Northwest Atlantic Fisheries Organization

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SCIENTIFIC COUNCIL MEETING – JUNE 2002

Canadian Research Report for 2001

PART I. Central and Arctic Region – by Margaret Treble and Sue Cosens

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SUBAREA 0

A. Status of the Fisheries

a) Shrimp

See report by Newfoundland.

b) Shellfish

Shellfish were fished year round in 2001 under experimental licenses in the Qikiqtarjuaq (55 ton quota) and Iqaluit (5 ton quota) areas. Divers collect primarily soft-shelled clams (*Mya truncata*) and Greenland cockles (*Serripes groenlandicus*). The catch is not distinguished by species and is sold locally.

c) Arctic Charr

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

d) Greenland Halibut

Nunavut companies have a 1 000 ton inshore allocation for Greenland halibut in Subarea 0. The Cumberland Sound fishery began in 1987 and is the only inshore fishery that has operated on an annual basis. The total allowable catch (TAC) for the Cumberland Sound fishery has been set at 500 tons since 1994. The fishery is exclusively a winter fishery (January to May) and the fishermen use long-lines set through holes cut in the land-fast sea ice. In recent years the TAC has not been reached. Fishermen have experienced unstable ice conditions on the sea ice platform (1996 to the present) and effort has been decreasing since the early-1990s. The fishery produced 127 tons in 2001.

Nunavut companies have a 500 ton quota in the Div. 0B offshore commercial fishery. In recent years they have also been allowed to transfer any surplus inshore quota to the offshore fishery. In 2001, Nunavut license holders in Div. 0B harvested 1 143 tons.

Since 1996 Nunavut companies have had exclusive access to an exploratory fishery license to harvest Greenland halibut in NAFO Div. 0A. Between 1996 and 2000 catches were less than 330 tons. In 2001,

following a recommendation by NAFO Scientific Council, the catch in NAFO Div. 0A increased to 2 625 tons. There is 100% observer coverage for this fishery. Approximately 20 species or families of fish were listed as by-catch by the observers but most occurred in amounts less than 1 ton. Greenland shark or boreal shark (*Somniosus microcephalus*) was caught in 138 of 716 tows for a total of 70 tons. Several skate species were caught, including Arctic Skate (*Amblyraja hyperborea*), for a total of 7 tons. Roughhead Grenadier (*Macrourus berglax*) were also relatively abundant with 2 tons recorded as by-catch. Wolfish (*Anarhichas* sp.) were caught in 8 sets for a total of 57 kg. No Atlantic halibut (*Hippoglossus hippoglossus*) were caught.

B. Special Research Studies

1. Environmental Studies

Bottom temperature data were collected during a scientific survey of the groundfish resources in Div. 0A and 0B (see SCR document Treble *et al*., 2002 for set by set temperature data). No other environmental studies were conducted.

Table 2. Mean temperature and S.E. in () for NAFO Div. 0A and 0B in 2001, by depth stratum.

NAFO	Depth Stratum (m)				
Division	401-500	501-750	751-1000	1001-1250	1251-1500
0A	0.70 (0.10)	1.46 (0.22)	0.89 (0.07)	0.73 (0.05)	0.21 (0.05)
0B	2.63 (0.24)	2.86 (0.15)	3.69 (0.04)	3.48 (0.03)	3.40 (0.00)

2. Biological Studies

a) Survey of NAFO Subarea 0

Two stratified random otter trawl surveys covering depths of 400 m to 1 500 m and targeting Greenland halibut (*Reinhardtius hippoglossoides)* were conducted in NAFO Subarea 0, Div. 0A from September 16 to 23 and Div. 0B from October 19 to 26, 2001. This was a collaborative effort between Fisheries and Oceans Canada, the Nunavut Wildlife Management Board, and the Greenland Institute of Natural Resources. Survey coverage was the same as in previous years (1 set per 750 km^2 for Div. 0a and 1 set per 1 030 km^2 for Div. 0B) with a minimum of two tows per stratum. However, both trips experienced difficulties in completing the survey in the time available and some strata were missed. In Div. 0A 48 of 92 tows were completed while in Div. 0B 36 of 76 tows were completed. Greenland halibut were present in all tows with the greatest densities in both Divisions between 501 m and 750 m. Total estimated biomass and abundance in the Div. 0A survey area were 97 627 tons and 142.7×10^6, respectively. Estimated biomass and abundance in the Div. 0B survey area were 68,917 tons and 85.9×10^6 fish. Lengths ranged from 10 cm to 99 cm for 0A with 68.1% less than 45 cm. For Div. 0B lengths ranged from 8 cm to 97 cm with 77.5% less than 45 cm. The distributions had single modes with peaks at 43 cm for 0A and 45 cm for Div. 0B. Otolith samples were collected for age determination but data is not available at this time. The catch of other commercially important species was minimal. However, some data on these and other non-commercial species from the by-catch are also presented.

Deep-Sea Ecosystem: A University of Manitoba graduate student made collections of fish from the by-catch for a project on 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 will support DFOs ecosystem approach to resource management and is being funded jointly by the University of Manitoba Northern Studies Program Grant and DFO Science.

Seabed Classification: Preliminary work conducted during the 2000 survey in Div. 0B was very successful and as a result a graduate student from the University of Calgary was recruited to continue with this work in 2001. Sonar data were collected and analyzed using the QTCView and SeaBed Classification System software developed by Quester Tangent Corp. of Sidney, BC. Sonar data were collected across Davis Strait in both Canadian and Greenland waters. Funding has been provided by Quester Tangent Corp., Canadian Marine Acoustic Remote Sensing Facility, Canadian Space Agency, University of Calgary, DFO, and GINR.

b) Nuclear DNA (Microsatellite) Analysis in Greenland Halibut

Microsatellite markers may be the best approach for the study of genetic stock structure in Greenland halibut. Microsatellites are widely distributed in large numbers in animal nuclear genomes. They have a higher mutation rate than mitochondrial DNA markers which is often more suitable for the examination of subtler genetic subdivision. Primers for analyzing these loci can be available in the literature, as primers developed for one species will often work for a wide range of other taxa. This provides a relatively fast and cost-effective approach to increasing the number of loci examined in a species of interest.

In 2001 primers developed for microsatellite amplification in Atlantic halibut (*Hippoglossus hippoglossus*) and olive flounder (*Paralichthys olivaceus*) were tested in Greenland halibut. Nine loci have been identified that are able to be cleanly interpreted and are highly polymorphic, however sample sizes to date are too small to adequately test whether or not stock differences can be detected. Additional samples collected during the 2001 survey of Subarea 0 will be examined in 2002-03.

c) Age Validation for Greenland halibut

The C^{14} method of age validation is being examined for its applicability in the case of Greenland halibut. This work is being undertaken in collaboration with Dr. Steven Campana at the Bedford Institute and in cooperation with scientists from DFO Newfoundland and the Greenland Institute of Natural Resources. In 2001 an analysis of C^{14} in the core of otoliths from 4 Greenland halibut collected in Cumberland Sound in 1986 showed that whole otolith ages may be under-aging these fish. However, since the C^{14} signal recorded in deep-sea environments is different (delayed) from that of the surface marine waters, reference C^{14} values appropriate to the environment experienced during the period of otolith core formation must be used. This work is continuing in 2002.

A tagging program for Greenland halibut from Cumberland Sound was conducted from 1997 to 2000 during the winter long-line fishery. One aspect of this tagging program was the marking of the otoliths using an injection of oxytetracyline (OTC). In 2001 one marked otolith was recovered. Two years had passed since marking and the OTC mark was visible on the sectioned otolith. In April 2002 a second marked otolith has been returned, three years since tagging, but it has not yet been examined.

d) Marine Mammal Studies

Our lab has been studying the beluga and narwhal stocks within Cumberland Sound (NAFO Div. 0B) for a number of years. There is an important subsistence harvest for these whales by hunters in the community of Pangnirtung. In 2001 a tagging project was initiated to capture narwhal and beluga at the sea ice edge in the spring and attach satellite tags. However, ice conditions were not ideal, making capture difficult and no tags were attached. The status of the beluga stock was assessed in late-2001 and a recovery plan was developed.

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PART II

SCIENTIFIC COUNCIL MEETING – JUNE 2002

Canadian Research Report for 2001

PART II. Newfoundland Region – by Dale Parmiter-Richards

SUBAREAS 0 AND 1

A. Status of the Fisheries

Nominal landings from 1990 to 2001 for fish stocks are listed in Table 1. Additional information on the status of the fisheries is as follows:

a) Shrimp - Div. 0AB

Between 1991 and 1996, the *Pandalus borealis* quota in Div. 0A was set at 8,500 t. Since that time, the quota varied between 7,650 and 9,350 t. Annual catches of 4,800 – 7,500 t were made between 1991 and 1994, but have since fluctuated between 500 and 2,600 t.

The *P. borealis* quota in Div. 0B was increased from 5,250 t in 1998 to 8,750 t during 1999. The increase was due to the inclusion of a 3,500 t exploratory quota for areas north of 63°N. In the traditional fishing area south of 63°N, 5,100 t were caught whereas only 100 t were taken in the northern areas. In 2000, the additional 3,500 t was not included in the quota report, and accordingly the catch was not counted against the TAC for the south (5,350 t). In 2001, the additional 3,500 t was included in the quota report as an exploratory quota east of 63°W. The preliminary data suggest that approximately 5,700 t were taken in the south. Approximately 640 t were taken in the exploratory area. The standardized annual CPUE showed an overall decline from 1988 to 1993. Catch rates increased sharply from 1993 to 1996 after which they remained stable. The CPUE model, standardized for year, month and vessel effects with effort weighting, showed that the 1988 - 1990 and 1996 - 2000 catch rates were similar to the 2001 estimate ($P > 0.05$) while all other estimates were significantly lower ($P < 0.05$) than the 2001 estimate. The pronounced increase in CPUE after 1993 is associated with the shift of fishing effort to the southwest. Fluctuations in catches and catch rates are not considered to be valid indicators of overall stock conditions and may reflect oceanographic conditions.

b) Greenland Halibut – 0B+1B-F

The Greenland halibut stock in Subarea 0+1B-F (offshore) is considered to be part of the same stock distributed in Subarea 2 and 3. Canadian catches for 2001 were approximately 5,500 t. The stock is managed jointly by Canada and Denmark (Greenland), with the TAC being split equally. Recent scientific information on this stock is limited, although new surveys were completed in Div. 0A and 0B in 1999-2001. NAFO Scientific Council and the Canadian Fisheries Resource Conservation Council (FRCC) recommended that the TAC in 2001 and 2002 should not exceed 11,000 t, as in recent years. NAFO SC also advised that an additional catch of 4,000 t could be taken from Div. 0A and 1A combined, and this was fished during 2001.

SUBAREA 2

A. Status of the Fisheries

Nominal landings from 1990 to 2001 for fish stocks are listed in Table 1. Additional information on the status of the fisheries is as follows:

a) Atlantic salmon

The commercial fishery remained closed for 2001. Approximately 9,200 salmon were retained or hooked and released in the recreational fishery.

b) Arctic charr

Commercial landings of Arctic charr in northern Labrador were 33 t, about 30% less than landings in 2000 and consistent with a corresponding reduction in directed effort, but still similar to the average landings from 1993 to 2000. Catch rates increased in two of the three primary stock complex areas. Over the past 28 years (1974 – 2001), more than 2,700 t of charr have been harvested from a limited stretch of the north Labrador coast, and attests to the capacity of this area to produce fish. No data are available on the amount of charr harvested for subsistence (food) purposes.

c) Shrimp

The shrimp fishery in Subarea 2 and the northern portion of Subarea 3 is divided into three management areas – 2G, Hopedale and Cartwright Channels (2HJ), and Hawke Channel (2J) + 3K. Between 1998 and 2001, annual catches of approximately 8,000 t were taken in 2G from 8,320 t TACs. The standardized and unstandardized fishing effort and catch per unit effort indices have fluctuated without trend since 1991, reflecting stability in the resource. Historically, the fishery has been concentrated north of 60°N in an area noted for producing high catch rates of large, high-quality shrimp. During 1998, a separate quota was created for the area south of 60°N to reflect the existence of high concentrations of shrimp along the shelf slope. The new quota resulted in a southward shift in fishing effort. Overall, the stock remains healthy as evidenced in continued high catch rates for female shrimp and expansion of the resource.

Catches in Hopedale and Cartwright Channels (2HJ) have increased from 7,500 t during 1994-1996 to 15,000 t during 1997 – 2001 due to TAC increases. Over the past ten years, fishing effort has remained relatively stable even though the TAC doubled between 1996 and 1997. The resource appears healthy, from fishery data, with commercial rates of both male and female components stable throughout the 1980s and increasing during recent years. The research survey biomass/ abundance estimates showed an increase since 1998. The lower 95% confidence intervals for the biomass indices averaged 108,000 t (about 24 billion animals) during the 1998 - 2001 period.

The fishery in Hawke Channel (southern Division 2J) + 3K began in 1987 with landings of approximately 1,800 t. Catches increased to more than 7,800 t in 1988 and ranged between 5,500 and 8,000 t between 1989 and 1993. The first multi-year management plan for 1994 – 1996 set the annual TAC at 11,050 t 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 t in each of these years. Between 1997 and 2001 catches increased to over 63,000 t reflecting the dramatic TAC increases over that period. The small vessel shrimp fishing fleet (<500 t; LOA<100') has been exploiting this resource since 1997 and took approximately 63% of the 2001 catch. 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 453,500 t (about 109 billion animals) during the 1996 - 2001 period. Research data showed that the 1996 year-class was weak compared to others produced during the 1990's. Although the 1995 year-class appeared weaker than most, female abundance remained high. However, the 1997 and 1998 year-classes are strong, the former being the most abundant year-class at age 4, within the time series. Residual 1994 year-class animals, as well as, the sex inversion of 1995 and 1996 year-classes maintained the spawning stock biomass (females). The fact that the 2001 female length frequency is broad relative to the 2000 length frequency suggests that the 2001 female distribution was less reliant upon any one year-class of animals. The positive effects of the stronger 1997 year-class upon spawning stock should be evident by 2003. The resource in this area remains

healthy with high biomass/ abundance of male and female components. Exploitation rates have remained low over the past 6 years and the fishery continues to cover a broad area. Therefore, fishery related impacts could not be detected from either the logbook, observer or the research data. The fact that catch per unit effort for the large vessels has been maintained at a high level, and the fishing fleets are able to take their quotas over broad geographic areas, throughout the year further suggest that the stock is healthy.

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

d) *Cod* – 2GH, 2J3KL

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

The northern cod (NAFO Divisions 2J+3KL) commercial fishery reopened in the inshore in 1998 after 6 years of moratorium when income support to Newfoundland fishermen terminated. There is no evidence of any recovery in the stock. Recruitment levels are extremely low. Mortality rates appear to be high given that there is no directed fishery in the offshore. By-catches in the offshore occur in the turbot, yellowtail flounder and shrimp fisheries but accurate estimates are not available. A new recreational fishery open to all Canadians with a limit of 30 fish per person was instituted in 2002 and this may add substantially to fishing mortality in the inshore. Predation by harp and hooded seals throughout the stock area may be contributing to the high levels of mortality that are observed. The harp seal population increased substantially during the 1980s and early 1990s because of reduced harvest rates. Higher levels of harvest by Canada and Greenland in the mid-1990s appear to have stabilized the population, at least temporarily, at around 5.2 million individuals. Accurate diet data for harp seals in the offshore are not available making it difficult to estimate total consumption of northern cod. There are no reliable estimates of the current size of the hooded seal population in the northwest Atlantic. The last comprehensive surveys were in 1990/1991. Viewed as a single stock, northern cod is well below a spawner biomass reference point of 200,000 t and no directed fishing would be consistent with a precautionary approach. If the inshore is considered to contain a functionally separate subpopulation, which will not contribute significantly to the recovery of cod in the offshore, then a small TAC could be argued for if it was demonstrated to be sustainable. There is considerable concern that the removals in the inshore which have taken place since the moratorium was lifted have not been sustainable. Estimates of exploitation rate from tagging have been variable, and while some are low, there is concern that returns in 2001 from a number of experiments resulted in exploitation rates that were calculated to be greater than 10%, with one as high as 30%. There has been a continuous decline in the commercial catch rate and the sentinel catch rate indices since 1998. Based on catch rates, there is a trend for the remaining fish to be concentrated in an ever decreasing portion of the stock area. The only known overwintering aggregation occurs in Smith Sound, Trinity Bay (Division 3L) and this aggregation is estimated to be about 20,000 t based on acoustic studies. Slightly elevated presence of fish has been noted in the offshore in Canadian research vessel bottom trawl surveys since 1999 in the vicinity of the 3K/3L boundary. However, the 2001 survey biomass is only about 2% of the average in the 1980's.

e) *American plaice* – 2+3K

There was no directed fishery on this stock in 2001. Analysis of data from annual fall multispecies research vessel trawl surveys indicates that recruitment, abundance, and total and spawning biomass remain low. The next assessment of this stock is scheduled for October 2003.

f) *Redfish* – 2+3K

There has not been a persistent directed effort on this stock since 1990 when 2,400 t were landed. Landings declined to 280 t in 1991, and were less than 14 t in each year from 1992-2001. Estimates of redfish by-catch discarded from

shrimp fisheries in the Div. 2G to Div. 3K area since 1980 have ranged from 14 t in 1983 to 665 t in 1990. In 2000 an estimated 95 t of redfish were taken in the shrimp fisheries within SA2+Div. 3K. Survey biomass estimates for Div. 2J3K from 1995-2000 (average 32,000 t), are less than 5% of the average from 1978 to 1990 (775,000 t). This is based on the conversion of Engel trawl results (standard trawl on surveys from 1978-1994) into comparable units of the Campelen trawl (standard trawl on surveys since 1994). Recruitment has been poor since the year-classes of the early 1970s. There are no indications that the status of the stock will change in a positive way in the foreseeable future.

g) *Snow crab* – 2J3KLNO

Catches increased by about 2% to 47,200 t in 2001 from 46,100 t in 2001, while fishing effort (number of trap hauls) increased slightly. These increases were associated with a slight increase in TAC in 2001. Fishery performance is monitored in through analyses of commercial logbook data, observer program data, and dockside monitoring. CPUE from logbook data generally remained at a high level in 2001, but has been declining in the north (Div 2J3K) since 1998. The exploitable biomass index, which is projected from the fall multispecies bottom trawl survey of the previous year**,** decreased between 1999 and 2000 but has been generally stable from 2000 to 2002. Therefore the exploitable biomass for 2002 is expected to be generally similar to that of 2000. The projected pre-recruit index for >94 mm new-shelled males decreased during 1997-2000 and has been generally stable from 2000 to 2002. Recruitment prospects in the medium and longer terms are uncertain.

h) *Iceland scallop* - 2HJ

Inshore aggregations here were again fished with nominal catches estimated at 146 t, round. The fishery is prosecuted by inshore vessels, typically under 45 ft (14m), L.O.A. Except for exploratory surveys for presence/absence, there have been no directed scientific missions into scallop aggregations along the Labrador coast.

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

Improved recruitment has lead to an increase in this stock, and catches have increased in recent years. Fisheries Commission set a TAC of 44,000 t for this stock in 2001, up from 40,000 t in 2001.

j) *Witch flounder* - Div 2J3KL

This stock remains at a very low level. SC recommended no directed fishing on this stock in 2002 and 2003, and that by-catches be kept at the lowest possible level. The relationship between witch flounder in Div 3M with those in Div 2J3KL is being examined.

B. Special Research Studies

1. Biological Studies

a) *Groundfish and Shellfish*

Biological and oceanographic data from fall multi-species research vessel surveys were collected from Div. 2GHJ to conduct distribution and abundance studies and detailed biological sampling. Stomach analysis is conducted from specimens of Greenland halibut caught during the fall surveys.

b) *Arctic charr*

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

SUBAREA 3

A. Status of Fisheries

Nominal landings from 1990 to 2001 for fish stocks are listed in Table 1. Additional information on the status of the fisheries is as follows:

a) *Squid* – Subarea 2+3.

Following a peak catch in 1979 of 88,800 t, Subarea 3 catch declined regularly to 5 t in 1983. Catches remained lower than 5,000 t during the thirteen-year period 1983 to 1995. They increased since 1995 to 12,700 t in 1997 before declining sharply to about 800 t in 1998 and 19 t in 1999. They remained low, at about 300 t, in 2000 and decreased to only about 1 t in 2001. Increases in catches in 1996 and 1997 were associated with environmental warming and increase in squid abundance at the northern extreme of their range. The recent very low catches during 1998-2001 reflect low squid abundance in Canadian waters, despite persistence of a warm oceanographic regime.

b) *Atlantic salmon* - Subareas 3 and 4

A moratorium on the Canadian commercial fishery has been in place since 1992. Landings at St. Pierre (Div. 3Ps) totalled 2.2 t in 2001. The 2001 recreational harvest, including both retained and hooked-and-released, was approximately 36,700 fish in insular Newfoundland.

c) *Shrimp* – 3LMNO.

Subarea 3 has been divided into two shrimp management areas – 3L and 3M. Results of the autumn 1995 – spring 2001 Canadian multi-species surveys indicate that shrimp have been widely distributed along the edge of 3L. The biomass index increased from 5,921 tons in autumn of 1995 to 59,914 tons during autumn of 1998, remained stable until spring of 2000, at which time it increased to 121,815 t. The index then decreased to 103,451 t during spring 2001. At least 72% of the biomass was within Canada's 200 Nmi limit, and at least 90% of the total biomass was found within NAFO Division 3L. Divisions 3N and 3O accounted for less than 14% and 1% of the biomass respectively. This is a new fishery with 2000 and 2001 TACs set at 6,000 t and fishing restricted to areas within 3L that have depths greater than 200 m. Canadian vessels took 3,800 and 4,800 t of shrimp in 2000 and 2001 respectively. The international catches in the NRA increased from 900 t during 2000 to 1,400 t during 2001. Areal and depth restrictions are to reduce by-catch of economically important groundfish presently under moratoria.

The fishery for northern shrimp at Flemish Cap began in the spring of 1993 and has since continued with estimated annual catches (as estimated by STACFIS) of approximately 27,000, 25,000, 33,000, 48,000, 25,000, 30,000 and 43,000 t from 1993 to 1999, respectively. The 2000 catch was 50,000 t, the highest in the series. Removals to October 2001 of about 41,000 t are similar to those reported for the same period in 2000 (40,000 t). Projections to the end of year 2001 are expected to reach 50,000 t. Vessels from as many as 16 nations have participated in this fishery since its beginning.

By-catch of groundfish has been quantified, and consists primarily of redfish and Greenland halibut.

d) *Iceland scallop.*

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

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

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

Catches from the LCC box were 32 t (round) from a TAC of 900 t in 2001. Catch rate (57 kg/tow) is down 42 % from 1995, when deposits here were first commercialized. Individual meat-weight frequency distributions show a bias toward slighter larger meats compared to 1998. Meat counts have decreased correspondingly.

Elsewhere, over the Grand Banks (Div. 3LN) little commercial activity was recorded in 2001.

The Iceland scallop fishery on St. Pierre Bank commenced in 1989 and is now separately managed as two zones: (a) the trans-boundary stock, along the northern edge co-managed by France (70% of annual TAC) and Canada (30% of TAC) and (b) the large area to the south that remains entirely under Canadian jurisdiction. Total removals declined compared with the previous year (539 t vs. 1134 t). Near-shore aggregations only accounted for 1% (7t) of the combined removals from this area. Catch rates in 2000 declined (14 vs. 34 kg/tow) from the previous year. There was no directed effort for Iceland scallops in the trans-boundary area, an area within NAFO Subdiv. 3Ps co-managed by Canada and France.

e) *Capelin* – Subarea 2 + Div. 3KL

Inshore capelin catches in Subarea 2 + Div. 3KL are taken during the inshore spawning migration. Female capelin is preferred to satisfy the Japanese roe market. Inshore catches in 1994 and 1995 were less than 1000 t because female capelin were too small to meet the size criterion established in the capelin management plan. A size criterion has not been included in subsequent management plans. Catches increased from 16,000 t in 2000 to about 19,500 t in 2001. Resource status has been determined by a mathematical model that incorporated several partially overlapping series of indicators.

The model provides estimates of relative year-class strength. This model could not be run for 2002 because there are not enough indices available, consequently there is no stock status update for 2002.

f) *Snow crab* – 3Ps.

Catches in 3Ps in 2001 (7,840 t) were similar to those of 2000 (7,920 t). CPUE increased steadily through the 1990's to 1999. It declined in 2000 and 2001, but remains above the low level of the 1980's. Bottom trawl surveys are unreliable for indicating resource status because they are carried out in spring when mating and molting occur and the population is incompletely available to the survey trawl. Therefore, resource status and prospects are uncertain.

g) *Cod* – 3NO and 3Ps.

The cod stock in NAFO Div. 3NO has been under moratorium to all directed fishing both inside and outside the Regulatory Area since February 1994. In the last assessment of this stock (2001) fishing mortalities in the range of 0.5-0.6 on the fully recruited ages were estimated for 2000, raising considerable concern about the rising levels of by-catch mortality and the implications for the recovery of the stock. Although data are incomplete and have not been subject to any comprehensive scientific analysis, observer reports exist of high by-catches, one as high as 285 t on a single EU vessel in 2000. The 2000 and 2001 Canadian spring and fall research bottom trawl surveys confirm that the stock size remains at an extremely low level. Model estimates of recruitment rates show that the stock persists in a low recruitment regime. Long-term projections indicate a very low probability of stock recovery under current levels of low recruitment and high levels of by-catch mortality.

Spawning stock biomass of NAFO Subdivision 3Ps cod increased from 1993 to 1998 due to good growth, early maturation and good survival over the moratorium period by the 1989 and 1990 year-classes. This increase in spawner biomass was not sustained by subsequent recruitment, and spawning stock biomass has declined during 1998-2001. This downward trend in 3Ps spawner biomass in recent years was a consistent feature of all sequential population analysis (SPA) formulations considered in recent assessments. Estimates of population size from various sequential population analyses cover a wide range, but trends are similar. Risk analyses based on evaluating 5 SPA formulations indicate that it is unlikely that the spawner biomass will continue to decrease between April 1 2002 and April 1 2003 over a TAC range of 10,000 – 20,000 t. The risk of exceeding the $F_{0.1}$ limit reference level was greater than

5% in 2 of the 5 formulations for a TAC of 10,000 t and greater than 5% in 3 out of 5 formulations for a TAC of 15,000 t. The risk of exceeding a target reference point of half $F_{0.1}$ was above 50% for 3 out of 5 formulations at a TAC of 10,000 t and above 50% for 4 out of 5 formulations for a TAC of 15,000 t. The TAC is currently set at 15,000 t. There are concerns that the monitoring of landings may considerably underestimate the true removals.

During 1999 and 2000, exploitation was high (0.24-0.45) for cod tagged in Placentia Bay (3Psc) and intermediate (0.07-0.19) for cod tagged west of the Burin Peninsula (3Psa/b/d/e), indicating a combined exploitable biomass for these areas of approximately 70,000-73,000 t.

Estimates of year-class strength show that all cohorts produced in the 1991-1996 period were substantially weaker than those produced in the 1980's. Although based on fewer data, the 1997 and 1998 year-classes appear strongest in the recent period. These encouraging signs of recruitment are likely to result in an increase in biomass.

The status of the 3Ps cod stock remains difficult to assess because of variability in the indices, incomplete reporting of all mortality caused by fishing, low fishing levels during the moratorium, and the mixing of fish between adjacent stocks. In particular, variable mixing of 3Pn4RS and 3Ps cod in the Burgeo Bank/Hermitage Channel area during their over-wintering period creates difficulties for interpretation of catches and indices of stock abundance.

h) *American plaice* - 3Ps

Research vessel surveys indicate that this stock has remained at a low level since 1992. Biomass and abundance in the last 3 to 4 years are somewhat higher than that seen in the mid-1990's. However, the average biomass in 1999-2001 is only 20% of the 1983-87 average and abundance is 30% of the 1983-87 average. An assessment of this stock is to be carried out in October 2002.

i) *Witch flounder* - 3Ps

Research vessel surveys indicate that this stock has remained relatively stable in recent years. The mean biomass index estimate during 1992-99 was about two-thirds of the mean estimate during 1983-92. The estimates of abundance and biomass from the 2001 survey were similar to the average value from 1996 to 2001. There is no indication of an increase in recruitment and the stock appears to be relatively stable under recent levels of exploitation. An assessment of this stock is to be carried out in October 2002.

j) *Yellowtail flounder* – 3LNO

Since the fishery for this stock reopened in 1998, stock size has continued to increase and the TAC's recommended for 2001 and 2002 were 13,000 t in each year In addition to the annual spring stratified-random survey in 3LNO and the fall multispecies bottom trawl survey, joint DFO-Industry surveys have been conducted since July of 1996. Two such surveys were conducted in 2001. 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-1990's.

k) *American plaice* – 3LNO

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

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

Redfish in the Canadian Atlantic have been reviewed on a zonal basis following redefinition of redfish management units in 1993 given substantial linkages between the various management units. Redfish were reviewed by teleconference in November 2001.

Unit 2 Canadian landings in 2001 totalled approximately 7,803 t and approximately 2,100 t was caught by Can(N). Total Canadian catches have declined steadily from 27,000 t in 1993 matching reductions in TACs. The current stock status was determined from annual stratified random industry surveys and sampling of the commercial fishery. Sampling of the 2001 fishery from January to September indicated that size compositions varied by area. Overall, year-classes younger than 1980 (fish less than 32 cm which were dominated by the 1988 year-class) represented about 38% of the catch numbers with the remainder being dominated by the 1980 year-class (fish 33-36cm). The 1988 year-class is now fully recruited to the fishery. Its future contribution will not likely be as great as that of the early 1980s year-class, which has supported the fishery for the past 11 years. The 2000 DFO survey and the 2001 industry survey measured the presence of the 1994 year-class and also detected the 1998 year-class. Biological characteristics suggest both these year-classes and the 1988 year-class are predominantly *S. fasciatus*, a shallower water species. The strength of year-classes of *S. mentella* since 1980 is apparently very weak, yet it continues to be the target of the fishery.

Canadian catches of 3O redfish have increased dramatically from less than 200 t annually from 1983-91 to 7,000 t in 1996 and have fluctuated between 2,000 t and 9,000 t since then due to a varying market for redfish sizes near the small fish protocol limit of 22 cm which predominate in Div. 3O Total catches since 1998 have exceeded 12,000 t partly due to increased foreign activity outside the 200 mile limit. About 22,000 t have been taken in 2001 with Can(N) accounting for 4,600 t of the 4,900 t Canadian catch. Resource status has been determined from spring and fall stratified random surveys in 3O. The spring index suggests that the stock may have increased since the early 1990s, but has stabilized at around 100,000 t since 1994. The fall survey generally supports this pattern. The additional 2001 survey information for both spring and autumn continues to indicate that stock status has not improved, and may be declining somewhat. Historically, the surveys catch fish in the 10 cm to 25 cm range. Prior to 1998, the surveys were considered to have sampled different size groups than the commercial fishery because the commercial catch was generally comprised of fish greater than 25 cm. Beginning in 1998, there has been greater overlap in the size distributions of the surveys and commercial fishery because the fishery has been targeting size groups that have recently surpassed the small fish protocol (22 cm). The 2001 autumn survey detected two pulses of recruitment to the stock, one pulse at 13-14cm corresponding to the 1996 year-class and one at 9cm corresponding to the 1999 year-class. These year-classes together represented about 20% of the survey abundance but this estimate was highly influenced by one station conducted in a stratum that represents 28% of the redfish survey area.

B. Special Research Studies

1. Environmental Studies

a) Plankton studies

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

The seasonality of chemical and biological conditions at Station 27 and along the major transects was similar to previous years (1999 and 2000) but the timing of fluctuations in phytoplankton and some zooplankton species were notably different than in previous years.

The vertical structure of the water column density at Station 27 indicate that more mixing was taking place over an extended winter period when conditions observed in 2001 were contrasted with those in 2000. In addition, the shoaling of the mixed layer in the spring appeared to be more abrupt than in the previous year but the timing was delayed by approximately one month. This was also apparent in the seasonal cycle of surface warming and cooling at this site.

The cycle of nutrient depletion in the upper 50 m of the water column followed a normal seasonal course but as with the vertical density structure of water column, the onset of the depletion was delayed relative to the previous year. The depletion of nutrients in the surface mixed layer appeared to be more substantial in 2001 than in the previous year, with silicate concentration approximately 2-3 µM lower in 2001. However, the deeper mixed layer in 2000 lead to an overall greater decrease in the total nutrient pool in that year relative to 2001. A potentially more important difference between the two years occurred in the deep nutrient pool (50-150m) where overall levels in 2001 were 1.5-2 times lower than in 2000. However, this pattern was not apparent in the three oceanographic surveys conducted in the spring, summer and fall of 2001. Along each of the major transects, deep nutrient pools appeared to be at comparable levels to those observed in previous years.

The onset of the spring phytoplankton bloom was also delayed by approximately 30 days and the duration of the period of high phytoplankton biomass in the upper 50 m of the water column was also reduced by approximately 50% relative to the previous year. Overall integrated peak concentrations were comparable to previous years but the vertical structure and progression of the spring phytoplankton bloom was different. Satellite observations of surface chlorophyll concentrations showed a general pattern that was consistent with the observations at Station 27 and suggest that the delay in the onset of the spring phytoplankton bloom was a shelf wide phenomenon extending from the southern Grand Banks to the coast of Labrador. Throughout the region, there was little indication of a bloom occurring during the fall. Chlorophyll concentrations did not substantially increase and high concentrations were only noted on the top of the Banks along the major transects sampled during the fall survey. Satellite observations of surface chlorophyll concentrations were consistent with the observations at Station 27 and along the oceanographic sections.

A notable point about the composition of phytoplankton throughout the region deals with the significant two-fold decrease in the density of small flagellates. Although these organisms do not make up a substantial portion of the total biomass of phytoplankton, in which diatoms are more important, flagellates play an important role in the microbial food web. Their decrease may be indicative of changes in this portion of the pelagic ecosystem during 2001.

It is noteworthy that both nitrate and silicate appear to be limiting phytoplankton growth at the fixed station (Station 27) whereas nitrate was a more limiting factor along the major oceanographic transects.

Overall zooplankton densities at Station 27 in 2001 were lower than in the previous year but similar to observations in 1999. The most notable differences appeared to occur at the start and end of the year, when the numerically dominant small copepods (*Oithona* sp. and *Pseudocalanus* sp.) were less abundant than in previous years. The relative importance of *Calanus finmarchicus* was greater in 2001 than in the two previous years, largely as a result of the influx of a cohort of young copepodite stages (CI-CV) from the fall of 2000 into the winter of 2001. The seasonal appearance of the summer peak in abundance of stage I (and subsequent stages) copepodites was delayed by approximately 30 days in contrast to 1999 and 2000. The peak in concentration of large calanoid nauplii was also delayed by a similar period of time and the magnitude of the peak concentration was approximately 50% of the level observed in 2000 but similar to that observed in 1999. Densities during the summer months were comparable to previous levels but the density of these young copepod stages was lower in the fall. Some important questions arise from these observations: Was the delay on the occurrence of peak concentrations of early stage copepodites the result of the delay in the onset of the spring phytoplankton bloom? Was this delay due to a difference in the timing of reproduction or did it relate more to differences in survival of nauplii? Were there differences in the condition of reproductive females between years? Did the large second cohort of copepodites found in 2000 contribute substantially to the dynamics of this species?

Densities of *Calanus finmarchicus* on the Newfoundland Shelf during the spring survey were similar to observations in previous years but there were substantially fewer copepodites found on the southern Grand Banks during this period. The apparent discrepancy with observations at Station 27 may have been due to the timing of the spring survey, which occurred after the appearance of the winter cohort of young copepodites. During summer survey, densities of *Calanus finmarchicus* were substantially higher on the Labrador Shelf than in 2000, while concentrations in the Newfoundland Shelf and Grand Banks were generally similar to observations in 2000.

Most other major zooplankton taxa were slightly less abundant on the Newfoundland and Labrador Shelves than in the previous year. Once again, we must question whether differences in the onset of the spring phytoplankton bloom had a significant impact on the patterns of reproductive success of the major zooplankton taxa in the region?

This is an important research question for which there is currently insufficient information to allow us to reach any substantive conclusions.

b) Oceanographic studies Subareas 2 and 3

Zonal Monitoring Program in the Newfoundland Region

Physical oceanographic observations are routinely collected during fish assessment and research surveys in the Newfoundland Region. The enhanced Atlantic Zonal monitoring program (AZMP) initiated in 1998 continued during 2001. This program was established to include biological and chemical oceanographic monitoring at a fixed coastal station at biweekly intervals and on offshore transects at seasonal time scales. The Newfoundland Region conducted three annual physical/biological oceanographic surveys during 2001 along several cross-shelf NAFO and AZMP sections from the Southeast Grand Bank to Nain Bank on the mid-Labrador Shelf. These surveys were conducted during mid-spring, summer and during the fall. The main objectives were to establish the seasonal temporal and spatial distribution and abundance of plant pigments, nutrients, microzooplankton and mesozooplankton in relation to the physical environment. Physical, biological and chemical variables being monitored include temperature, salinity, dissolved oxygen, ocean currents as well as measures of primary and secondary production and biomass, species composition of phytoplankton and zooplankton and nutrients. This monitoring program should allow an understanding of changes in ecosystem productivity and changes in ecosystem structure over time.

Physical oceanographic studies were conducted on the Newfoundland and Labrador Shelves during 2001 in NAFO Div. 2J and 3KLNO. These studies were based on observations from Nain Bank on the mid Labrador Shelf to the Southern Grand Bank on the Newfoundland Shelf. The annual water column averaged temperature at Station 27 during 2001 warmed slightly compared to 2000 remaining above the long-term mean. Surface temperatures were above normal for 9 out of 12 months with anomalies reaching a maximum of near 1.6^{o}C in October. Bottom temperatures at Station 27 were above normal (by ? 0.5^{o}C) during all 12 months of the year. Water column averaged summer salinities at Station 27 decreased to below normal values over the near-normal conditions of 2000. The cross-sectional area of sub-zero ^{o}C (CIL) water on the Newfoundland and Labrador Shelves during the summer of 2001 decreased over 2000 values, except on the Grand Bank where there was a slight increase. Off Bonavista the CIL area decreased to the lowest value observed since 1978. Bottom temperatures on the Grand Banks during the spring of 2001 were generally above normal (by up to 0.5^{o}C) over most areas, except the southeast shoal of the Grand Bank where temperatures were slightly below normal. During the fall bottom temperatures were above normal on the northern Grand Bank (Div. 3L) and in Div. 2J and 3K. In general, over all areas of the Newfoundland Shelf the near-bottom thermal habitat continued to be warmer than that experienced from the mid-1980s to the mid-1990s. In summary, during 2000 and 2001 ocean temperatures were cooler than 1999 values, but remained above normal over most areas continuing the warm trend established in 1996. Salinities during 2001 were generally fresher-than-normal in the inshore regions continuing the trend observed during most of the 1990s.

An oceanographic assessment study was also conducted in NAFO Subdivisions 3Pn and 3Ps during 2001. Oceanographic data from NAFO subdivisions 3Pn and 3Ps during the spring of 2000 and 2001 were examined and compared to the long-term (1971-2000) average. Temperature anomalies on St. Pierre Bank show anomalous cold periods in the mid-1970s and from the mid-1980s to mid 1990s. Beginning around 1996 however, temperatures started to moderate, decreased again during the spring of 1997 and returned to more normal values during 1998. During 1999 and 2000 temperatures continued to warm to above normal values over most of the water column. During the spring of 2001 however, temperatures cooled significantly over the previous two years to values observed during the mid-1990s. The areal extent of <0^{o}C bottom water increase significantly from the mid-1980s to mid-1990s, but decreased to very low values in 1998-2000. During 2001 it increased again, returning to values observed during the mid-1990s. Since 1995 the areal extent of bottom water with temperatures >1^{o}C has been increasing, reaching pre-1985 values by 1999-2000. During 2001 the area of warmer water decreased significantly compared to the pervious 2-years. On St. Pierre Bank <0^{o}C water completely disappeared during 1999-2000 but increased to near 30% during 2001. The area of near-bottom water on the banks with temperatures >1^{o}C was about 50% of the total area during 1998 the first significant amount since 1984. This increased to about 70% during 1999 and to 85% during 2000 but decreased to a very low value during 2001. In general, there were significant variations in water mass characteristics particularly on St. Pierre Bank during the past several years, with cold conditions from 1990 to 1997 and above normal temperatures during 1998 to 2000, which decreased to below normal values during the spring of 2001.

An oceanographic assessment study was also conducted during the spring of 2001 on the Flemish Cap in NAFO Division 3M. The cold near-surface temperatures (0.5° to 2°C below normal) experienced over the Cap from 1993 - 1996 had warmed to 0.5° - 1.5°C above normal by July of 1997, which increased further to 2°C above normal by the summer of 1999. Upper layer temperatures directly over the Flemish Cap during the spring of 2001 were generally below normal by up 0.5°C. Bottom temperatures over the Cap, which were generally below normal during the early to mid-1990s increased to 1°C above normal by 1999 but decreased to near-normal values during 2000 and 2001. Salinities over most of the upper water column during the spring of 2001 were saltier-than-normal (by 0.2-0.8). In the deeper water (generally below 100-m depth) and near bottom, salinities were generally 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 indicates a reversal in the recent warm trend in some areas of the water column with near normal temperatures in most areas. During most of the 1990s summer chlorophyll levels in the upper 100-m of the water column over the Cap were higher compared to the adjacent Grand Bank and during the spring of 2001 levels were generally lower over the Cap relative to the Grand Banks. Dissolved oxygen levels were about normal for the region with some super-saturation in the near surface layers. Both the measured currents and the geostrophic estimates, while showing considerable differences and variability between years, indicate a general anticyclonic circulation around the Flemish Cap.

c) Hydrographic Surveys Subareas 3 and 4

The hydrographic priorities for multi-beam and single beam hydrographic acoustic surveys for 2001-2002 in Newfoundland and Labrador were Notre Dame Bay, Red Bay and St. Anthony Harbour. Hydrographic surveys completed at several sites throughout Notre Dame Bay collected new information to augment and replace existing historical hydrographic data obtained during British and French Surveys from the 1700s and 1800s. At Red Bay, Labrador, hydrographic survey data obtained will replace British Admiralty Hydrographic surveys from 1890s. Hydrographic surveys at St. Anthony were conducted to delineate numerous changes that have occurred at this site in recent years. All data sets from these surveys will be used to produce new paper and electronic navigation charts meeting modern hydrographic and cartographic standards. Seventeen detailed acoustic data sets were cleaned and archived as a result of these surveys.

A multi-beam acoustic survey was also completed at Leading Tickles, Newfoundland. This site is an area of interest as a proposed Marine Protected Area. In addition to detailed bathymetric information bottom classification data was also obtained. This work was conducted as part of a joint program involving three Divisions of the Science Oceans and Environment Branch, DFO Newfoundland Region.

Hydrographic Publications

A number of new and revised hydrographic products have resulted from the 2000-2001 hydrographic survey program in Notre Dame Bay, Red Bay and St. Anthony:

Chart No.	Title	Scale	Publication Date
4669	New Edition Red Bay, Labrador	1:12,000	Fall 2002
4514	New Edition St. Anthony Bight and Hr.	1:15,000	Fall 2002
4514	Chart Inset St. Anthony Hr.	1:7,500	Fall 2002
4847	Chart Patch Bay Roberts, Conception Bay	1:5,000	Winter 2003
4849	Chart Patch Hr. Grace, Conception	1:25.000	Winter 2003
4849	Chart Patch Hr. Grace Fish Plant	1:3,000	Winter 2003
4849	Chart Patch Hr. Grace Marine	1:2,000	Winter 2003
N/A	Sailing Directions Diagram, Snooks Arm	1:10,000	Fall 2002
N/A	Sailing Directions Diagram, Pacquet Hr.	1:10,000	Fall 2002
N/A	Sailing Directions Diagram, Snooks Arm	1:10,000	Fall 2002

2. Biological Studies

a) Flatfish

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

Analysis of sexual maturity data is conducted annually on A. plaice, yellowtail, G. halibut and other species. In 2001 studies on Greenland halibut were presented to NAFO SC, including a paper presented at the NAFO Special Session on Deepwater Fisheries in Sept. 2001.

Research on yellowtail age and growth is ongoing, using a variety of methods. An 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 FPI 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 2001, data storage tags were used, along with the Petersen discs used in both 2000 and 2001.

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

b) *Seals*

Multi-disciplinary studies on harp hooded, and grey seal population dynamics and seal -fish interactions continued in 2001. The objectives of these studies were to develop a better understanding of seasonal distributions of seals, determine current population size of harp and grey seals, examine interannual changes in growth and reproductive status, and to estimate consumption of prey species by seals.

New information on the diet of harp seals in NAFO Div. 2J3KL was presented to the Newfoundland Groundfish Regional Assessment in 2001. Consumption of prey by harp seals in NAFO Div. 2J3KL was estimated by synthesizing and integrating information on individual energy requirements, population size, distribution, and diet composition. Diets were estimates using reconstructed stomach contents collected between 1982 and 1998, inclusive. Uncertainty in the estimates of numbers at age, diets, residency in 2J3KL and the proportion of seals in nearshore areas, was incorporated into the consumption estimates. Based on their average diet, harp seals consumed an estimated 893,000 (95% CI: 682,000-1,100,000) tons of capelin, 186,000 (95% CI: 58,000-457,000) tons of Arctic cod and 37,000 (95% CI: 14,000-62,000) tons of Atlantic cod in 2000. The proportion of cod in nearshore diets varied among years and seasons with a significant increase in cod present in the winter 1998 diet. Generally low levels of cod were present in offshore winter diets while no cod were present in the summer. Examination of the proportion of nearshore seal stomachs containing cod (prevalence), mean weights of Atlantic cod, Arctic cod and capelin in the stomach, and mean lengths of cod consumed indicated that during the winter of 1998, the prevalence of Atlantic cod in harp seals was higher than average but not the highest documented. However, the mean weight of cod in stomachs and the length of cod consumed were greater than previously seen. Improvements in estimates of consumption can be achieved by further diet sampling in offshore areas and increased information on residency of seals of all ages in the area. However, estimates will likely remain highly variable owing to the strong temporal and spatial variation observed in diet composition.

In response to a recommendation from the Standing Committee on Fisheries and Oceans in 1999, the Minister of Fisheries and Oceans appointed a panel of eminent persons, in June 2000, to advise on future seal management strategies. The objectives of the Eminent Panel's work were to evaluate the current state of scientific knowledge, to develop a strategic harvesting plan for seal populations over a 5-year period; and to provide advice on long-term strategies for seal populations management in Atlantic Canada. Dr. Ian McLaren of Dalhousie University chaired the Panel. Other Panel members were Mr. David Vardy, Chair of the Newfoundland Public Utilities Commission;

Professor John Harwood of the Sea Mammal Research Unit in St. Andrews, United Kingdom; and Dr. Solange Brault of the University of Massachusetts in Boston. The Panel provided an Interim Report in February 2001 summarizing what is known about seal biology, population dynamics and seal-fish interactions and its final report in the fall of 2001. Some of the main conclusions of the panel in their review of the current state of scientific knowledge on seals and seal-fisheries interactions include:

- Past estimates of abundance of harp seal pups based on aerial surveys are broadly satisfactory. Conclusions seem robust that the harp seal population has increased since the 1970s, accelerated during 1980s and early 1990s because of lower catch rates, and remained nearly constant since the mid1990s. Estimates of abundance of pups of hooded seals are less reliable, and no comprehensive surveys have been made since 1990/1991.

- Seals are clearly important predators of cod in 2J3KL, but the resulting mortality cannot be reliably estimated. The status of capelin and the effects of seals in this groundfish food base are unclear. Among other groundfish stocks in 2J3KL, only American plaice (to the extent included in "Pleuronectidae) is both highly depressed and subject to considerable offshore predation.

- The estimated consumption of cod, and some other commercial species, are so large that a large reduction in seal predation could reasonably be expected to have a substantial effect on the size of these stocks. However, the impact of a reduction of seal abundance on Atlantic cod, and other commercial species (shrimps, crabs, etc.) is not possible to predict with any accuracy.

The full report of the Eminent Panel can be found at: http://www.dfo-mpo.gc.ca/seal-phoque/reports/expert/SealManagement2001.pdf

c) *Capelin*

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

3. Miscellaneous Studies

a) Fish Habitat Compensation Studies

Scallop Habitat Creation

Petro Canada, on behalf of the Terra Nova Offshore Oil Development Project, is undertaking a multi-year fish habitat compensation program associated with the creation and increase in productive capacity of Iceland scallops in Paradise Sound, Placentia Bay. Iceland scallop spat were found in collectors set out the previous fall indicating the presence of scallop spat in the project area. Scallop shell habitat was created in the fall in three locations, utilizing discarded scallop shells. The habitats were generally created at depths ranging between 7 to 20 m with 1-3 inches thickness of shells. Spat collectors were again deployed to collect spat for seeding of the created habitats with Iceland scallop spat in 2002.

Lobster Habitat Creation

Newfoundland Transshipment Ltd., on behalf of the Newfoundland Transshipment Terminal Project, has undertaken a multi-year fish habitat compensation program associated with the creation of habitats for both the early benthic phase and adult lobsters. Lobster habitat was created in 1997, including the construction of two cobble artificial reefs for the early benthic phase, and construction of a causeway composed of solid rock and rubble fill for adults. The artificial reefs were placed at depths of approximately 10 m, and had elevations of approximately 1 m off the seafloor. The causeway armour stone extended from above the low water mark to a depth of 15 m. Monitoring of the created habitats, including surveys for early benthic phase and adult lobsters, is continuing. Lobster surveys in 2001

indicated the presence of adult lobsters on the reefs but no early benthic phase lobster were found. A more intensive monitoring effort is being planned for 2003.

Artificial Reefs

Husky Oil, on behalf of the White Rose Offshore Oil Development Project, will be undertaking a multi-year fish habitat compensation program associated with the creation of multi-species artificial reefs and eelgrass transplants. Husky Oil is now developing a detailed fish habitat compensation plan for the habitat creation including project design, site selection, and monitoring effectiveness of habitats created.

b) Environmental Effects Monitoring Studies (EEM)

Terra Nova Offshore Oil Project

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

An EEM program was designed, with input from DFO. A Baseline Characterization program was conducted in 1997 and the first year of the operational EEM program was conducted in 2000. The second year of the EEM program was conducted in the summer of 2001, the results of which have been submitted to Department and are under review.

White Rose Offshore Oil Project

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

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

Newfoundland Transshipment Terminal

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

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

c) Marine Classification (Subareas 2 and 3)

MEHM 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.

d) Seismic (Subareas 2 and 3)

A literature review and compilation of information has been undertaken to identify distributions of known spawning and nursery areas for a variety of marine finfish within the Newfoundland Region to assist in the regulatory decision-making process regarding seismic projects. This initiative is in very early stages of development.

SUBAREA 4

A. Status of the Fisheries

Nominal landings from 1990 to 2001 for fish stocks are listed in Table 1. Additional information on the status of the fisheries is as follows:

a) *Snow Crab* – 4R

Catches in 4R in 2001 (1,675 t) remained virtually unchanged from 2000 (1,640 t). The commercial catch rate has remained stable over the past 4 years at a lower level than in other divisions. There are no research data available from this division.

b) *Iceland scallops* – 4R

The nominal catch from the Strait of Belle Isle (4R) in 2001 is estimated at 637 t (round) against a TAC of 1000 t. CPUE in 2001 increased by 26% from the previous year. The fishery here continues to be driven by the exploitation of an accumulated biomass consisting largely of cohorts of old, possibly well separated year-classes with little potential for further growth. No significant larval settlement or recruitment has been detected in recent years. Fishing activity in high density scallop aggregations causes high collateral mortality to scallop spat and appears to have had a significant effect on recruitment dynamics in the area.

SUBAREAS 2 + 3 + 4

A. Status of the Fisheries

Nominal landings from 1990 to 2001 for fish stocks are listed in Table 1. Additional information on the status of the fisheries is as follows:

a) *Lobster*

Landings increased to 2,194 t (preliminary) in 2001 following an 8-year period of decline to 1,774 t (preliminary) in 2000 from a long-term high of 3,207 t in 1992. The increase occurred primarily in 4R but included LFA 11 in 3Ps as well. The recent downward trend appears to be part of a widespread pattern in Atlantic Canada. The fishery is monitored at a few localized sites through co-operative arrangements with harvesters to complete logbooks and conduct at-sea sampling of commercial catches. Average seasonal catch rates vary considerably from year to year and are usually highest early in the season and decline rapidly as the season progresses. The fishery is characterized by high exploitation rates and size limits that are small in relation to growth rate and size at maturity. Yield per recruit analyses demonstrate growth overfishing with potential substantial increases in yield through reduction in exploitation rates or an increase in size limit. Increased landings in some LFAs in 2001 may be partly attributable to improved Y/R associated with a 1.5 mm CL size-limit increase implemented as a conservation measure during the 1998 fishing season. Egg-per recruit analysis indicates a sufficiently low level of egg production under the current management regime to suggest a high risk of recruitment failure under unfavourable environmental/ecological conditions. The limited at-sea sampling being carried out indicates that v-notching to protect spawners when non-ovigerous has not been practiced in the fishery overall anything near the extent to which harvesters had committed in the 1998-2001

Management Plan. Landings can be expected to average lower with a greater degree of inter-annual fluctuation than under a more moderate level of exploitation.

B. Special Research Studies

1. Sentinel Surveys

The Sentinel Surveys, initiated in October 1994, were continued in 2001 and data collected tabled at regional stock assessments in the autumn of 2001 for 3Ps. There was no formal assessment for 2J3KL cod in spring 2002. However, the data were included in the stock status review. Sites in 2J3K3L, 3Ps and 3Pn4Rs were sampled by inshore fish harvesters using traditional fishing gears based on historic fishing patterns. The objectives of the program are: to develop a reliable inshore catch rate, length frequencies, sex, maturity, and otolith series for use in resource assessment; to incorporate the knowledge of inshore fish harvesters in the process of resource assessment, to describe temporal and spatial inshore distributions; to establish a long-term physical oceanographic and environmental monitoring program of the inshore area; and to provide a source of biological material for other researchers for genetic, physiological, food and feeding, and toxicological analyses.

2. Gear and Selectivity Studies

a) *Comparative trawl studies: Canadian Campelen and the Spanish Pedreira.*

Comparative fishing studies were conducted on the southern Grand Bank in 2000 and 2001with EU-Spain to determine the efficiency of the Canadian Campelen bottom survey trawl and the Spanish Pedreira bottom survey trawl. In 2001 three vessels were involved in the comparison, the old and new Spanish research vessels and the Canadian vessel. However, only the results from the Canadian Campelen catches by the *CCGS Wilfred Templeman* and the Spanish Pedreira catches by the *C/V Playa de Menduiña* (old RV) were examined.

Eighteen side-by-side parallel hauls were completed. The Pedreira catches (wt) of groundfish were on average 5 times more higher for plaice, 6 times more higher for thorny skate, and 12 times more higher for yellowtail flounder than that seen in the Campelen catches. These differences have been attributed to an increase in herding and hence catch rates by the 267 m sweeps used on the Pedreira trawl, compared with the 46 m sweeps on the Campelen, and the smaller footgear on the Pedreira which is expected to reduce the escapement underneath the trawl when compared to the Campelen. Futher comparative fishing will occur in 2002.

b) Effect of mesh size on Greenland halibut catches.

c) Catchability of snow crab by the Campelen survey bottom trawl

A small scale study was carried out during Sept 2001 within Conception Bay, Div. 3L, to provide first estimates of catchability of snow crab by the Campelen trawl. Twelve sets were executed within two survey strata using the Campelen trawl together with a secondary trawl with independent and smaller footgear. Results indicated that catchability of snow crabs was considerably lower than 1 and was a function of depth and substrate, being lower on shallow hard substrates than on deeper soft substrates. Catchability also decreased with decreasing snow crab size.

OTHER RESEARCH INFORMATION NOT SPECIFICALLY DELINEATED BY SUBAREA

A. Oceans Management

Oceans Management In 1997, the federal government adopted the *Oceans Act*, for which the Department of Fisheries and Oceans will prepare an implementation strategy. This "Canada's Oceans Strategy" (COS) will be based on the principles of sustainable development, integrated and collaborative management, and a precautionary approach. Three main programs - Marine Protected Areas, Integrated Management, and Marine Environmental Quality, support the COS.

a) *Marine Protected Areas Program*

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

Proposed Eastport Marine Protected Area (Subarea 3)

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

In 2002 multilateral consultations were held with stakeholders groups including local municipalities, the Kittiwake Economic Development Association, FFAW, Provincial Department of Fisheries and Aquaculture, and Parks Canada. A Steering Committee was formed to work with DFO in the further evaluation and development of the sites. Existing biological and physical information pertinent to the Peninsula was compiled in an overview. A similar document was prepared for social and economic information. Public awareness activities include the development of a website, and a pamphlet to be distributed to local tourist information centres and the Terra Nova National Park.

Proposed Leading Tickles Marine Protected Area (Subarea 3)

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

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

Activities undertaken include a fall lobster tagging program at sites chosen for possible closure, and a commercial lobster logbook program to record information on the capture of tagged lobster and collect fishing effort information. Existing biological and physical information for the study area was compiled in an overview. A similar document was prepared for social and economic information. An article providing a brief history and future plans for the Leading Tickles AOI was also included in the Lewisporte Yacht Club newsletter distributed throughout Canada and in the US. Other public awareness activities include the development of a website and signage, and the hosting of public information sessions held in several surrounding communities.

Oceans staff partnered with the Canadian Hydrographic Service, Ecosystem Processes Division, and Environmental Sciences Division to collect acoustic multibeam data to allow detailed mapping of the AOI from the nearshore 5m contour to the 185m contour. A QTC View 4 and a 50KHz transducer also collected substrate classification information. A digital elevation model (DEM) was developed with the assistance of partners such as the provincial Department of Government Services and Lands, Newfoundland Forest Service, Canadian Hydrographic Service, and Ecosystems Processes Division. The model will combine multi-beam bathymetric and seafloor classification information collected by CHS with the marine/ terrestrial interface DEM developed by the provincial government. The overall goal is to create a bathymetric 3D digital base map unto which may be layered additional digital ecological data to eventually create an ecosystem model. The mapping and the model would be flexible and adaptive in that future biophysical or socioeconomic data could be added.

Proposed Gilbert Bay Marine Protected Area (Subarea 2)

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

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

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

In November 2001, the Gilbert Bay AOI Steering Committee was established, comprised of representatives from local fisheries committees, town councils, aquaculture interests, Labrador Metis Nation, Memorial University, and the Provincial Department of Fisheries and Aquaculture.

Scientific research conducted in Gilbert Bay during 2001 was a continuation of research initiated in 1998. Primary research activities involved sonic tracking of Atlantic cod, conducting an external tagging experiment, collection of cod eggs, larva and pelagic juveniles, and the collection and analysis of zooplankton.

b) Integrated Management Program

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

Community Coastal Resource Inventories

DFO has been working with community groups throughout coastal Newfoundland and Labrador to document and map coastal resources since 1996. Information documented in these Community-Based Coastal Resource Inventories (CCRIs) is largely traditional ecological knowledge collected through an interview process with local community members who have knowledge of coastal resources based on their long-term interaction with these resources. The entire coastline of the island of Newfoundland has now been inventoried under this program as well as approximately one-quarter of the coast of Labrador. 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.

Sensitive Areas Identification and Mapping

Inshore

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

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

Offshore

Under the *Oceans Act*, DFO is responsible for the conservation and protection of marine areas with high biodiversity and biological productivity. In the offshore, the Grand Banks were selected as a study area due to the increasing activity related to hydrocarbon exploration and development. Leases held by oil and gas industry have been overlaid on DFO data from the Newfoundland Fishery Observer Program and Groundfish Scientific Surveys. 18 commercially significant groundfish species are identified using data from 1980-2000. The extracted data will be spatially represented using SPANS GIS Software. Upon completion, resulting maps would be stored in several mediums including CD and web-based applications. Identifying these areas is an important step toward effective oceans planning and management in the offshore area.

b) Marine Environmental Quality Program

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

Marine Environmental Quality Profiles

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

Contaminant Database

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

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

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

Northwest Atlantic Fisheries Organization

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Corrigendum

SCIENTIFIC COUNCIL MEETING – JUNE 2002

Canadian Research Report for 2001

PART II. Newfoundland Region – by Dale Parmiter-Richards

Please insert Table 1 as page 20 in SCS Doc. 02/10 "Canadian Research Report for 2001 (PART II).

Table 1. Nominal landings from 1990 to 2001 for fish stocks.

			Catch (t)											
Subarea	Species	Division	2001	2000	1999	1998	1997	1996	1995	1994	1993	1992	1991	1990
0+1	Greenland halibut	0B+1B-F	3,181	2,615	3,556	3,300	1,700	1,453	5,852	3,723	2,561	8,200	5,945	6,194
	Shrimp	0A	3,611	1,588	2,046	933	517	2,623	2,361	4,727	5,501	7,493	6,788	6,177
		0B	6,326	5,383	5,132	5,204	5,670	3,220	3,564	476	106	1,291	1,107	1,609
2	Cod	2GH	0	0	0	0	0	0	0	0	3	0	0	400
	Shrimp	2G (SFA 4)	8,195	7,206	7,961	8,051	5,217	5,160	5,104	3,982	2,723	2,706	2,561	2,945
		2HJ (SFA 5)	15,052	14,777	15,028	15,170	15,103	7,383	7,616	7,499	5,719	6,315	6,118	5,360
		2HJ3K (SFA 6)	52,599	63,074	51,028	46,337	21,246	10,923	10,914	10,978	8,035	6,609	5,500	5,598
	Crab	2J	3,756	3,794	5,448	4,061	3,166	3,090	3,178	2,978	2,275	1,529	989	645
2+3	Redfish	2+3K	41	28	2	3	4	2	1		2	9	161	1,806
	Greenland halibut	2+3KLMNO	8,235	10,637	4,124	4,081	5,877	5,891	3,229	2,928	4,899	6,933	6,664	9,129
	American plaice	2+3K	132	67	6	6	2	16	28	16	77	103	494	1,770
	Witch	2J+3KL	151	92	2	1	6	4	10	11	343	1,632	2,430	2,825
	Cod	2J3KL	6,887	4,817				350	330	1,309	3,938	24,356	120,135	204,900
	Grenadier	2+3	212	234	145	209	98	225	125	130	614	992	365	152
	Capelin	2J3KL (offshore)	0	0	0	0	0	0	0	0	0	0	450	57,170
	Squid	2+3	23	310	19	815	12,748	8,285	48	1,954	276	924	1,719	4,440
3	Redfish	3LN	24	32		7	19				46	657	362	958
		3M	0	0									1	
		3O	4,532	880	1,990	6,121	1,895	128	24	1,192	677	845	173	5,131
	Yellowtail	3LNO	12,240	9,425	5,540	3,536	1				6,265	6,369	6,257	4,754
	American plaice	3LNO	1594	622	269									
		3Ps	877	607	542									
	Witch flounder	3NO	12	4	24	4	18			437	3,971	4,093	2,457	2,499
		3Ps	444	331	461									
	Atlantic halibut	3	317	183	124	165	152	101	107	36	138	114	231	165
	Cod	3NO	506	172		306	289	54	31	3	3,719	5,232	5,456	7,222
		3Ps	12,818	19,652		15,664	7,518	520	337	574	13,519	21,845	24,693	23,048
	Haddock	3LNO	88	70		14	190	28	9	0	675	598	708	1,423
		3Ps	99	163		191	69	118	48	20	86	251	263	232
	Pollock	3Ps	808	710		428	592	435	248	59	113	437	1,188	1,060
	Capelin	3L	14,440	12,160	11,120	20,300	3,560	16,840	100	890	23,480	3,160	22,310	48,000
		3K	5,890	4,180	7,460	10,420	9,230	8,920	30	70	13,525	19,350	20,000	35,140
	Shrimp	3M	293	618	490	469	785	906	970	1,041	3,724			
		3L	4,983	4,025										
	Sea scallop	3Ps	unavailable	unavailable	79	257	9	8	564	1,299	1,438	676	1,279	1,559
	Iceland scallop	3LNO	39	335	138	1,310	3,986	9,454	6,501	3,941	817	22	-	-
		3Ps	539	1,134	1,188	2,763	5,245	302	831	440	667	5,967	755	507
	Crab	3K	15,277	15,431	21,470	16,788	14,830	14,190	12,245	11,039	9,760	7,295	7,675	4,253
		3LNO	28,154	26,857	32,725	23,533	22,185	16,656	13,790	12,237	8,979	6,652	6,394	5,211
		3Ps	7,843	7,917	7,909	6,615	4,753	3,047	1,853	1,590	704	121	176	596
	Atlantic salmon	2J3KLPs+4R	39	30	38	45	82	114	95	133	126	213	353	498
	Arctic Charr	2J3KLPs+4R	33	47	41	38	38	16	30	31	38	74	70	100
3+4	Redfish	3P+4V	2,506	4,439	5,335	4,101	3,825	4,566	3,978	7,594	9,350	4,635	6,628	6,227
4	Iceland scallop	4R	637	1,073	1,046	1,307	1,205	1,204	1,497	2,294	2,122	1,296	457	88
	Crab	4R	1,675	1,640	1,612	1,064	969	833	920	655	-	-	-	-

Note: Newfoundland landings only