year, month, number of trawls and vessel effects. Number of trawls was found to have an insignificant influence upon model results ($P = .3006$) and therefore was not included in the final model. The final model explained 85% of the variance in the data and indicated that the annual, standardized catch rates for 2000-2003 were similar to the 2004 CPUE estimate (1 455 kg/hr).

Preliminary data exploration indicated that there was no relationship between length of small vessel (<65 ft) and tonnage or horse power. Therefore small vessel CPUE was modeled using month and year as explanatory variables. The final model explained 80% of the variance in the data and indicated that the annual, standardized catch rates have been increasing since 2001 with only the 2003 CPUE estimate being statistically similar to 2004 estimate (494 kg/hr).

The fishery for northern shrimp at Flemish Cap began in the spring of 1993 and has since continued with annual catches (as estimated by STACFIS) fluctuating between 25 000 and 54 000 tons between 1993 and 2002. The 2003 catch was 62 000 tons, the highest in the series. Preliminary NAFO catch statistics indicate, 43 000 tons of shrimp were caught in Div. 3M during 2004. 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.

m) ***Iceland Scallop* – Subdiv. 3Ps**

The Div. 3LN Iceland scallop fishery commenced in 1992. Aggregations over the eastern Grand Bank (Div. 3L) were first commercialized. In 1994, the fishery expanded into the Lilly and Carson 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. Nominal landings have declined throughout, partially because of effort diversion into shrimp and crab.

There was no directed fishery for Iceland scallops from the LCC box in 2004, the third consecutive year since aggregations were first exploited in 1994. Elsewhere, over the Grand Bank (Div. 3LN), there has been no commercial activity since 2000.

The Iceland scallop fishery on Subdiv. 3Ps commenced in 1989. It encompasses the trans-boundary stock, along the northern edge of St. Pierre Bank, co-managed by France (70% of annual TAC) and Canada (30% of TAC), and the remainder of Subdiv. 3Ps that remains entirely under Canadian jurisdiction.

Total removals from the Canadian zone have decreased from 5 367 tons, (round) in 1997 to 87 tons in 2003. In 2004 only 19 tons of a total 3 500 tons TAC were removed. There has been no directed effort for Iceland scallops in the trans-boundary area since 1998.

n) ***Sea scallop* – Subdiv. 3Ps**

The sea scallop fishery on St Pierre Bank commenced soon after its discovery in 1953. The area has been fished by both Newfoundland inshore vessels and larger Maritimes (Nova Scotia) based offshore vessels. Occurring as they do towards the northern extreme of its distribution, sea scallops here have not been able to withstand continued heavy exploitation. The fishery is typically characterized by a disproportionate dependence on sporadic recruitment of a single or a few intermittent and sometimes, well-spaced year-classes. Figures shown in Table 1 represent only landings in Newfoundland ports and do not include removals from the area but landed in Nova Scotia.

Since 1997 there has been very little effort by offshore vessels with most of the landings coming from inshore beds. In 2003 there was sign of a large recruited year-class, with 647 tons (round) removed. In 2004, there was a significant increase in effort and landings by both inshore and offshore fleets. A total of 3 417 tons (round) was landed in Newfoundland, while an additional 1073 tons was removed but landed in Nova Scotian ports. CPUE for the inshore fleet decreased by 25% in 2004 from the previous year.

o) ***Squid* – Subarea 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 600 tons in 2003. Catches increased further in 2004 to approximately 2 000 tons. Increases in catches in 1996 and 1997 were associated with environmental warming and increase in squid abundance at the northern extreme of their range.

p) ***Snow crab* – Subdiv. 3Ps**

Landings in Subdiv. 3Ps declined by 38% (7 640-4 720 tons) during 2002-2004 due to reductions in TACs. Inshore CPUE declined from 2001-2004 by 67%, whereas offshore CPUE declined by 67% from 1999-2003 and remained unchanged in 2004 due to an apparent reduction in the abundance of commercial-sized males. No exploitable biomass index is available as there are insufficient fishery-independent data from this area. Recruitment appears to have been stable in recent years and is expected to change little in the short term. Longer-term prospects are unknown.

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 Atlantic Zonal monitoring program (AZMP) initiated in 1998 continued during 2004 with three physical and biological oceanographic offshore surveys carried out. The first was conducted on the CCGS Teleost from April 17 to May 2, the second from July 20 to August 5 and the last from November 17 to December 7. 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 2004 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 autumn. 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. Data from this effort are used to produce annual physical, chemical and biological state of the ocean reports and in studies relating environmental conditions to marine resources.

a) ***Plankton studies***

Overall, the seasonality of chemical and biological variables at Station 27 and along the major AZMP sections in 2004 was similar to previous years (1999-2003). 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 program 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 inter-annual 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 the timing of the spring bloom returned to an average start time, the strength of the mixing during the period January-March, as determined from the depth of the mixed layer, appears to have resulted in a reduction in the overall magnitude of the phytoplankton bloom.

Variations in the physical environment since the inception of the Atlantic Zone Monitoring Program is likely to be contributing to the variability 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 until 2003. 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. In 2004, it appears that the spring phytoplankton bloom followed a relatively abrupt shoaling of the mixed layer, that may have resulted in a smaller fraction of the surface nutrient inventory being converted into biomass However, in addition to the factors that regulate the vertical structure of the water column, there is a preliminary indication that inter-annual variations in incident light may also have contributed to the increase in the overall intensity of the spring phytoplankton bloom. In 2004, light levels were lower than the overall peak in 2001-03 but the value remained elevated relative to those from CMS, further raising the need for intercalibration.

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 conditions at Station 27 persisted in 2004 but there appears to be limited evidence for nutrient depletion over the remainder of the Shelf, in contrast to previous suggestions that the inner part of the Bonavista transect may have shown a decrease in deep nutrient inventories (Pepin *et al*., 2002). There was some evidence of greater variability in the deep nutrient inventory at Station 27, but the pattern was no strong enough to suggest a significant change at this time. The surface nutrient inventories appear to have been higher in 2004 than in the previous year, but the limited intensity of the spring phytoplankton bloom may be partly the cause.

The relationship between silicate and nitrate concentrations in the upper layer (0-50 m) indicates that 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, and this was particularly evident in 2003 and 2004 at both Station 27 and on the Newfoundland Shelf. It is unclear at this time the mechanism through which this occur, because deep water inventories of both nutrients are comparable. One possibility is that the uptake of silicate changes seasonally as a result of changes in phytoplankton community structure.

The overall standing stock of phytoplankton on the NE Newfoundland Shelf was generally comparable for slightly higher than in previous years, as were surface nutrient inventories. There was relatively little change in the deep water nutrient inventories. Although stratification was less intense over much of the Grand Banks, which suggests that nutrient replenishment may have occurred more readily, the integrated temperature was also lower. However, primary production, and dense phytoplankton blooms, are know to occur when temperatures are low, suggesting that the effect of temperature on phytoplankton standing stock may be affected indirectly through the impact of other strophic levels. This trend was reversed for the Labrador sections occupied during the summer. Satellite data suggests that an intense phytoplankton bloom was occurring in the Labrador Sea during our summer surveys, but the overall standing stock on the Shelf was relatively limited. Alternatively, higher grazing pressure from a slight increase in the density of large calanoid copepods may have maintained standing stocks at low levels, which could also be mediated through variations in temperature.

The decline in abundance of major phytoplankton taxa observed in recent years appears to have persisted into 2004. The cell densities of diatoms, dinoflagellates, and flagellates have continued to decrease. Although flagellates do not make up a substantial portion of the overall phytoplankton biomass compared to larger diatom and dinoflagellate cells, the decrease in the abundance of all taxa 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 both Station 27 was generally in keeping with previous observations. The 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 observed in 2002 did not appear to persist into 2003 and 2004. The abundance of copepodites of *Metridia* sp., *C. glacialis*, *C. hyperboreus* and *Microcalanus* sp. which had become more frequent members of the community although the overall increase in their abundance has been modest returned to levels consistent with conditions at the start of the monitoring program. The warm water species, *T. longicornis*, whose abundance peaks during the autumn, has shown an increase in overall abundance and in relative frequency of occurrence at Station 27.

The most notable advance in 2004 was in our ability to provide quantitative analysis of inter-annual differences in the abundance of dominant zooplankton taxa at Station 27 and along the key oceanographic transects. The analytical approach is somewhat simplistic and does not take into consideration of major shifts in the spatial distribution of species (this appears as part of the error). However, the approach has revealed significant inter-annual variations in the abundance of zooplankton on the Shelf. Many taxa, particularly the three *Calanus* species, appear to be at the highest levels encountered north of the Grand Banks, whereas the opposite is true over the Grand Banks, at least since the inception of AZMP. Variations in cross-shelf transport may play a role in this pattern but we have not conducted the analysis required to investigate this possibility. Other groups, such as bivalves, gastropods, euphausiids and larvaceans were highly patchy in their distribution, making statistical intercomparisons unfeasible at this time. Longer time series of observations may be required before we can detect significant inter-annual variations in abundance based on the AZMP survey design and collection methods.

b) ***Oceanographic studies* - Subareas 2 and 3**

Physical oceanographic studies were conducted on the Newfoundland and Labrador Shelf during 2004 in NAFO Div. 2J and 3KLNO. These studies were based on observations from southern Labrador Shelf to the Southern Grand Bank on the Newfoundland Shelf. The annual water-column averaged temperature at Station 27 for 2004 remained above the long-term mean and reached the highest value on record. The annual surface temperature at Station 27 was 1°C above normal, also the highest on record, while the annual bottom temperature were the highest since 1966. Water-column averaged annual salinities at Station 27 remained above normal for the 3rd consecutive year. The cross-sectional area of <0°C (CIL) water on the Newfoundland and Labrador Shelf during the summer of 2004 decreased over 2003 remaining below the long-term mean along all sections. The CIL areas were below normal along all sections from the Flemish Cap section on the Grand Bank, to the Seal Island section off southern Labrador. Off Bonavista for example, the CIL area was below normal for the 10th consecutive year. Seasonally, the CIL water mass extended to the surface during the winter was the smallest since 1965 in the summer and was completely eroded by late autumn of 2004. The area of the CIL in recent years are in sharp contrast to the near record high values measured during the extremely cold years of the early 1990s on the Newfoundland Shelf. Temperatures along the standard sections, except for some isolated cold surface anomalies, were generally above normal by 1° to 2°C in most areas during spring and summer and in all areas during the autumn. Except for slightly negative salinity anomalies at mid depth over the inner shelf during the spring most of the shelf during 2004 experienced generally saltier-than-normal conditions, particularly during the autumn. In Div. 3LNO spring bottom temperatures were above normal in all areas of the Grand Banks by 1°C to 1.5°C. As a result the spring of 2004 had the lowest area of <0°C water in Div. 3L since the surveys began in the early 1970s. Bottom temperatures during the autumn of 2004 were predominately above normal in all areas by 0.5° to 2°C and were the highest on record in Div. 2J.

An oceanographic assessment study was also conducted during the summer of 2004 on the Flemish Cap in NAFO Div. 3M. Oceanographic data from the summer of 2004 on the Flemish Cap were examined and compared to the long-term (1971-2000) average. The cold near-surface temperatures (0.5° to 2°C below normal) experienced over the Cap from 1993 to 1996 had warmed to 0.5°-1.5°C above normal by the summer of 1997, which increased further to 2°C above normal by the summer of 1999. Upper layer temperatures over the Flemish Cap during the spring of 2001 and the summer of 2002 generally showed a downward trend with temperatures decreasing to below normal values. During the summer of 2003, temperatures directly over the Cap were highly variable while adjacent areas showed significant positive anomalies and during 2004 they increased to above normal values. Near bottom temperatures over the Cap during 2004 were >4°C, which was above normal by 0.5°C over the shallow areas of the Cap. Salinities over most of the upper water column during the summer of 2002 to 2004 were generally saltier-than-normal (0.25-0.5). In the deeper water (>100-m depth) 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 observations indicate a reversal in the recent warm trend in some areas with water column temperatures decreasing to near normal values. However during the summers of 2003 and 2004 most areas of the water column again experienced an increase in both temperature and salinity. During 2004 and throughout most of the 1990s and early 2000s 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%. The circulation pattern during the summer of 2004 was dominated by the southward flowing Labrador Current to the east of the Cap indicating a reduced gyre circulation *c)* ***Multi-disciplinary studies*** **- Subareas 2 and 3**

A study was conducted in NAFO Subdiv. 3Pn and 3Ps during 2004 relating possible influences of oceanographic conditions on the distribution and abundance of Atlantic cod (*Gadus morhua*). Oceanographic data from NAFO Div. 3P during the spring of 2004 were examined and compared to the previous year and 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 in 1996 however, temperatures started to moderate, decreased again during the spring of 1997 and returned to more normal like values during 1998. During 1999 and 2000 temperatures continued to increase, reaching the highest values observed since the late 1970s in some regions. During 2001-2003 however, temperatures cooled significantly to values observed during the mid-1990s with the average temperature during the spring of 2003 the coldest in about 13 years. Temperatures during the spring of 2004 warmed considerably over 2003 values to 1°C above normal in the surface layers and by almost 0.5°C in the near-bottom depths over St. Pierre Bank. The areal extent of <0°C bottom water during 2003 increased to the highest in about 13 years but decreased during 2004 to <10%, the lowest since 1988. The areal extent of bottom water with temperatures >3°C has remained relatively constant at about 50% of the Div. 3P area during the past decade. On St. Pierre Bank bottom water with temperatures <0°C essentially disappeared during the warm years of 1999 and 2000. It appeared again however during 2001 to 2003 covering about 90% of St. Pierre Bank in 2003. During the spring of 2004 it again disappeared with <0°C water restricted to the eastern most regions and the approaches to Placentia Bay. In general, temperatures during the spring of 2004 increased significantly over values observed during 2001-2003. The most evident trend in the numbers of cod caught per set during the multi-species surveys was the high number of zero catches in the <0°C water on St. Pierre Bank and regions to the east of the Bank, mainly from 1985 to 1998 but also from 2001 to 2003. During 1999 and 2000 larger catches became more wide spread over St. Pierre Bank as cold (<0°C) water disappeared from the area. In general, during most surveys the larger catches occurred in the warmer waters (2°-6°C) along the slopes and areas to the west of St. Pierre Bank. In 2004 there was no observed shift in the distribution of cod over St. Pierre Bank and there were many low or zero catches in the warm deeper waters off the banks compared to most years. Finally, variations in the estimated abundance and biomass of cod from the RV surveys in strata with water depths <92 m are significantly correlated with bottom temperatures for that depth range.

A study on the spatial distributions and abundance of northern shrimp was also carried out for NAFO Div. 3LNO. The study examined variations in the thermal habitat and shrimp distribution and abundance for NAFO Div. 3LNO during spring surveys from 1998-2004 and for autumn surveys from 1995-2003. The highest numbers of shrimp were found in the 2°-4°C-temperature range during the spring surveys with lower numbers in waters <2°C and >4°C. During the autumn surveys most shrimp were found in a colder temperature range of 1°-3°C. Cumulative frequency distribution of the number of shrimp caught and temperature indicates that <5% of the catches are associated with temperatures <1°C in the spring and up to 30% are associated with temperatures <1°C in the autumn. About 80-90% of the shrimp were caught in the 2°-4°C temperature range during the spring, while only about half that number appeared in this temperature range during the autumn. In terms of available thermal habitat, about 30% of the surveyed region was covered with water in the 2°- 4°C temperature range during the spring, while about 40% was covered by water in this temperature range in the autumn. In 2004 the average spring bottom temperature increased significantly over 2003 to >2°C, the highest since the early 1980s. An apparent shift in the shrimp distribution towards colder temperatures further upon the Grand Bank and towards the inshore regions occurred during the autumn and as a result, a greater proportion (30%) of the catch shifted into the 0°-1°C-temperature range. Very low numbers of shrimp were found in temperatures <0°C and >4°C during both spring and autumn. Shrimp catches were mostly zero in all surveys in the swallow waters (<100 m) of the southeast Grand Bank, where temperatures generally range from 2°- 7°C. In general, during the spring most of the large catches were found in the warmer water along the slopes of Div. 3LN, while in the autumn, larger catches were found in most areas of Div. 3L including the inshore areas of the bays along the east coast of Newfoundland. During the spring of 2004 most of the shrimp were found in the 3^o-4^oC temperature range with a significant decrease in the overall catches over the previous 2 year. It is not know if the decrease in abundance during the spring is related to the warming environment on the Grand Banks during the spring of 2004. Furthermore, it is not clear if the observed changes in the distribution from spring to autumn are environmentally driven, or due to other factors, such as changes in trawl catchability due to vertical migration, feeding behaviour or other unknown environmental variables.

2. Biological Studies

a) Flatfish

A food and feeding study on Greenland halibut is being conducted based on annual stomach collections from autumn trawl surveys in Subarea 2 and 3 and an analysis of samples collected over the span of three decades is expected to be published in 2005.

Analysis of sexual maturity data is conducted regularly on American plaice, yellowtail flounder and other species. The yellowtail and American plaice analyses are presented to NAFO during the biannual assessment of Div. 3LNO American plaice and yellowtail flounder. 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 2004, only 15 data storage tags were deployed along with the Petersen discs used in 2000-2004. This represents the last year of the tagging program.

A study into changes in fecundity in several flatfish species (and cod) has begun. This study will produce new estimates of fecundity and compare them with previous estimates. The potential use of proxies for fecundity will be examined. New estimates of reproductive potential will be produced and their utility for use in stock assessment examined.

b) Seals

Multi-disciplinary studies on harp, hooded, and grey seal population dynamics and seal-fish interactions continued in 2004. A two year project, the Atlantic Seal Research Program (ASRP) was initiated in 2003. The objectives of the ASRP are to: 1) conduct surveys to estimate the abundance of the three seal species believed to be important groundfish predators; 2) determine seal distribution in relation to fish resource and provide current estimates of the diet of each species; and 3) evaluate the utility and test seal management tools, which might aid the recovery of Atlantic cod stocks (e.g. Seal Exclusion Zone, immuno-contraception). In addition, research is continuing on other aspects of seal biology and ecology (e.g. interannual changes in growth and reproductive status) in order to determine their role in the ecosystem of the Northwest Atlantic.

As part of the ASRP, visual and photographic surveys were conducted in March 2004 to estimate harp seal pup production. Over 8 000 photographs were obtained and are currently being examined. The results of these surveys are expected to be available in the spring of 2005 and will be incorporated into the harp seal population model to estimate abundance of the northwest Atlantic harp seal population

Consumption of prey by 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 and hooded seals in nearshore and offshore areas of NAFO Div. 2J+3KL was collected during 2004. Once analyses of these samples are completed, new estimates of consumption will be made available.

c) ***Capelin***

A comparative study to determine factors governing capelin survival during egg development and larval emergence from beach sediments and from demersal spawning sites in Trinity Bay continued in 2004. Samples of adult capelin were collected in 2004 at spawning sites in Labrador, Div. 2J, and the east coast of Newfoundland, Div. 3KL, as part of a study on capelin biodiversity. An ongoing offshore acoustic survey initiated in the spring of 2000 examined capelin distribution, behavior, and feeding habits in Div. 3KL. Seasonal inshore surveys were conducted in 2004 to map the abundance and dispersal of larval capelin and to track seasonal distributions of capelin, cod, and marine mammals in Trinity Bay, Div. 3L.

d) ***Salmon***

A method was derived by which numbers of adult Atlantic salmon returning to fishways or fish counting fences could be combined into separate regional indices (e.g. northeast coast, south coast, southwest coast, northwest coast), or a composite index of all Newfoundland. The approach uses data from all counting facilities in constructing the indices, even those where projects have now been terminated. Owing to the sequence of specific management measures, such as the 1984 salmon management plan followed by the closure of the commercial fishery in 1992, data could be analyzed with planned contrasts to evaluate the impact of the 1992 fishery closure on returns of salmon to Newfoundland rivers. Results of analyses showed that while indices of freshwater production have generally been maintained, marine survival rates remain low (2-10%) and highly variable. Overall, total stock size differs little from that prior to the closure of the Newfoundland commercial salmon fishery. Spawning escapements have increased by a factor of 2 or 3 in some rivers, but in other areas total returns are still lower on average than those prior to the fishery closure.

3. Miscellaneous Studies

a) ***Fish Habitat Compensation Studies***

Artificial Reefs, Eelgrass Restoration and Scallop Habitat Creation

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 a multi-species artificial reef, eelgrass restoration and scallop habitat creation. In 2004, baseline studies were undertaken to determine suitable locations for the placement of an artificial reef and for the placement of scallop shell habitat. Based on the results, North Harbour, Placentia Bay was chosen as a candidate site. Scallop spat collectors were set in North Harbour and will be retrieved in 2005 to evaluate spatfall in the area. Monitoring of the restored eelgrass bed in the East Arm of Bonne Bay was also undertaken in 2004. Results showed that although the transplant survival was low, the surviving transplants exhibited good growth and evidence of spreading through rhizome elongation and seed production.

b) ***Environmental Effects Monitoring Studies*** *(EEM)*

Hibernia Offshore Oil Project

Hibernia is located near the northeast corner of the Grand Banks, approximately 315 km east-southeast of St. John's. Hibernia uses a gravity-based structure (GBS) to complete drilling of up to 83 development wells that will be required throughout the lifetime of the project.

The Hibernia Environmental Effects Monitoring (EEM) Program has been ongoing since 1998 and DFO has contributed to the program since its inception. The EEM program is scheduled to be conducted every second year. The latest sampling program occurred in the spring/summer of 2004, with reporting expected in the autumn of 2005.

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 and has been ongoing since 2000. As environmental effects at Terra Nova remain limited and fully within the range predicted by the Environmental Impact Statement, EEM sampling occurs only every second year. The latest sampling program occurred in the spring/summer of 2004, with reporting expected in the autumn of 2005.

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 2004, a draft White Rose EEM Program document was submitted top DFO for review. The first installment of this program is expected to be submitted for DFO review in early summer 2005

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 EEM field program has been ongoing since August of 2000. Results from the 2003 monitoring season were submitted to and reviewed by DFO in 2004. At present, Newfoundland Transshipment Limited (NTL) has completed the original EEM requirements; however, there remains a need for future monitoring. NTL in consultation with DFO staff has developed a reduced EEM program to be implemented and conducted every second year from 2006 to 2010.

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 for the NL Region. A workshop was held in March 2005 to present the proposed classification system (procedures and methods) in order to receive feedback on its utility from Science and other DFO staff.

d) ***Seismic*** **- Subareas 2 and 3**

Building on a literature review conducted by MEHM in 2001, an Environmental Studies Research Fund (ESRF) project was conducted in 2003 in the Newfoundland and Labrador Region, to identify and map key spawning and nursery areas and times for 12 commercial finfish species on the Newfoundland Grand Banks (specifically NAFO areas Div. 3LMNO and Subdiv. 3Ps). 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. The work was completed in winter 2003 and has been published in the DFO Technical Report series in 2004 (No. 2522).

There is scientific uncertainty associated with potential impacts of seismic testing on the marine environment. Habitat managers require a nationally consistent scientific basis for evaluating the potential environmental consequences of seismic surveys. A DFO National Science Advisory meeting was held in May 2004 to review working papers providing overviews of the primary and secondary literature on the possible effects of seismic testing on various components of aquatic ecosystems. Reports on standards used by other jurisdictions internationally for regulating seismic activities in marine ecosystems and on sound propagation models for marine environments were also reviewed. A DFO Habitat Status Report (2004/2002), published in 2004, is a review summary of the scientific impacts of seismic sound on fish, invertebrates, marine turtles and marine mammals. Additional Canadian Science Advisory Secretariat research documents have also been published (CSAS Res. Doc. 2004/125; 2004/121) and continue to be published as a product of this initiative. Further, this information has formulated the basis of the Statement of Canadian Practice on the Mitigation of Seismic Noise in the Marine Environment currently under review.

Priority research attention needs continued focus on addressing exposure distance/seismic energy relationships and the potential for producing damaging effects (i.e. serious pathologies leading to mortality and morbidity, adverse reproductive outcomes, predator susceptibility) in representative fish, shellfish and other species. Pilot studies carried out by DFO NL Region using a small seismic source have reinforced the need for research in this area. The Region has assisted with a snow crab seismic survey research project carried out near Cape Breton in the autumn of 2003. This work has since been published as a DFO Habitat Status Report (2004/2003). Habitat Management and Science in the NL Region are currently undertaking a seismic energy distance-effects relationship study on lobster life stages. This work is particularly important because the DFO expects to receive seismic referrals in inshore lobster ground areas on the province's west coast. Research in this area continues to be essential as Marine Environment and Habitat Management must make informed predictions on whether delayed mortality or morbidity could be problematic when carrying out seismic surveys in the Region and what remedial measures are required.

e) ***Aquaculture***

A *Standard Methods Guide for Finfish Aquaculture* for the NL Region has been developed to guide growers through the "one window" aquaculture application process with emphasis on the collection of site baseline data. Throughout FY 2004-05, Habitat Management has continued to refine ways to collect site baseline data. For hard bottom, high energy sites, the use of underwater video has been demonstrated as cost effective and efficient. Using such an approach, growers are able to more readily identify important fish habitat that is likely to be impacted by aquaculture activities and therefore avoid locating farms near those habitats.

SUBAREA 4

A. Status of Fisheries

Nominal landings from 1994 to 2004 for fish stocks are listed in Table 1. Additional information on the status of the fisheries is as follows:

a) ***Snow Crab*** **– Div. 4R**

Landings in Div. 4R in 2004 (1 450 tons) decreased by 7% from those of from 2003 (1 565 tons). The commercial catch rate has remained at a lower level than in other divisions. There are no research data available from this division. It is not possible to infer trends in exploitable biomass from commercial CPUE data because of recent changes in the spatial distribution of fishing effort. Recruitment prospects are unknown.

b) ***Iceland scallops* – Div. 4R**

The nominal catch from the Strait of Belle Isle (Div. 4R) in 2004 is estimated at 335 tons (round) against a TAC of 1 000 tons. CPUE in 2004 increased by 19 % from the previous year, coinciding with a shift of effort to the north of areas fished in recent years. 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.

SUBAREA 2 + 3 + 4

A. Status of Fisheries

Nominal landings from 1994 to 2004 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 1 758 tons in 2002, from a long-term high of 3 207 tons in 1992. Preliminary figures indicate increases in recent years, to 2 059 tons in 2002 and 2 256 tons in 2003, followed by a decrease in 2004, to 2 021 tons. In the majority of LFAs, landings remain low, following the recent downward trend, but landings continue to increase in Div. 4R LFAs, and LFA 11 in Subdiv. 3Ps. The lobster fishery is monitored at several localized sites through at-sea sampling programs and co-operative arrangements with harvesters who voluntarily complete logbooks on commercial catch and effort. The fishery is characterized by high exploitation rates and a small size limit relative to growth rates and size at maturity. Yield per recruit analysis demonstrates growth overfishing and substantial increases in yield could result from a reduction in exploitation rate or a size limit increase. Egg per recruit analysis indicates a low level of egg production under the current management regime, suggesting a high risk of recruitment failure in periods characterized by unfavourable environmental/ecological conditions. While egg production has been augmented as a consequence of the 1.5 mm carapace length size limit increase introduced in 1998, the doubling objective of the 1998-2002 management plan has not been achieved. Limited at-sea sampling indicates that, overall, v-notching of females has not taken place to the extent recommended in the 1998-2002 management plan. Given the strong environmental/ecological influence on recruitment and the current low level of egg production, fluctuations in annual landings will be especially subject to environmental variability. Future landings can therefore be expected to be lower, on average, and less stable than they would under a management regime involving a lower level of exploitation.

B. Special Research Studies

1. Miscellaneous Studies

a) ***Sentinel studies***

The Sentinel Surveys, initiated in October 1994, were continued in 2004. Data collected were tabled at regional stock assessments in the autumn of 2004 for Subdiv. 3Ps. While there was no assessment for Div. 2J+3KL cod in 2004, a stock status report update included 2003 sentinel results. Sites in Div. 2J+3KL, Subdiv. 3Ps and Subdiv. 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.

b) ***Gear and selectivity studies***

Engineering sea trials of the performance of Campelen 1800 shrimp trawl and the Western IIa otter trawl used in bottom trawl surveys of Atlantic Canada

Sea trails were carried out the southern Gulf of St. Lawrence in depths of 20-120 m to measure the performance and geometry of both survey trawls with particular emphasis on trawl door stability in shallow waters, i.e. less than 40 m. In depths greater than 35 m the Western IIa trawl doors performed well but were very unstable at depths 20-35 m. The Campelen was only tested in depths of 20-40 m and its trawl doors were very stable at the lower depths.

c) ***Hydrographic Surveys***

The Canadian Hydrographic Service (CHS) priorities for Sub areas 2, 3 and 4 for 2003-2004 were Placentia Bay, Mortier Bay, Corner Brook, Cow Head and Labrador.

At Placentia Bay, on the south coast of the Island of Newfoundland Natural Resources Canada (NRCAN) and the CHS participated in a joint demonstration project called Smart Bay. During 2003-2004 a hydrographic survey, using the Canadian Coast Guard (CCG) Hydrographic vessels Creed and Matthew, was commenced to collect an acoustic multibeam data set for the whole of Placentia Bay. The Smart Project will use this data set, combined with other data sets, to illustrate the benefits of improved access to information for management and sustainable development of the diverse coastal and ocean resources in the Bay. During 2003-2004 approximately 50% of Placentia Bay was isonified with the remainder scheduled for 2004-2005.

At Mortier Bay, the CCG Hydrographic vessel Matthew completed a multibeam survey in the approaches to Mortier Bay. Mortier Bay is the site of the Marystown Ship Yards, and the Cow Head Fabrication Facility where oil rigs, large vessels and the Floating Production Storage and Offloading (FSPO) vessels are built and repaired. The information from this survey will be used to produce a new edition of the CHS Chart 4597.

On the west coast of the Island of Newfoundland hydrographic surveys were conducted at Corner Brook and the port of Cow Head.

At Corner Brook a hydrographic revisory survey was completed using the CCG Hydrographic vessel Matthew and its survey launches. Information from this survey will be used to revise and update the CHS Chart 4652. A second priority at Corner Brook was the verification of depths off the public wharf at Corner Brook in anticipation of the arrival of the large cruise ship Queen Mary II.

A hydrographic survey was also started at Cow Head, further north from Corner Brook, along the west coast of the Island of Newfoundland. Cow Head is the only port of refuge for small vessels along this section of the coastline. The single beam survey at Cow Head was commenced but was not completed in 2003-2004 and is scheduled for completion in 2004-2005.

The annual Sailing Directions Revisory Survey continued in 2003-2004. Sailing Directions publications are produced by the CHS to amplify charted details and to provide an abundance of information to mariners in the interest of safe navigation. Sailing Directions, often referred to as Coast Pilots, are intended to be read in conjunction with the Navigation Chart. The text contains valuable information that cannot be graphically displayed on a chart.

Information from this survey was used to update the five (5) Sailing Directions Publications for Newfoundland and Labrador. This work included the completion and publishing of two (2) new Sailing Directions publications for the coast line of Labrador, replacing older information contained in the Hudson Bay and Labrador Sailing Directions book.

In northern Labrador a tidal survey was conducted at Cape Kakkiviak, Cape Chidley, Hebron and Kangalsiorvik Fiord to installed, monitor and collect tide gauge data (30 day records) in support of the Northern Initiatives Fund (NIF) Project. The tidal data from this project will be used in the generation of new detailed shoreline plots, in support of Search and Rescue operations along this portion of the Labrador coast.

OTHER RESEARCH INFORMATION NOT SPECIFICALLY DELINIATED 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.

1. 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.

a) Proposed Eastport Marine Protected Area - Subarea 3

The waters surrounding Round Island and Duck Islands (approximately 2.1 km^2) off the Eastport Peninsula in Bonavista Bay were proposed as potential MPA sites by the Eastport Peninsula Lobster Protection Committee. Following consultations with interested and affected stakeholders, a Steering Committee was formed in 2002 to work with DFO in the further evaluation of the merits of this site as a potential MPA under Canada's *Oceans Act*.

Various projects were undertaken in support of the evaluation including a Seabed Imaging and Mapping System survey to identify and quantify critical habitat. Existing biophysical and socio-economic information was compiled for review. In addition, lobster research has been ongoing with the help of various partners including Memorial University, Atlantic Canada Opportunities Agency, and the Newfoundland and Labrador Legacy Nature Trust (NLLNT).

Community support for the conservation and protection initiative continues. A joint Eastport/ Leading Tickles MPA coordinator has been hired with assistance from NLLNT, Shell Canada, and Mountain Equipment Co-op. A quarterly newsletter, The Coastal Current, was also developed and is distributed to all households on the Eastport Peninsula. A logo was developed for the MPA based on submissions from local school children, with prizes for the logo contest being provided by DFO and the Kittiwake Economic Development Corporation.

Following the Ministers approval in March 2003 of a Recommendation concluding that a MPA was the most suitable management tool for the area, DFO in collaboration with the Steering Committee began regulatory management planning as per Step 4 of the National Framework for Establishing and Managing MPAs (1999).

Consultations on the regulatory intent of the MPA were held with other federal and provincial governments in 2004, and public consultations took place during the winter 2005. The Department of Justice is developing draft regulations in consultation with DFO, and it is anticipated that the regulations will be published in Part I of the Canada Gazette in the spring

2005. Interim protection continues to be provided to Round Island and Duck Islands with all commercial and recreational fishing prohibited while waiting for formal MPA designation.

A Review of Habitat Availability/Utilization and Marine Environmental Quality Issues in Inner Newman Sound, Bonavista Bay was completed in March 2004. This review was initiated at the request of the MPA Steering Committee in March 2004 following presentation of the MEQ profile for the Eastport area, including information related to the bacterial contamination resulting in a closure of inner Newman Sound to shellfish harvest. A study to determine the source of fecal coliform contamination of Newman Sound (Eastport) was initiated in 2004 as part of a pilot project coordinated by the National Program of Action (NPA). Results were inconclusive, and recommended methodology must be modified.

b) ***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. Following consultations with interested and affected stakeholders, a Steering Committee was formed in 2001 to work with DFO in the further evaluation of the merits of this site as a potential MPA under Canada's *Oceans Act*.

Various data was collected in support of the evaluation including multibeam bathymetry, the location of marine vegetation and algae beds, and underwater video. In addition, temperature loggers have been deployed and baseline information on the local lobster population and type/ abundance of juvenile fish utilizing the area is collected annually. Biophysical and socio-economic overviews were completed to compile existing related information for use in management planning, identifying information gaps, and determining research priorities.

Following a technical assessment in April 2004, the Region with the support of the Steering Committee, submitted a Recommendation to the Minister suggesting that a MPA under the *Oceans Act* was the most appropriate management tool for the area.

The Department closed two areas to commercial lobster harvesting within the proposed MPA boundary at the request of the Steering Committee. The Steering Committee supports the use of the *Fisheries Act* in providing interim protection to local species. In the summer 2005, research in partnership with Memorial University and the University of New Brunswick will commence on Atlantic herring (*Clupea harengus harengus*), capelin (*Mallotus villosus*), and winter flounder (*Pseudopleuronectes americanus*). Efforts will be focused on determining the areal extent of spawning sites, egg density, larval draft, and numbers of adults to ensure pre-treatment data is collected prior to the implementation of further species specific conservation strategies.

Community support for the MPA initiative continues. A joint Eastport/ Leading Tickles MPA coordinator has been hired with assistance from the Newfoundland and Labrador Legacy Nature Trust, Shell Canada, and Mountain Equipment Co-op. A quarterly newsletter, The Coastal Current, was also developed and is distributed to all households in Leading Tickles and surrounding areas.

It is anticipated that documentation outlining the regulatory intent of the proposed MPA and related management actions will be developed in 2006. Following consultations, it is hoped that the Tickles MPA will be formally designated in 2007.

c) ***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 Valley-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 have been studying the cod (*Gadus morhua)* found in Gilbert Bay. They discovered a resident 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 confirming the population 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 Area of Interest (AOI) in October 2000. In 2001, the Gilbert Bay Steering Committee was established, representing all interested and impacted parties.

In 2002, the Gilbert Bay 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 began drafting a management plan including a regulatory package. In February 2005, DFO (in partnership with the Newfoundland and Labrador Legacy Nature Trust) hired a community coordinator to provide assistance to the Steering Committee.

Scientific research conducted in Gilbert Bay during 2003 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 were able to estimate the population of Gilbert Bay cod (~70 metric tons). The results of this analysis are published as a Canadian Science Advisory Secretariat document. In 2004, a fish fauna survey was completed in Gilbert Bay as well as a sentinel survey adjacent to the proposed MPA.

In December 2004, a draft management plan was compiled for Gilbert Bay and is currently under review by the Gilbert Bay Steering Committee. It is anticipated the management plan will be completed by the autumn 2005. In February 2005 a monitoring workshop was hosted by DFO. The results of the workshop will be implemented as a part of the 2005 field season.

In April 2004, regional DFO staff submitted a regulatory package to headquarters in Ottawa for review. Regulations have been drafted and will be posted on the public registry for review in June. It is anticipated that the Gilbert Bay MPA will be designated late summer/early autumn of 2005.

2. 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.

Large Ocean Management Areas (LOMAs), are the planning framework for Oceans Management. Coastal Management Areas (CMAs) are nested within LOMAs and generally reflect areas of high human activity and high environmental value. Newfoundland and Labrador Region is responsible for the Placentia Bay/Grand Banks LOMA and is working in collaboration with other DFO regions on Integrated Management activities within the Gulf of St. Lawrence (GOSLIM).

a) *Placentia Bay/Grand Banks LOMA*

The Placentia Bay/Grand Banks was identified in the Oceans Action Plan (2004) as one of five priority Large Ocean Management Areas (LOMAs) for integrated management planning. IM projects currently underway in the Placentia Bay/Grand Banks LOMA include two coastal IM projects; Placentia Bay IM and Bay D'Espoir/Connaigre Peninsula IM, as well as the offshore focused Grand Banks IM project. A workshop was recently held in St. John's (March 2005) during which stakeholders associated with the LOMA came together to discuss IM issues regarding the area.

<u>*Placentia Bay*</u>

The Placentia Bay area is located within the Placentia Bay/Grand Banks LOMA and the southern Grand Banks ecoregion. In the Placentia Bay IM Planning area, a comprehensive scoping exercise, completed in late 2003/early 2004, concluded that a Placentia Bay Integrated Management Planning Committee should be established for the area, and it had to be community lead with stakeholder representation from government partnerships. However, the structure, role and authority of the committee must be carefully considered in order for it to become effective.

An Interim Placentia Bay Integrated Management Planning Committee was formed and held its first meeting in March 2005. The first order of business for the committee is to adopt a mandate and Terms of Reference for its operations and prioritize a list of issues and concerns the committee would address.

Federal and Provincial personnel continue to work collaboratively with agencies and stakeholders to research and develop a draft Ecosystem Overview Report and associated ecological assessment for Placentia Bay. This draft report has been undertaken using direction provided in national draft guidelines for ecosystem overview reporting in order to describe existing aspects of the physical, biological and socio-economic aspects of the Placentia Bay ecosystem.

In accordance with the approved milestone structure for IM, work completed to date in the Placentia Bay area is categorized under Stages 1 and 2 *Define IM Area* and *Engage Interested Parties*. During the 2005/2006 fiscal year, IM planning in Placentia Bay will move to Stage 3, *Development of an IM plan.*

Marine Environmental Quality (MEQ) Atlases were completed for Placentia Bay, the Coast of Bays and the South Coast in 2004.

A preliminary study of potential areas of anoxia in Placentia Bay assessed a series of water quality parameters at 14 reference sites, 18 sewage outfalls, and 5 fish plant outfalls in low energy receiving environments in Placentia Bay in the autumn of 2004. Major sources of water quality degradation include municipal sewage outfalls and industrial effluents. The major source of industrial effluent in Newfoundland and Labrador is associated with fish processing plants.

MEQ staff reviewed and provided comments on the draft Ecosystem Overview and Assessment Report for Placentia Bay in 2004.

The MEQ Program worked with Memorial University to compare types and sources of marine debris at a series of rural and urban sites on the south and northeast coasts of Newfoundland in 2004. The MEQ Program conducted a study of marine debris sources, movement and loading through a survey of 86 collector beaches within Placentia Bay. An educational poster "Marine Debris Trashing our Ocean, Trashing our Future" and a marine debris communication strategy were completed in March 2005.

A pilot study to assess the impacts of the Come by Chance oil refinery on fish health was initiated by the MEQ Program in partnership with DFO Science in 2004. Winter flounder collected near the oil refinery at Come by Chance, Placentia Bay, were compared to winter flounder at a reference site (Baker's Cove). A photo collection documenting external lesions and fin erosion for the study fish was produced in October 2004. A report entitled "Histopathological Studies on Winter Flounder from Placentia Bay" was produced in March 2005. Also in March 2005, a preliminary assessment of hydrocarbon contamination in beach sediments at 9 sites throughout the bay, was summarized in a report entitled "Hydrocarbons in Placentia Bay Sediments".

Bay D'Espoir/Connaigre Peninsula

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 pursuing IM planning on the area. The sponsor group, Coast of Bays Corporation, has developed a strategic plan to proceed with Integrated Management in the area. A planning committee was formed, with the first meeting on March 14, 2005 and a coastal planning coordinator has been hired. In addition, a communications strategy has been developed and a Coast of Bays marine infrastructure strategic plan is being created. A draft Ecosystem Overview Report was completed in Fy2003/04 and was further revised in 2004/05 to extend the coverage from Coast of Bays to the entire south coast (Point May to Cape Ray). A coastal planning website is currently online (http://coast.coastofbays.nl.ca) and an Environmental Profile pamphlet for the Coast of Bays Region was produced in late 2004.

In this area two projects were undertaken in 2004/05 to identify and map significant/sensitive areas. One exercise focused on the Coast of bays region while the other encompassed the south coast (point Crewe to Cape Ray) and offshore including Subdiv. 3Psa, 3Psb, 3Pse, 3Psg, 3psd and 3Psn. This information is generally anecdotal in nature and from a variety of sources.

Grand Banks

The Grand Banks IM (GBIM) project was initiated in spring 2004 and is the latest IM project established in the Region. The project has an offshore focus and is currently in the first step of the six-step IM planning process – Defining and Assessing the Management Area. Activities conducted at this stage in planning have included recommendation of a management boundary and compilation of biophysical and socio-economic area information. Specific activities include the following:

A management boundary recommendation is being developed based upon the input of national and regional working groups.

A State of the Knowledge Report for the Grand Banks is being compiled led by Science personnel from DFO NL Region. The State of the knowledge report will provide information on biological, physical and human use aspects of the Grand Banks environment.

As a contribution to the identification of Ecologically and Biologically Significant Areas, species distribution mapping for potential Grand Banks species at risk is being conducted. This project is being led by Science personnel from DFO NL Region.

Mapping of Grand Banks finfish diversity is being conducted as another contribution to the identification of Ecologically and Biologically Significant Areas. This project is also being led by Science personnel from DFO NL Region

Mapping of NL Region deep sea coral distributions (including the Grand Banks) may also contribute to identification of Ecologically and Biologically Significant Areas. A partnership between DFO and Memorial University of Newfoundland has been established to undertake this project

Preparation of a Human Use Atlas for the Grand Banks is being undertaken by Oceans Division personnel at DFO NL Region. The atlas will present human use activities spatially with supporting text.

DFO Oceans Division personnel are preparing a Regulatory Overview pertaining to legislation and policy used to regulate activities on the Grand Banks. This will contribute to development of a governance framework and identify relevant information pertaining to jurisdictional considerations.

The use of MarXan, a GIS-based decision support tool, is being evaluated as a contribution to Grand Banks IM planning.

Establishment of a federal-provincial Grand Banks Technical Working Group has engaged both levels of government and provided opportunities for collaboration and information sharing.

b) ***Gulf of St. Lawrence IM*** *(GOSLIM)*

In 2000, DFO Oceans initiated the Gulf of St. Lawrence Integrated Management project. In 2004, the Gulf of St. Lawrence was announced as one of the five Large Oceans Management Areas as part of the Oceans Action Plan. Nested within GOSLIM are two Coastal Management Areas that fall within the Newfoundland and Labrador region, these are Bay of Islands and Northern Peninsula.

In the Gulf of St. Lawrence, NL Region personnel continued to work collaboratively with colleagues in the Gulf and Quebec Regions to research and develop an Ecosystem Overview Report and associated ecological assessment for the Gulf of St. Lawrence. This report is being undertaken using direction provided in national draft guidelines for ecosystem overview reporting in order to describe existing aspects of the physical, biological and socio-economic aspects of the Gulf of St. Lawrence ecosystem.

A listing and map of Ecological/Biological Significant Areas (EBSAs) in the Gulf of St. Lawrence was completed in 2004 and a web application is being developed. In November 2004 the GOSLIM team participated in the development of scientifically based criteria for the evaluation of proposed EBSAs.

An Ecosystem Overview (descriptions of biological, physical and socio-economic components of ecosystem and ecological assessment) of the Gulf of St. Lawrence is being compiled. In January 2005 the draft report was reviewed in a scientific forum. Once published, the final report will become an important engagement tool and contribute to the development of ecosystem objectives.

Marine Environmental Quality (MEQ) Atlases were completed for Bay of Islands, St. George’s Bay, and The Northern Peninsula West, in 2004, and MEQ staff reviewed and provided comments on the draft Ecosystem Overview and Assessment Report (EORA) for GOSLIM

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 2004/05 included: revision of the Coastal Management Plan (2004) as well as the Goals and Objectives. The State of the Harbour document will be available in 2005.

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 L'Anse aux Meadows located within subdivisions 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. Other work undertaken includes the collection, review and compilation of data and information which may be used to describe the physical, biological and socio-economic aspects of the coastal environment within this planning area, the formation of an interim coastal steering committee and the development and delivery of a presentation on Integrated Management

During 2004/2005 work on this initiative included the completion of wide-spread stakeholder consultations in 2004, updating of the stakeholders database, meetings with the steering committee in 2005. Other activities in 2005 included the preparation of an action plan for future ICZM activities, preparation of a communications plan and the ranking of issues and concerns coming from previous public consultation sessions.

3. **Community-based 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. A project in collaboration with CHS provided for the dissemination of the information on the internet via DFO's GeoPortal. This was officially completed in June of 2004.

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Table 1: Summary of preliminary catches for stocks within the DFO, Newfoundland and Labrador Region, 1994-2004. Note that unless otherwise specified, this table presents Newfoundland and Labrador landings only.

Subarea	Species	Division	Catch (t) 2004	2003	2002	2001	2000	1999	1998	1997	1996	1995	1994
0+1	Greenland halibut	SA 0 + 1A(offshore)+ 1B-F	4,029	4,204	2,561	3,181	2,615	3,876	3,300	1,700	1,453	5,852	3,723
	Shrimp*	0A	6,699	6,291	6,247	3,625	1,588	2,046	933	517	2,623	2,361	4,727
		0B	4,809	5,094	5,597	5,829	4,805	5,132	5,204	5,670	3,220	3,564	476
2	Cod	2GH	0	0	0	0	0	0	0	0	0	0	0
	Shrimp*	2G (SFA 4)	11,065	11,943	8,393	8,116	7,529	7,884	8,051	5,217	5,160	5,104	3,982
		2HJ (SFA 5)	26,162	18,020	15,180	15,036	14,645	15,109	15,170	15,103	7,383	7,616	7,499
		2HJ3K (SFA 6)	73,396	60,886	59,912	52,554	63,175	51,202	46,337	21,246	10,923	10,914	10,978
	Crab	2J	1,933	2532	3,522	3,756	3,794	5,448	4,061	3,166	3,090	3,178	2,978
	Iceland scallop	2HJ	393	528	272	218	230	685	1,295	1,027	360	167	340
	Arctic Charr	2J3KLPs+4R	19	19	21	33	47	41	38	38	16	30	31
2+3	Redfish	2+3K	169	21	35	41	28	3	3	4	2	1	
	Greenland halibut	2+3KLMNO	4,870	6,960	6,292	8,235	10,637	4,124	4,081	5,877	5,891	3,229	2,928
	American plaice	2+3K	17	34	100	132	67	6	6	2	16	28	16
	Witch	2J+3KL	28	111	166	151	92	2	1	6	4	10	11
	Cod	2J3KL	689	1,029	4,193	6,887	5,354	8,472	4,501	501	1,500	332	1,309
	Grenadier	2+3	133	185	272	212	234	145	209	98	225	125	130
	Capelin	2J3KL (offshore)	0	0	0	0	0	0	0	0	0	0	0
	Squid	2+3	1,997	622	228	23	328	19	815	12,748	8,285	48	1,954
3	Redfish	3LN	1	9	48	24	32	5	7	19	0	0	0
		3M	0	0	0	0	0	0	0	0	0	0	0
		3O	2,339	3,093	2,988	4,532	880	2,027	6,121	1,895	128	24	1,192
	Yellowtail	3LNO	12,575	12,702	9,958	12,240	9,425	5,540	3,536	1			
	American plaice	3LNO	1,296	1,606	1,377	1594	622	269	204	71	47	65	59
		3Ps	731	881	1,011	877	607	542	405	213	112	80	112
	Witch flounder	3NO	49	52	26	12	4	3	3	18	26	0	0
		3Ps	542	530	518	450	332	507	452	259	250	273	429
	Atlantic halibut	3	317	398	365	317	183	124	165	152	101	107	36
	Cod	3NO	442	714	424	506	172	485	306	289	54	31	3
		3Ps	10,807	12,440	12,118	13,339	19,683	24,328	15,690	7,327	767	581	575
	Haddock	3LNO	21	69	183	88	70	50	14	190	28	9	0
		3Ps	129	137	109	99	163	98	191	69	118	48	20
	Pollock	3Ps	298	332	492	808	710	729	428	592	435	248	59
	White hake***	3NOPs	1,572	1,469	1,847	1,430	1,390	920	626	893	1,054	603	657
	Thorny skate***	3LNOPs	not available	423	1,014	511	414	350	127	486	488	206	274
	Capelin	3L	16,066	13,270	8,639	13,898	12,041	11,403	19,809	3,560	16,840	100	890
		3K	11,342	4,067	1,553	5,018	4,066	7,254	10,225	9,230	8,920	30	70
	Shrimp*	3M	0	0	8	293	618	490	469	785	906	970	1,041
		3L	10,137	10,008	5,417	4,986	4,111						
	Sea scallop	3KLNO	0	0	0	0	0	0	6	20	27	9	10
		3Ps	3,417	647	51	338	85	70	266	9	8	418	534
	Iceland scallop	3LNO	0	0	0	39	336	141	1,300	3,986	9,454	6,501	3,941
		3Ps	20	87	478	498	1,148	1,197	2,792	5,367	608	1,061	440
	Crab	3K	16,460	16,493	16,352	15,288	15,390	21,470	16,788	14,830	14,190	12,245	11,039
		3LNO	31,053	31,627	30,032	28,172	26,773	32,725	23,533	22,185	16,656	13,790	12,237
		3Ps	4,720	6,110	7,637	7,843	7,917	7,909	6,615	4,753	3,047	1,853	1,590
	Lobster	3K	173	206	206	275	231	251	295				
		3L	85	118	128	124	126	158	146				
		3Ps	818	787	762	709	637	612	683				
		3Pn	15	22	12	25	18	25	26				
	Atlantic salmon**	2J3KLPs+4R	35	36	39	39	30	38	45	82	114	95	133
3+4	Redfish	3P+4V	3,435	3,040	3,289	2,506	4,439	4,726	4,101	3,825	4,566	3,978	7,594
4	Iceland scallop	4R	335	268	249	638	1,083	1,058	1,348	1,205	1,204	1,497	2,294
	Sea scallop	4R	0	0	0	0	1	0	0	0	0	2	37
	Lobster	4R	930	1201	950	985	747	766	885				
	Crab	4R	1,452	1,565	1,750	1,675	1,640	1,612	1,064	969	833	920	655

*Shrimp catches are for Eastern Canada (i.e. taken by vessels from Newfoundland and Labrador, Quebec, and Nova Scotia).
**Recreational catch.
***Canadian catches only.

PART II. CENTRAL AND ARCTIC REGION

SUBAREA 0

A. Status of the Fisheries

a) Shrimp

See report by Newfoundland (Part I).

b) Shellfish

The Nunavut Department of Sustainable Development funded a pilot project to run a fishery in Qikiqtarjuaq. The Aboriginal Business Quest of BC was contracted to manage and provide diving supervision for the fishery. The project began January 2004 and began harvesting clams in February. In eight weeks of diving 11 divers collected 4 672 kg of clams, all *Mya* sp. Field data from previous assessment work were analyzed to estimate Total Allowable Harvest for this area.

c) Arctic Charr

Subsistence and commercial Arctic charr fisheries in the Baffin region (NAFO Subarea 0) 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 – Div. 0B

Inshore: Nunavut companies have a 1000 ton inshore allocation for Greenland halibut in Subarea 0. The only inshore fishery that has operated on an annual basis is the Cumberland Sound fishery which began in 1987. The total allowable catch (TAC) for this fishery has been set at 500 tons since 1994 but catches have not reached this level since the early 1990's. 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. Exploratory fishing was conducted in the summer, open water season, in 1995 and 2002 but they were not successful in locating exploitable aggregations of Greenland halibut. Sea-ice conditions can affect the success of the winter fishery by restricting access to deeper more productive areas and thereby curtailing effort. Catches were lowest in the late 1990's at less than 100 tons with a slight increase in 2002 and 2003. However, ice condition was unstable again in 2004 and catches dropped to 63 tons (Table 1). Following a review of information and a recommendation from NAFO Scientific Council (see pg. 34, NAFO 2004) the Cumberland Sound inshore fishing grounds will be managed separately from offshore Div. 0B effective in 2005.

Offshore: Nunavut companies have a 500 ton quota in the Div. 0B offshore commercial fishery. In recent years they have also been allowed to transfer surplus inshore quota to the offshore fishery. In 2004, Nunavut license holders in offshore Div. 0B harvested approx. 998 tons all taken with otter trawl gear, for a total catch of 1 061 tons from Div. 0B (Table 1).

e) Greenland Halibut – Div. 0A

Since 1996 Nunavut companies have had exclusive access to an exploratory fishery license to harvest Greenland halibut in NAFO Div. 0A and there is 100% observer coverage for this fishery. Between 1996 and 2000 catches were less than 330 tons. Catches began to increase in 2001 (2 625 tons) and in 2004 they caught 3 740 tons (Table 1). Long-line gear was used in this fishery in 2002 and 2003. In 2004 a majority of the catch (3 725 tons) was caught using bottom trawl. A single gillnet vessel entered the fishery late in the 2004 season (early November) and caught only 15 tons before losing 149 nets due to equipment failure and severe ice conditions.

Data on by-catch in the Greenland halibut fisheries in Subarea 0 were not available at this time.

B. Special Research Studies

1. Environmental Studies

A Seabird 19© conductivity, temperature and depth instrument equipped with a fluormeter was deployed at 4-5 stations along three transects in Div. 0A during two otter trawl fisheries surveys conducted in September and October, 2004 (see below). Readings were taken to the bottom or within the top approx. 600 m of the water column. A Seamon© temperature sensor (sensitive to within $\pm 0.1^{o}C$) was mounted on one of the trawl doors and provided bottom temperature data for most sets. See Treble and Van Hardenberg 2005 for more information.

2. Biological Studies

a) Survey of NAFO Division 0A

Greenland Halibut Assessment: Two stratified random otter trawl surveys covering depths of 400 m to 1500 m and targeting Greenland halibut (*Reinhardtius hippoglossoides)* were conducted in Div, 0A (Baffin Bay) (Treble, 2005). The first was conducted in northern Div. 0A from September 4 to 12 in an area that had not been previously surveyed. The second, from October 14 to 24, 2004 covered previously surveyed strata in southern Div. 0A. A detailed report was presented to the NAFO Scientific Council in June 2005 (Treble, 2005).

Ecosystem assessment: A University of Manitoba Zoology PhD student collected fish from the by-catch for a study of northern marine ecosystems. Linkages will be examined between species and the types of parasites they carry. Detailed sampling in the lab will include the identification of parasites present, description of stomach contents, collection of tissues for stable isotope analysis, and development of an archive of DNA material. This project is being funded jointly by the University of Manitoba Northern Studies Program Grant, NSERC Northern Internship Scholarship, and DFO Science.

Comparative life-history: A Dalhousie University Biology PhD student collected fish from the by-catch for research concerning the evolutionary ecology of Arctic fishes. Important life-history traits related to individual growth and reproduction will be collected in the lab for comparison to data from related taxa collected in Gulf of St. Lawrence and Scotian Shelf waters. These data will be used to advance basic biological knowledge about these little-known species, and to test hypotheses concerning life-history adaptations of polar fishes.

Bottlenose Whales: Bottlenose whales were not seen during the first survey in northern Baffin Bay. During the second survey 6-7 sightings were recorded by an honours student in marine mammal studies from Dalhousie University who was able to record location information and take photos.

Collection of deep-sea coral and other rare fish: No coral was found in the northern Baffin Bay area but some coral samples were collected in southern Baffin Bay. These samples may be sent to DFO-Bedford Institute or University of Manitoba for archiving. Collections of rare fish specimens were also made. These will be sent to the Canadian Museum of Nature.

Information on the distribution of Arctic fishes: This is the first survey conducted at these depths in arctic waters north of $72^{o}N$. New data on range extensions for some species has been collected. The survey data will be provided to Dr. James Reist and Dr. Brian Coad for inclusion in their book on Arctic Fishes.

b) Age Validation for Greenland halibut

Research into the C^{14} method of age validation was completed in 2004. The project also included otoltih samples from Greenland halibut that had been marked with Oxytetracycline. The project was expanded in 2004 to include analysis of growth from tag-recapture data available from the Greenland Institute of Natural Resources. A comparison of age methods and structures was also completed. A report of the results was presented to the NAFO Scientific Council meeting in June 2005 (Treble *et al*., 2005).

c) **Nuclear DNA (Microsatellite) Analysis in Greenland Halibut**

Our research into the stock structure of Greenland halibut continued in 2004 with collaboration from Norwegian scientists working on Greenland halibut genetics in the Northeast Atlantic. We exchanged information on primers and methods we developed in 2001 and they analyzed a shared set of samples in an effort to increase our sample size and improve on our initial results.

d) **Marine Mammal Studies**

The first of a two to three year bowhead whale tagging project was begun in Cumberland Sound (NAFO Div. 0B) in 2004. The research team applied satellite-linked tags to three bowhead whales in April. Sea ice moved into the area hindering the application of additional tags. The transmitters on two of the whales did not work but the third whale was tracked from Cumberland Sound up the east coast of Baffin Island, into Lancaster Sound and Prince Regent Inlet. This project will continue in 2005.

Our lab has also been studying beluga and narwhal stocks within Cumberland Sound for a number of years. There is an important subsistence harvest for these whales by hunters in the community of Pangnirtung. Cumberland Sound belugas are currently listed by COSEWIC as Threatened and a recovery strategy is being developed. Field work was not done in 2004 but an aerial survey of Cumberland Sound belugas is planned for 2005.

Research results are reported to the International Whaling Commission (IWC), the North Atlantic Marine Mammal Committee (NAMMCO) and the Canada/Greenland Joint Commission.

e) **Shellfish**

Stock Assessment photographic survey of Clam Fishing Zone 3 was conducted in 2003. Most of the area that currently can be fished has been sampled. The results will provide a good estimate of the standing stock of clams in the area. Samples were collected by divers for ageing and biomass estimates.

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TABLE 1. Summary of catch estimates (tons) for Greenland halibut by Central and Arctic licensed vessels.

Div.	2004	2003	2002	2001	2000	1999	1998	1997	1996	1995	1994	1993	1992	1991	1990	1989
0A offshore	3740	4278	3561	2610	211	0	42	203	295	0	0	0	0	0	0	0
0B inshore	63	244	106	77	45	34	63	66	60	285	400	425	430	147	255	180
0B offshore	998	1016	812	1013	1341	1568	1720	1446	1417	407	0	20	1020	0	0	0
Total 0B	1061	1260	918	1090	1386	1602	1783	1512	1477	692	400	445	1450	147	255	180