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Allocation Criteria: Analysis of Biomass Distribution and Catch History for Species of Commercial Interest in Waters Adjacent to Atlantic Canada, Inside (Canadian Waters) *Versus* Outside (Regulatory Area) 200 Miles

by

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Abstract

Part of the responsibilities of NAFO (Northwest Atlantic Fisheries Organization) is the equitable allocation, among member countries, the fish resources residing in waters adjacent to Atlantic Canada. Since 1977, when Canada established its 200 mile limit NAFO responsibilities have focused on stocks that straddle that border. We present an analysis of the distribution of biomass in relation to Canada's 200 mile limit for selected commercial species. For thorny skate, two methods, one employing GIS software, the other, adapting stratified random survey methodology were employed to derive distribution of the biomass. Seasonality (intra-annual variation in distribution of the stock) is accounted for in both methods by using research survey data from both the spring and fall period. The two methods yielded very similar results where the 1995-99 seasonally adjusted combined annual average biomass located inside the 200 mile line in Div. 3LNPOs amounted to 82.8% as derived using SPANS and 83.9% as derived from STRAP. For all other species, the modified STRAP method was employed. For redfish, roundnose grenadier and roughhead grenadier only STRAP was used. Estimates of biomass for redfish in Div. 3O outside the zone were 22.4%, averaged from 1995-1999 for spring and combined. For roundnose and roughhead grenadier in Div. 2GHJ3KLMNO averaged from 1996-1999 surveys there were 22.1% and 57.1% outside the zone respectively. We also present information on the secondary allocation criterion, catch history. The catches reported to NAFO are listed for all species and in the case of skate, numbers estimated for the NAFO Regulatory Area (NRA) by Canada's Conservation and Protection group plus reported catches inside 200 miles. The latter is compared to the catches reported to NAFO. Some discussion is also provided on the remaining criteria, namely zonal attachment and investment i.e. management and contributions to science and enforcement by member states. For landings data, two sets of statistics are presented, those reported in NAFO STATLANT 21A and statistics that account for unreported catches. Analyses of biomass distribution and landings for nine additional species of commercial interest were also conducted for comparative purposes.

Introduction

Establishment of an Exclusive Economic Zone (EEZ) includes extended rights of ownership and management responsibilities of fish resources as indicated in the Convention of the Law of the Sea (Anon., 1982). When stocks straddle international zones, the Convention suggests that states exploiting the resource should seek to agree upon measures necessary to ensure the conservation of those resources. For NAFO (Northwest Atlantic Fisheries Organization) as part of its responsibilities of ensuring sustainable fisheries and stability within the organization is the equitable allocation among member countries, of fish resources residing in waters adjacent to Atlantic Canada. Since 1977, when Canada established its 200 mile limit (formally referred to the EEZ) NAFO responsibilities have focused on stocks that straddle that border (Fig. 1).

While allocating quotas has been a long standing responsibility of NAFO, the criteria used have evolved and changed. The origins of the application of quotas and allocations for the Northwest Atlantic can be found on Anon (1969), the report of the Standing Committee on Regulatory Measures of ICNAF (The International Commission for the Northwest Atlantic Fisheries, predecessor of NAFO). At a time when quotas were first discussed for stocks adjacent to Atlantic Canada, allocation criteria (methods used to apportion quotas among member countries) were based solely on catch history. Combinations of year groupings of catch records were used in determining member states allocations. A long time series favouring countries fishing in the area balanced against a shorter period favouring recent participants (or those with increasing participation) was felt to be the most appropriate approach for incorporating catch history in determining allocations. Time periods used in these calculations varied over time. Although coastal state rights comprised a part of these early discussions, it was not until the establishment of the Canadian 200 mile limit in 1977 that adjacency played an increasingly significant role in the discussions pertaining to the apportioning of the resources. Halliday and Pinhorn (1990) and Clay (1996) provide further discussion of some of the issues surrounding the partitioning of marine resources for the northwest Atlantic.

Thus, in recent years, in discussion of allocation of resources, emphasis has been placed on employing a combination of factors when dealing with associated fishing rights for stocks that straddle international borders. The 1995 UN Agreement on Straddling Fish Stocks and Highly Migratory Fish Stocks comprises a general guide to NAFO's allocation process and Article XI (4) of the NAFO Convention provides the specifics for both qualification (which member countries are eligible for a portion of the quota) and allocation criteria. The elements in that Article XI are broad and open to interpretation and negotiation. The current system of allocation of fish stocks, by a joint decision of General Council and Fisheries Commission in 1997, a Working Group was given the mandate of dealing with Allocation of Fishing Rights (Refer to Annex 2, Terms of Reference in NAFO/GC Doc. 99/4). Taking into account international legal issues and stability of the organization, appropriate interpretation and application of these criteria is the primary focus of discussions of this working group. Allocation of new stocks (stocks currently fished but not regulated) is considered a high priority.

In determining an appropriate strategy for dealing with future fishing opportunities for straddling stocks, the criteria listed or discussed by the WG to apportion available quota among interested member countries in good standing include but are not necessarily exclusive to:

a) Reference fishing pattern (catch history),
b) Biomass Distribution (proportion inside/outside the coastal state territory),
c) Seasonal Component (accounting for movement across borders),
e) Zonal Attachment and
f) Investment i.e. management and contributions to science and enforcement.
g)

These criteria as yet not entrenched in the NAFO Convention, continue to undergo an evolutionary development (Anon 1999 and 2000). As pointed out earlier, the relative importance of each criterion is variable in the way that it is applied and as such, allocation of quotas among countries through the application of the criteria is to be accomplished by negotiation and consensus. At the last (third) meeting of the WG (March 2000), it was concluded that biomass distribution should be the initial factor to be considered in apportioning quota. Anon (2000) states that "the Commission will determine, in taking into account any relevant information or advice provided to it by Scientific Council, the fishable stock(s) or, where appropriate, the portion of the fishable stock(s) in the NRA to be allocated to Contracting Parties who are eligible and interested in the allocation". That is, the proportion to the biomass occurring inside 200 miles would be allocated to the coastal state and the non-coastal states (other interested and qualified member counties) would share a quota in proportion to the stock biomass that is distributed outside the 200 mile limit. The remaining criteria, particularly catch history would then be applied to determine allocated proportions for the NRA. This approach abides by the general guidelines laid out in the Law of the Sea: that the coastal state is entitled to that portion of the resource within the EEZ.

There are several straddling stocks: (1) Div. 3LNOPs thorny skate (*Raja radiata*), (2) 3O redfish (*Sebastes sp.*), (3) SA2+3 roundnose grenadier (*Coryphaenoides rupestris*) and (4) roughead grenadier (*Macrourus berglax*) not currently regulated by NAFO (although advice on the status of (3) and (4) is sought from Scientific Council). As a result, associated effort for these stocks has been unregulated outside 200 miles (although these stocks have been

regulated by Canada for years inside the coastal zone limits). Through the Allocation WG, NAFO has been working on bringing these stocks into the regulatory framework and providing allocations to qualified member countries.

In consideration of the role of biomass distribution with respect the derivation of the coastal state allocation and the importance of catch history in allocating the remaining quota, we present a comprehensive analysis of the distribution of biomass for the above named species in relation to Canada's 200 mile limit. Two methods, one employing GIS software are employed to derive distribution of the biomass. Seasonality (intra-annual variation in distribution of the stock) is accounted for in both methods by using research survey data from both the spring (Apr.-Jun.) and fall (Sep.-Dec.) period. Biomass apportioning in other parts of the world are examined. We also present information on the secondary allocation criterion, catch history. The catches reported to NAFO are listed for all species and in the case of skate, numbers estimated for the NRA by Canada's Conservation and Protection group plus reported catches inside 200 miles. The latter is compared to the catches reported to NAFO. Some discussion is also provided on the remaining criteria, namely zonal attachment and investment i.e. management and contributions to science and enforcement by member states.

Background: Thorny skate (*Raja radiata* in Divs. 3LNOP)

Although previously distributed much further to the north, Kulka and Deblois (MS 1996) and Kulka and Mowbray (MS 1998) showed that there has been a southward contraction of the distribution since the late-1970's. Currently the biomass is largely concentrated along the south and western Grand Banks from the areas adjacent to the Laurentian Channel to the tail of the Grand Bank outside 200 miles. Kulka and Mowbray (MS 1998) suggested that a seasonal migration occurs based on: different spring and fall distributions, higher density and greater proportion of biomass observed in deeper waters in the spring (aggregations being 30% on average more dense in the fall *vs*. spring surveys), estimates of biomass from Canadian surveys being on average 40% lower in spring than in fall, differences in distribution in relation to temperature and depth between spring and fall, high concentrations located in depths greater than 1,100 m in Spanish surveys in the spring and doubling of skate by-catch rates in deepwater slope fisheries in Dec.-Jun vs. in Jul.-Nov. (outside the survey area).

In terms of the fishery, significant by-catches of skates have been taken since the start of offshore fishing in the late-1940's initially by non-Canadian and later by Canadian fleets. Before the mid-1980's, non-Canadian fleets, the largest component of offshore fisheries on the Grand Banks at the time retained several thousand tons of skate for market each year although this was taken as by-catch. In contrast, the Canadian fishing industry was largely unable to profitably market skate in Canada although limited amounts were exported to European countries in the 1970's. Kulka (MS 1986, 1989) reported that in the early to mid-1980's, about 3,000 t of skate were taken annually as by-catch in the Canadian offshore fisheries and mostly discarded. Kulka and Mowbray (MS 1998) subsequently estimated that an average of about 5,000 t was discarded annually by the Canadian fleet during the 1980's and early-1990's while no more than a few hundred t appeared in Canada's annual landing statistics during that period.

In 1985, a directed, non-regulated skate fishery was started by Spain outside Canada's 200 mile jurisdiction on the tail of the Grand Bank (MS Junquera and Paz 1998). Skate were found to be of sufficient density at depths less than 100 m in the fall on the tail. By-catches of skate in other (slope) fisheries outside 200 miles continue to contribute significant amounts to the catches reported by non-Canadian countries. For Canada, with the collapse of major groundfish stocks in the early-1990's, attention was turned to "non-traditional" species. Since skate was known to be a common by-catch, particularly on the Grand Banks, and that it was potentially marketable in Europe, it was identified as a potential candidate for increased exploitation. Interest in fishing skate grew as markets in Europe, particularly France and Belgium were developed. Significant amounts of skate landings first appeared in the Canadian statistics in 1993 and 1994 the result of experimental fishing.

Since 1995, thorny skate has been managed by Canada inside 200 miles as a unit encompassing NAFO Divisions 3L, 3N, 3O and Subdivision 3Ps (MS Kulka and Mowbray 1998). A Total Allowable Catch (TAC) was set, gear and by-catch policies implemented, and the existing licensing system was applied by Canada. In 1999, the Fisheries Commission requested advice on elasmobranch stocks overlapping the NRA. Information on 3LNOPs thorny skate was first presented to Scientific Council in 2000.

Background: Redfish (*Sebastes sp* in Div. 3O)

Redfish in Div. 3O have been subject to management regulation since 1974, but, has only applied to that portion of Div. 3O within Canada's 200 mile limit. About 10% of the habitable redfish area within Div. 3O occurs outside Canada's 200 mile limit. A TAC of 16,000 t was first implemented in 1974. The TAC was increased in 1978 to 20,000 t and generally remained at that level through to 1987. The TAC for 1988 was reduced to 14,000 t and remained unchanged until 1994 when it was reduced to 10,000 t as a precautionary measure and maintained at that level to 1999. During 1999 a shift was implemented from the current calendar year based TAC to a fiscal year based TAC which will take effect from April 1, 2000 to March 31, 2001. To facilitate this temporal shift in TAC, the 1999 calendar year TAC was extended to March 31, 2000 and increased from 10,000 tons to 10,200 tons to accommodate the extension. In addition to catch regulation, a small fish protocol at 22 cm was implemented inside the 200 mile limit for this stock in 1995. The 1999 adjusted TAC (10,200 t) is divided into a Canadian quota (8,670 t), and a French quota (1,530 t).

Nominal catches have ranged between 3,000 t and 35,000 t since 1960. Up to 1986 catches averaged 13,000 t, increased to 27,000 t in 1987 with a further increase to 35,000 t in 1988, exceeding TACs by 7,000 t and 21,000 respectively. Catches declined to 13,000 t in 1989, increased gradually to about 16,000 t in 1993 and decline subsequently to about 3,000 t in 1995, partly due to reductions in foreign allocations since 1993. Since 1996, catch has fluctuated between 9,000 t and 14,000 t with the exception of 5,000 t in 1997. Up to the end of the third quarter in 1999, total catch was at 9,000 t.
The increased catches in 1987 and 1988 were due primarily to increased activity outside the 200 mile limit by countries that were not contracting parties of NAFO (primarily Panama and South Korea) and had no bilateral agreements with Canada. Canadian surveillance estimates of non-reported catch, which have ranged from 200 t to 23,500 t, are included in catch statistics since 1983. A further explanation of these is given in Shelton and Atkinson (1994). There hasn't been any directed activity in the area outside the 200 mile EEZ by non-NAFO fleets since 1994.

Russia (formerly USSR) predominated in this fishery up until 1993 and generally caught its share (about 50%) of the total non-Canadian allocation, which accounted for about 2/3 of the TAC. From 1985 to 1993 Russian catches ranged from 3,800 t to 7,200 t. Russia and Cuba, impacted by the reduction and eventual elimination of foreign allocations by Canada, have not fished since 1995 and 1993 respectively. Catches by Portugal, which began fishing in the limited stock area outside the 200 mile limit in 1992, peaked at 4,800 t in 1995 and declined to 1,900 t by 1998. Spain, which had only incidental catches of redfish before 1996 has increased catch outside the 200 mile limit from 300 t in 1996 to 1,900 t in 1998.

Canada, which has had limited interest in a fishery in Div. 3O because of small sizes of redfish encountered in trawlable areas, landed less than 200 t annually from 1983-1991. In 1994, Canada took 1,600 t due to improved markets related to lobster bait, but declined to about 200 t in 1995. Since then Canadian catches have alternated between levels of about 8,000 t and 2,500 t due to the market demand for redfish near the 22cm size limit.

Stratified random groundfish surveys have been conducted by Canada in the spring and in Div. 3O since 1991, with coverage of depths to 730 m. From 1991 to spring 1995 an Engel 145 otter trawl was used (1.75 n. mi. standard tow) and from 1995 onwards a Campelen 1800 shrimp trawl (0.75 n. mi. standard tow). The 1991 to spring 1995 Engel 145 data were converted into Campelen 1800 trawl equivalent data. Details of the comparative fishing trials and data modelling can be found in Power and Atkinson (MS 1998).

The spring and series exhibits large fluctuations in estimates between seasons and years for some strata, not uncommon for bottom trawl surveys for redfish. This is usually accounted for by the influence of one or two large sets on the survey. It is difficult to reconcile year to year changes in the indices, but generally, the revised spring survey biomass index suggests the stock may have increased since the early-1990s, but has stabilized at around 100,000 t since 1994. The surveys, while more stable in the early-1990s, generally supports this pattern. It should also be noted that the estimates for 1996 and 1999 do no include important strata that were not sampled in those years. In most surveys, the densities outside the 200-mile EEZ (strata 355, 356, 721, 722 and the eastern half of strata 354) were generally lower than inside. Differences between the spring and fall surveys may be related to changes in availability within the Division at different times of the year. A more complete account of redfish in Div. 3O can be found in Power (MS 1999).

Background: Roundnose Grenadier (*Coryphanoides rupestris*) in SA 2+3

Roundnose grenadier are found throughout Subareas 2 and 3 although the request for advice from NAFO Fisheries Commission applies only to that portion of the resource lying within Canada's 200-mile economic zone. It is believed that only one stock occupies the entire area including the NRA although there are different areas of concentration. The directed fishery prior to 1990 traditionally occurred in the Canadian zone. The first TAC imposed was at 32,000 t in 1974, increased marginally to 35,000 t in 1977 and reduced to 27,000 t by 1982. A precautionary TAC of 11,000 t, was implemented in 1983 based on results of the fishery in "traditional" areas in the Canadian zone, and was maintained at this level to 1993. From 1994 to 1996 a 3,000 t TAC was in effect for the Canadian zone only. Currently there is a moratorium on the directed fishery imposed within the Canadian zone.

It has been recognized for a number of years that catches of grenadiers by EU-Portugal from 1987-1996 and EU-Spain from 1992-1996 reported to NAFO as roundnose grenadier from directed Greenland halibut fisheries in the Div. 3LMN area were primarily roughhead grenadiers (Alpoim *et al.,* MS 1994; Power and Parsons MS 1998 (Junquera, MS 1998). The statistical data has been clarified for EU-Portugal. These data were mis-classified because roundnose grenadier was the only name appearing in the statistical data reporting forms during this time. This mis-classification has not been resolved for Spain in the official statistics for 1992-96 but the species has been reported correctly since 1997. The following description is based on the revised figures.

The first reported catch of roundnose grenadier in NAFO Subareas 2+3 was 17,000 t in 1967. Up to the extension of jurisdiction by Canada in 1977 nominal catches were on average about 23,000 t with the exception of the largest reported catch of 75,000 t in 1971. Catches declined to 8,000 t in 1979 and averaged about 5,000 t up to 1989. Catches declined rapidly to 800 tons in 1990 and have since been taken as by-catch primarily in the Div. 3LMN Greenland halibut fishery. Catches have been about 50 tons each year from 1996-1998.

Over most of the years of the directed roundnose grenadier fishery (prior to 1990), the bulk of the catch came from Div. 3K. This traditional fishery was conducted by the former USSR and former GDR during the second half of the year. These fleets fished before the extension of jurisdiction in 1977 and under bilateral arrangements with Canada afterward. Beginning in 1993 there have been no allocations to foreign vessels inside the Canadian zone. The distribution of actual roundnose grenadier catches by area and season in the NRA in recent years has not been confirmed, but based on reports to NAFO, catches of roundnose and roughhead combined have been taken primarily during the first half of the year corresponding with the period of the most effort for Greenland halibut. There has been very limited commercial data since the cessation of fishing within the Canadian zone in 1993.

Recent Canadian surveys covering depths to 1500m indicate a substantial decline in the survey biomass index between 1996 (59,000 tons) and 1998 (19,000 tons) for Div. 2HJ3K where the traditional directed fishery occurred and an increase from 1996 (8,500 tons) to 1997 (15,000 tons) followed by a decrease in 1998 (6,000 tons) in the divisions where by-catches of roundnose grenadier are currently taken (Div. 3LM). It is difficult to interpret the nature of the general decline from 1996 to 1998. Although these surveys cover down to 1500m for most of the area it is known from other investigations that roundnose grenadier inhabit waters down to 3,000m (Leim and Scott, 1966; Atkinson et al. 1981, Sahrhage, 1986). It is also well known that grenadier size increases with depth so the surveys inherently only cover part of the distribution and part of the size range. Consequently there will be a degree of uncertainty as to whether the decline from 1996 to 1998 are due to mortality, emigration from the survey area or some catchability effect in the survey. A more complete account of roundnose grenadier can be found in Power (MS 1999b).

Background: Roughhead Grenadier (*Macrourus berglax*) in SA 2+3

Roughhead grenadier were distributed throughout Subareas 2 and 3. Parsons (1975) indicated that, based on research surveys in SA 2+3 during 1958-1973 in waters less than 400 fathoms (730 m), roughhead grenadier is more widely dispersed than roundnose grenadier and occurs in greatest numbers at somewhat shallower depths (180 m to 500 m). The largest catches were from Div. 3LN. It was further reported that from its depth distribution in the research surveys roughhead grenadier distribution overlaps that of redfish, and probably occurs in limited numbers in commercial grenadier catches off Northeast Newfoundland and Labrador. Recent survey information suggests that roughhead are most abundant beyond 500 m in Div. 3MNO (Murua, MS 2000).

Roughhead grenadier have become a relatively important commercial fish in NRA and reliable information is needed for its assessment. The fishery for *M. berglax* is unregulated as it is mainly taken as by-catch in EU-Portugal and EU-

Spain Greenland halibut fisheries primarily in NAFO Div. 3LMN. The following description takes into account the misclassification of roughhead grenadier as roundnose grenadier (see previous background section on roundnose grenadier). Catches of roughhead grenadier increased sharply from about 300 tons in 1989 to 6,700 tons in 1992, remained stable at an average of about 4,300 from 1993 to 1997 and increased to 7,200 tons in 1998 and 1999. EU-Portugal has accounted for over 96% catch accumulated from 1987 to 1991. Since 1992, EU-Spain has accounted for 68% of the accumulated catch and EU-Portugal has taken 27% with the remainder being caught mainly by Canada. The current by-catch fisheries in Div. 3LMN are being conducted mainly between 900 m and 1200 m but have ranged down to 1700m.

Background: Yellowtail flounder (*Pleuronectes ferruginea* in Divs. 3LNO)

Yellowtail flounder is distributed off Newfoundland across much of the shallow portions of the Grand Banks within NAFO Div. 3L, 3N, 3O and Subdiv. 3Ps (Fig.1). A productive mixed fishery for over 30 years, the NAFO Fisheries Commission closed the Grand Bank to directed fishing for yellowtail, plaice and cod in 1994. This action was taken even though a 7,000t TAC (Total Allowable Catch) for yellowtail had been recommended for that year. The fishery was closed because TAC's had been exceeded each year from 1985 to 1993, unreported catches outside 200 miles were a concern and overlapping cod and plaice stocks were in decline (NAFO Scientific Council). From 1995 until 1997, the only commercial catches of yellowtail on the Grand Banks occurred outside Canada's 200 mile limit, Reported as by-catch in other fisheries, 2,069 t was reported as taken primarily by Spain in 1994 subsequently falling to less than 300 t annually in 1995-97. Following 3 years of closure, the NAFO Scientific Council indicated that yellowtail in 3LNO was abundant enough to support a limited fishery in 1998 and an expanded fishery in 1999 with further expansion in 2000 and 2001. The Council indicated that the stock should be able to sustain a limited fishery and a commercial fishery for yellowtail flounder was re-instituted in 1998. However, the stock biomass had not returned to historic levels and Scientific Council recommended that the TAC not exceed 4,000 t for 1998. Based on increased biomass of fully recruited fish, the quota was increased to 6,000 t for 1999. Of this, 5,850 t was allocated to Canada to be fished solely within the 200 mile limit. NAFO allocated 80 t to the European Union and the remainder to "other". The quota was allocated in this manner based primarily on pre-moratorium allocations. In 2000 and 2001, the quota was increased to 10,000 t and 13,000 t respectively, again the large majority allocated to the Canadian offshore fleet. Further details of the fishery are available in Kulka (2002).

Background: American plaice (*Hippoglossoides platessoides* in Div. 3LNO)

American plaice is widely distributed across the Grand Banks, including within the NRA. Once part of a mixed fishery with yellowtail and cod on the Grand Banks, the stock has been under moratorium since 1994. In the NRA, it is increasingly commonly been taken as a by-catch in recent years and the actual amounts taken have merited considerable discussion at Scientific Council although there has never been a directed fishery in the NRA. Catches from this stock were generally in the range of 40,000 to 50,000 tons per year throughout the 1970s and 1980s, before declining to low levels in the early-1990s. There has been no directed fishing on this stock since 1993. The TAC's in 1995-2002 have been set at 0. The catch in 1999 was 2,565 tons, in 2000 it was 5,176 tons and in 2001 5,739 tons. Catch in all three years was taken primarily in the NRA. Further details are available in Morgan et al (2002).

Background: Greenland halibut (Hippoglossus hippoglossus in SA 2 and 3)

Greenland halibut is the predominant directed groundfish fishery prosecuted within the NRA although this species are much more widely distributed in the northwest Atlantic. The Canadian catch of Greenland halibut in 2001 in NAFO Subarea 2 and Divisions 3KLMNO was reported to be almost 8,400 tons. This was down by 2,200 tons from the catch in 2000, but was still more than double the catches taken. in each of 1998 and 1999. Although gillnet was still the predominant gear type, otter trawl catches of about 1,800 tons were 500 tons higher than in 2000, and the highest by this fleet sector in ten years. As in 2000, much of the catch came from Divisions 3KL, and about half of the catch was taken in July and August. The catch at age in 2001 was dominated by the 1994 year-class, which accounted for 55% of the catch numbers and 40% of the catch weight. This (Canadian) fishery and assessment of the resource are elaborated in Brodie and Power (2002) and Mahe and Bowering (2002).

Background: Other

Striped (Atlantic), spotted and northern (broadhead) wolffish (*Anarhichus sp.*), black dogfish (*Centroscyllium fabricii*), monkfish (*Lophius americanus*) and longfin hake (*Urophysis chesteri*) are common by-catch in the NRA fisheries but are not the target of directed effort. Information on theses species is limited. Simpson and Kulka (2002) for wolffish and Kulka and Miri (2001) for monkfish provide the latest information on these species. Similar information are not available for black dogfish and longfin hake.

Methods

Biomass Distribution

Canadian spring and research survey data were used to examine distribution of thorny skate in Div. 3LNOPs, redfish in Div. 3O, roundnose grenadier in SA 2+3 and roughhead grenadier in SA 2+3 in relation to the 200 mile limit. For redfish in 3O, spring and fall surveys were analysed from 1991 to 1999 to determine seasonal variation. From 1991 to spring 1995 an Engel 145 otter trawl was deployed (1.75 n. mi. standard tow, 32mm liner) and from 1995 onwards a Campelen 1800 shrimp trawl (0.75 n. mi. standard tow, 12mm liner). The 1991 to spring 1995 Engel 145 data were converted into Campelen 1800 trawl equivalent data. Details of the comparative fishing trials and data modelling can be found in Power and Atkinson (MS 1998a). For skate, no such conversions are possible from the comparative fishing trials so only the spring and period from 1995 to 1999 were analysed that deployed the Campelen (except for spring 1995). In addition, 3Ps was only surveyed in spring. For roughhead and roundnose grenadier in SA 2+3, only the 1996-1999 surveys are analysed because no data conversions are possible. This series covered strata down to 1500 m but incompletely for some years. Finally, for redfish and grenadier distributions only those strata where the species under consideration were most abundant are summarized for biomass.

The Campelen trawl used for the surveys (except spring 1995) captures a wide range of sizes for these species, including that portion making up the fishable biomass.

Two methods are employed to define distribution of biomass in relation to the 200 mile limit.

a) SPANdex - The first method, potential mapping (SPANS, Anon 1997) was applied only to thorny skate. The 1995-1999 distributions were mapped and biomass estimated from spring and fall survey data (by year and season). The method converts point data (the survey sets) into a surface depicting fish density strata, a post-stratification technique where the values of the point data are used to derive the strata (Fig. 2). From this point in the method, the calculation is very similar to the STRAP method elaborated below except that it employs local fish density (as reflected by catch rate per standardized tow) rather than depth to define strata. Mean catch per tow in each stratum adjusted to area of the stratum summed over all strata yields an estimate of biomass. Refer to Kulka and Mowbray (MS 1998) for an elaboration of the method used to produce distribution maps for skate.

   To determine how much of the biomass occurred inside 200 miles, a vector (border) defining the 200 mile line and the coastline was combined as a continuous line encompassing Canada's territorial water This enclosed line converted to an area defines all fishing grounds inside 200 miles. This area was overlaid with the distribution (density strata) of skate to "cookie cut" those parts of the strata lying inside 200 miles. Thus, that portion of the distribution occurring outside of the area was eliminated from the calculation of biomass as illustrated in Fig. 2. Next, the SPANdex method Kulka (MS 1998) was applied to this truncated distribution to calculate biomass inside 200 miles. By this method, biomass is derived by areal expansion for each density stratum summed over the strata. The spring 1995 calculation is presented in Table 1 to illustrate how the method estimates biomass. The upper panel of Table 1 shows total area, the lower panel is area inside 200 miles. Each row is a calculation of biomass for each stratum sorted in descending order by increasing density. The bottom row is the biomass estimate summed over all strata. Subtraction of this value in the bottom panel of Table 1 from biomass estimated from the total distribution (top panel) provides an estimate of biomass outside 200 miles. Details of the method including the areal expansion formula used are elaborated in Kulka (MS 1998).

b) STRAP - The Stratified Analysis Programs of Smith and Somerton (MS 1981) were used to estimate biomass by strata. An explanation of the stratified-random survey design can be found in Doubleday (1981). The stratification charts used are those endorsed by the Scientific Council for the NAFO area. There have been various modifications to the charts since their use first use in 1973 (i.e. Bishop MS 1994, Murphy MS 1996). Biomass outside 200 miles was calculated as the sum of (1) estimates for strata that lie completely outside the 200-mile limit and (2) a proportion of the estimate for strata that were straddling the line equal to the proportion of the

stratum area that was outside the 200-mile limit. The area of strata outside was determined by a planimeter measurement of the stratification charts. These straddling values are added to the outside 200 strata to provide an estimate of biomass outside 200 miles by year and season. Biomass inside 200 miles is a subtraction of this value from total biomass estimated by STRAP.

Both the first and second methods were applied for thorny skate as a way compare and validate the results. Given the similarity in results between methods, only the STRAP method was applied to the other species.

As well, Kulka and Mowbray (MS 1998) showed that thorny skate migrate to deeper water during the winter/spring period. In doing so, the species is distributed differently in relation to the 200 mile limit at different times of the year. Thus, calculations of biomass were done for both the spring and the fall surveys and a seasonally adjusted average was calculated based on the months when skate were located on vs. off the bank A $5/12^{th}$ weighting was applied to the spring estimate, $7/12^{th}$ to the fall to account for seasonal movement as described in Kulka and Mowbray (MS 1998). A further complication, that 3Ps was not surveyed in the fall was compensated for by adjusting the fall estimate of biomass. Fall estimates accounting for the missing Subdiv. 3Ps component are derived by applying an adjustment factor annually, a ratio of total Div. 3LNOPs biomass to Subdiv. 3Ps biomass based on spring survey data for that year.
Catches

In terms of catch estimation for the species, NAFO tables found in STATLANT 21A are used as the basis for one estimate of landings. For thorny skate, a second estimate of catch is provided. The second estimate comprises information combined from several sources:

a) Canadian Atlantic ZIF (Zonal Interchange Format, a data base combining statistics from all Atlantic fleets) for the landed component
b) discards of skate, a significant component of the catch in earlier years estimated using data collected by fishery observers from a variety of fisheries as described in Kulka and Mowbray (MS 1998)
c) non-Canadian catches derived from estimates provided by Fisheries and Oceans, Conservation and Protection based on boarding data.

Rationale for providing this second estimate is specified in results.

Results

Biomass Distribution

Thorny skate

The analysis of biomass inside vs. outside was based on a 1995-1999 time series for two reasons. First, there was a change in the Canadian survey gear in 1995. With the exception of the spring 1995 survey employing a Campelen trawl, data from earlier years was not used in this because of a change from Engel trawl in that year. However, even with the change of gear, although the biomass estimates are quite different (Engel about double for the Campelen gear), the ratio of biomass inside vs. outside 200 miles is quite similar between the spring 1995 data employing the Engel trawl and subsequent years. Secondly, and most importantly for skate, there was a shift in the distribution of the biomass as described above in the Introduction. Had earlier years been used in the analysis, an increasingly larger proportion of the biomass would have been located inside 200 miles. While the distribution in the vicinity of the area where the 200 mile limit overlap the Grand Bank (south and eastern areas) has seen little change, there is far less biomass in Div. 3L and north into 3K and 2J, all of this area located within 200 miles.

Proportion of thorny skate biomass inside/outside 200 miles is presented for two methods in Table 2 (STRAP) and 3 (SPANdex). Fig 3. shows the annual spring and fall estimates for each year between 1995 and 1999 plus a seasonally weighted average (7 month spring outside/5 month fall) for each year. Seasonal weightings are derived based on pattern of migration as derived from Kulka and Mowbray (MS 1998) that indicates the distribution observed during the distribution observed from the spring survey persists for a 7 month period, November-May, the remainder of time following the fall distribution. Both 1995-99 (full time series analysed) and 1996-99 (Campelen years only) averages are summarized in Table 2. Over the period of analysis, the seasonally adjusted percent of stock occurring inside 200

miles varied between 78.8% in 1999 and 87.1% in 1995 and appeared to vary without trend although in the last two years, the percent biomass inside was lower than the previous three years (Fig. 3).

The two methods yielded very similar results. The 1995-99 seasonally adjusted (using both spring and fall estimates) combined annual average biomass located inside the 200 mile line in 3LNPOs amounted to 82.8% as derived using SPANS and 84.3% as derived from STRAP. The 1995-1999 seasonally adjusted average for the two methods was 83.5% of the biomass inside 200 miles, 16.5% outside. Differences between the annual estimates produced by the two estimates varied by no more than 7% both positively and negatively suggesting no bias and indicating that the use of either method will produce a similar result.

Figure 4, Based on STRAP shows proportion of biomass inside vs. outside 200 miles, by NAFO Division (averaged over all years). A greater proportion of the biomass in NAFO Div. 3L and 3N occurred outside 200 miles compared to NAFO Div. 3N. The largest proportion of skate outside 200 miles, 64.4% average for 1995-99 spring surveys, 52.9% for fall occurred in Div. 3N, an area straddling the 200 mile limit where skate were most densely concentrated. The lower value observed in fall inside 200 miles is expected given the migration pattern observed. It is during the fall of the year when the skate are up on the bank in shallow water straddling the line that the directed Spanish fishery takes place. The straddling area with the least biomass is Div. 3O: an average of 8.6% in the spring and 5% in the fall. This to be expected because only about 10% of the bank where depth is less than 400 m occurring in 3O falls outside 200 miles.

Given the comparable outcome between the two methods for skate, only STRAP was used for partitioning biomass for the other species.

Redfish

The Div. 3O survey biomass estimates show high variability between years of the survey and within year stratum by stratum estimates (Table 4) suggesting considerable variation in the distribution of redfish with respect to the 200 mile line. It is also apparent that there is a substantial difference in the proportion of the biomass outside the 200-mile limit between seasons. The 1995 to 1999 spring estimates (Table 4) ranged from about 3% to 47% while a comparable period in the fall series ranged from 15% to 37%. The estimates from 1995-1999 suggest, on average, that about 17% is outside 200 miles in the spring while about 24% is outside in the fall. Combining both survey results gives an average of about 20%.

Grenadier

Only fall survey data was used for grenadiers. The survey estimates of roundnose grenadier biomass by Division the most abundant areas are north of Div. 3L. The 1996 to 1999 estimates of the proportion of biomass outside the 200-mile limit (Table 5, Fig. 5) ranged from about 11% to 36%. On average, about 22% of the biomass based on the surveys falls outside 200 miles.

For roughhead grenadier, the survey estimates of biomass by Division suggest that they are most abundant in Div. 3LN. The 1996 to 1999 estimates of the proportion of biomass outside the 200-mile limit (Table 5) ranged from about 53% to 61%. On average, about 57% of the survey biomass in Div. 3LN falls outside the 200 mile limit. However, the majority of this species (stock) occurs to the north inside 200 miles.

Yellowtail flounder

Estimates of the proportion of yellowtail flounder biomass inside the 200 mile limit vary from 60-100 percent (Table 6, Fig. 6). On average, 75% of the spring survey estimated biomass in 3LNOPs is within the Canadian 200 mile limit. In NAFO division 3O, the majority of biomass occurs within Canadian waters, while in division 3N only 60-70% of the biomass occurs within the 200 mile limit. Based on fall surveys, 35% of the estimated stock biomass in 3LNO is outside the 200 mile limit. Seasonally adjusted, about 30% of the yellowtail biomass falls outside 200 miles.

American plaice

In both spring and fall surveys, the estimated biomass of American plaice in divisions 3LNO inside the 200 mile limit ranged from 54 to 92%. In divisions 3LO, the majority of biomass was within the Canadian 200 mile limit, whereas in division 3N only 23% of the biomass was inside the limit. On average, based on fall surveys, less than 34% of the American plaice stock in 3LNO was outside the 200 mile limit (Table 7, Fig. 7). Estimates from the spring survey indicated that less than 22% of the 3LNOPs stock was located outside the 200 mile limit. The annual average was 28% outside.

Greenland halibut

Overall, less than fifty percent of the fall biomass of turbot in NAFO Div. 3LNO was estimated to be within the 200 mile limit (Table 8, Fig. 8). Based on the spring surveys estimates, on average 46% of the biomass in NAFO division 3LNOPs was outside the 200 mile limit. While Greenland halibut in division 3N are distributed mainly outside the 200 mile limit, in divisions 3LO, the majority of biomass is distributed inside the 200 mile limit. However, a large proportion of the stock exists north of the Grand Banks and thus a much smaller proportion of the stock as a whole occurs outside of 200 miles.

Wolffish

In both spring and fall surveys, most of the estimated biomass of striped wolffish is inside the Canadian 200 mile limit. During spring surveys, on average less than 15% of the estimated biomass of striped wolffish in NAFO division 3LNOPs was outside the 200 mile limit. However, fall surveys in Div. 3N indicated that 70% of the estimated biomass of striped wolffish was outside the 200 mile limit (Table 9, Fig. 9). Overall, less than 34% of the estimated fall biomass in 3LNO was distributed outside the 200 mile limit.

The distribution of spotted wolffish biomass inside and outside the 200 mile limit is highly variable in both the spring and fall surveys, ranging from 32 to 90 percent (Table 10, Fig. 10). On average, 64% of the estimated biomass of spotted wolffish in Div. 3LNO, from fall surveys, was distributed inside the 200 mile limit. Similarly, 66% of the spotted wolffish biomass in Div. 3LNOPs was distributed inside the 200 mile limit based on spring survey estimates.
Estimates of northern wolffish biomass within NAFO Div. 3LNO were highly variable inside the 200 mile limit, varying from 27-80%. On average, estimates from the fall surveys indicated less than 40% of the biomass of broadhead wolffish in 3LNO was distributed within the 200 mile limit (Table 11, Fig. 11). Based on the biomass estimated in 3LNOPs from the spring surveys, on average less than 40% of the biomass was distributed outside the 200 mile limit.

Black Dogfish

Black dogfish were concentrated in NAFO Div. 3O based on spring surveys with the majority of the biomass from 3LNOPs inside the 200 mile limit. Estimates of black dogfish biomass from the fall surveys indicted that on average less than 40% of the 3LNO biomass was distributed inside the 200 mile limit. In particular, 80% of the biomass in divisions 3L and 3N was outside the 200 mile limit (Table 12, Fig. 12).

Monkfish

On average, over 90% of the estimated biomass of Monkfish was distributed inside the 200 mile limit in NAFO Div. 3LNO based on fall biomass estimates. In particular, less than 10% of the estimated biomass of monkfish was distributed outside the 200 mile limit in division 3O in either the spring or fall surveys (Table 13. Fig. 13). During the fall surveys, less than 40% of the estimated biomass in division 3N was distributed outside the 200 mile limit. Based on spring survey estimates, over 97% of the biomass in 3LNOPs was distributed inside the 200 mile limit.

Longfin hake

Longfin hake are distributed mainly outside the 200 mile limit in NAFO Div. 3L and 3N, and mainly inside in division 3O. Since longfin hake are most abundant within NAFO division 3O, on average, over 90% of the biomass of 3LNO is estimated to be distributed inside the 200 mile limit in both spring and fall surveys (Table 14, Fig.14). On average, only

8% of the estimated fall biomass in NAFO division 3LNO is distributed outside the 200 mile limit. Furthermore, less than 2% of the biomass estimated in NAFO divisions 3LNOPs is distributed outside the 200 mile limit based on spring survey results.

Spring and fall estimates of proportion of each of the species examined, all years combined, are summarized in Table 15.

Landings

Thorny skate

From the time of the extension of jurisdiction to 1984, skate landings reported to NAFO averaged 5,000 t. Since that time, catches have increased dramatically. This was due in part to the emergence of a directed foreign fishery outside 200 miles in 1985, and more recently to the introduction of a directed skate fishery in Canadian waters starting in 1994.

Although poorly represented in the landings statistics, skate were caught in Canadian waters of 3LNOPs previous to 1994. Kulka (1986) reported that skates consistently comprised the greatest non-commercial by-catch in the Newfoundland offshore trawl fisheries, averaging 3,000-4,000 t during the early-1980's. Skate was sometimes the dominant by-catch of Grand Bank fisheries for plaice, cod, redfish and yellowtail, although nearly all of this incidental catch was discarded at sea. As a result, landing statistics for skate in Canadian waters prior to 1994 represent only a fraction of the actual catch. Thus, two sets of catch estimates from different sources are presented, the first, reported landings (STATLANT 21 A), the second accounting for missing information.

Table 16 (by country, Canada vs. other) and Figure 15 (Canada vs. non-Canadian) present the landings of skate as reported to NAFO in STATLANT 21A. Reported catches of skate ranged between 31,950 t in 1991 (the highest reported catch in any year) and 7.337 t in 1996. Fig. 16 shows that until 1994, the reported 99% was taken by countries other than Canada (mainly Spain). From 1990 to 1992, non-EU counties reported some catches, Since 1993, reported catches have been almost exclusively attributable to UE countries and Canada.

Table 17 and Fig. 16 present a separate estimate of catch combined from three different sources:

- Canadian landings from ZIF database
- discards estimated from information collected by fishery observers
- non-Canadian catches estimated from boarding data collected by Fisheries and Oceans, Conservation and Protection.

The second estimate was done for skate because a significant portion of the skate caught, particularly for Canadian fleets directing for other species was not reported in the landing statistics reflected in STATLANT 21A. As well, data from surveillance boardings suggested that skate have been misreported in the NRA. The catches are categorized as Canadian and non-Canadian. Figure 16 shows that the largest catches came from Div. 3N, particularly for non-Canadian countries fishing outside 200 miles. Table 16 also shows that although Canadian landings were almost non-existent until 1994, the amounts discarded were a significant component of the fishing mortality for skate in earlier years. They comprised 40% of the total catch between 1985 and 1993. As well, estimates for the non-Canadian catches differ (STATLAN 21A vs. C&P boardings data) as illustrated in Fig. 15, 16 and 18. The greatest differences are seen for the years 1990-1993 when very little of the skate catches appear in the NAFO statistics. Fig. 17 summarizes the proportion of skate taken by various countries since 1990.

Redfish

Nominal catches declined to 13,000 t in 1989, increased gradually to about 16,000 t in 1993 and decline subsequently to about 3,000 t in 1995, partly due to reductions in foreign allocations since 1993 (Table 18, Fig. 19). Russia (formerly USSR) predominated in this fishery up until 1993. Russia and Cuba have not fished since 1995 and 1993 respectively. Catches by Portugal, which began fishing in 1992, peaked at 4,800 t in 1995 and declined to 1,900 t by 1998. Spain had only incidental catches of redfish prior to 1996 has increased catch outside the 200 mile limit from 300 t in 1996 to 1,900 t in 1998. Since 1996, catch has fluctuated between 9,000 t and 14,000 t with the exception of 5,000 t in 1997. Up to the end of the third quarter in 1999, total catch was at 9,000 t

Roundnose Grenadier

It has been recognized that catches of grenadiers by EU-Portugal from 1987-1996 and EU-Spain from 1992-1996 reported to NAFO as roundnose area were primarily roughhead grenadiers (Alpoim *et al.,* MS 1994; Power and Parsons MS 1998 (Junquera, MS 1998). Catches of roundnose grenadier declined to 800 tons in 1990 and have since been taken as by-catch primarily in the Div. 3LMN Greenland halibut fishery. Catches have been about 50 tons each year from 1996-1998. There has been very limited commercial data since the cessation of fishing within the Canadian zone in 1993 (Table 19, Fig. 20).

Roughead grenadier

Roughhead grenadier catches increased sharply from about 300 tons in 1989 to 6,700 tons in 1992, remained stable at an average of about 4,300 from 1993 to 1997 and increased to 7,200 tons in 1998 and 1999. EU-Portugal has accounted for over 96% catch accumulated from 1987 to 1991 (Table 20, Fig. 21). Since 1992 EU-Spain has accounted for 68% of the accumulated catch and EU-Portugal has taken 27% with the remainder being caught mainly by Canada.

Yellowtail flounder

Total reported landings of yellowtail flounder, as reported to NAFO in STATLANT 21A, ranged from a low of 70t in 1995 to 11,998t in 1991(the highest reported catch in any year, Table 21). Figure x shows that until 1994, greater than 55% of reported landings were attributed to Canada. From 1994 to 1997, EU counties reported over 90% of the landings of yellowtail flounder (Table 21). Since 1998, over 80% of reported landings have been attributed to Canada with the remainder attributed to mainly EU countries (mainly Spain: Table 21, Fig. 22).

American plaice

From 1990 to 1993, Canadian landings of American plaice attributed for over 83% of the reported landings (Table 22, Fig. 23). Since 1994, Canadian landings have attributed for less than 30% of the total landings. Landings declined from a high of 32,457t in 1991 to a low of 913t in 1995. Landings of American plaice have since remained low reaching only a high of 3,366t in 1999. From 1994 to 1999, EU countries, mainly Spain have landed 65 to 83% of the reported American plaice landings.

Greenland halibut

EU countries, mainly Spain and Portugal have landed 60 to 95% of the Greenland halibut landings. Total landings of turbot were highest from 1993-1994 when total landings ranged from 49,716t to 55,875t (Table 23, Fig. 24). However, since 1995 reported landings of turbot have been less than 23,000t. Canadian landings have not exceed 33% of the total landings, and in most years are less than 25%.

Wolffish

Wolffish was sometimes but not consistently reported on a species basis (Table 24 and 25, Fig. 25 and 26). Reported landings of striped wolffish are low, with the largest reported landings reaching 388t in 1991. With the exception of 1994, from 1991 to 1999 Spain has been the only country reporting landings of striped wolffish. Canada has no reported landings of Atlantic wolffish from 1990 to 1999. Landings of spotted wolffish have only been reported for 1994 at 1t. From 1990 to 1999, there are no reported landings of spotted wolffish from Canadian vessels. No landings of northern wolffish were reported.

Unspecified wolffish, the majority of the reports are found in Table 26 and Fig. 27. From 1990 to 1999, Canadian landings of wolffish have been minimal. In 1991, the largest reported Canadian landings were 670t, 19% of the total reported landings for wolffish. EU countries, in particular Portugal and Spain, can be attributed with greater than 75% of the landings from 1991 to 1999. Since 1996, the total reported landings, in STATLANT 21A, of wolffish have been less than 1300t.

Other

Reported landings of black dogfish could not be distinguished from spiny dogfish since dogfish were reported as unspecified (Table 27). However, it it likely that most dogfish taken in the NRA are black dogfish. Landings have risen since 1994 (Table 27, Fig. 28). Prior to 1994, the total reported landings of dogfish by Canadian vessels didn't exceed 1t. Since 1994, landings by Spain and other countries have increased the total landings to 610t in 1998 and 549 t in 1999. From 1997 to 1999, Spain has reported greater than 98% of the dogfish landed.

In most years from 1990-199, Canadian landings of monkfish comprised greater than 90% of the total reported landings. In 1998, when reported landings of Monkfish were the greatest (719t), Canadian landings contributed 60% of the catch. In 1990-1992 and 1998, EU countries reported relatively large landings of monkfish (Table 28, Fig. 29). Longfin hake is not listed in the NAFO STATLAN records.

Discussions

During the establishment of EEZ's by various states around the world in the late-1970's, ICES (International Council for the Exploration of the Seas) examined biological data relevant to zonal attachment (Anon 1978). Hamre (1993) described and discussed methods based on biological parameters for quantifying criteria of zonal attachment in the North Sea for the purpose of partitioning of the resource across political borders. He presented an age dis-aggregated approach to partitioning the biomass and took into account seasonal changes in the location of the fishable biomass due to migration. The method was applied to capelin, a highly migratory species. In 1995, a multilateral WG was established to examine the issue of biomass distribution of Norwegian spring spawning herring in relation to international borders. Their aim was to examine the methods of Hamre (1993) for apportioning this highly migratory stock. However, they found that the model depends on a number of assumptions about the timing of growth and distribution patterns and as well, the incorporation of fishing activities. This leads to the model being dependent on factors that are not well understood.

The current analysis differs from this work in the North Sea in a number of ways. First, the species analysed in the present study are far more sedentary than the pelagic species of interest in the North Sea simplifying the seasonal component of the current analysis. The stocks at issue in the North Sea are highly mobile, crossing borders in a complex spatio-temporal pattern that makes partitioning of the quota at best a difficult proposition Secondly, only one border had to be considered for the northwest Atlantic in contrast to the situation in the North Sea where there are a variety of political borders and nine zones considered for biomass partitioning all covering a relatively small area over which the pelagic species move. Thirdly, age disaggregated data are not available for many species. Although such information was available for redfish and the grenadiers, the species straddling Canada's 200 mile limit, current knowledge suggest little variation in the distribution of the year classes (recruited year classes are well mixed) in any of the stocks under study and thus an age disaggregated approach is not required.

Allocation of marine resources among countries fishing the same waters particularly where they straddle international borders is a highly complex issue with political overtones. The problem comprised part of the discussions at the NAFO has been wrestling with this issue long before the introduction of the 200 mile limit off Canada in 1977. Although allocation criteria had been formulated years ago, how these criteria are applied in the allocation of stocks continues to evolve. Recognition of coastal state rights in terms of apportioning quotas based on stock distribution abides by the general principles laid out in the Law of the Sea Convention. Thus the application of these rights in terms of allocation of stocks depends on a sound knowledge of the distribution of those stocks in relation to the political borders, in addition to information on catch history. It is felt that for the stocks analysed in this study that there is sufficient information to address the biomass distribution issue.

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Table 1. Example of a biomass calculation using the SPANdex method. The example shown is for thorny skate for the fall 1995, upper panel total area, lower panel, inside 200 miles only. Each row provides the calculation for a density strata. The bottom row in each table is the sum of the strata. Column 5 shows biomass estimate in tonnes by density strata. Refer to Fig. 2 for a spatial representation of the strata corresponding to the row calculations.

Total area

Set Count	3LNOP Area	Mean Kg per tow	Biomass kg	Biomass t	Stdev	% of Biomass
21	25,051	0.0	0	0	0.0	0.00%
26	24,750	0.1	105,924	106	0.2	0.08%
29	25,256	0.4	421,548	422	0.4	0.33%
28	27,236	1.0	1,142,318	1,142	1.0	0.89%
26	23,974	0.9	943,943	944	1.1	0.73%
27	23,519	1.4	1,419,239	1,419	1.7	1.10%
35	23,979	2.5	2,606,647	2,607	2.8	2.02%
21	22,660	3.5	3,384,565	3,385	3.5	2.63%
33	19,122	5.8	4,713,823	4,714	5.1	3.66%
28	19,138	7.9	6,437,787	6,438	7.5	5.00%
35	18,356	9.6	7,541,657	7,542	8.3	5.86%
31	18,781	15.5	12,458,561	12,459	17.8	9.68%
29	21,666	23.5	21,762,527	21,763	19.9	16.90%
30	22,070	30.0	28,364,501	28,365	22.2	22.03%
26	16,402	53.4	37,456,752	37,457	43.5	29.09%
425	**331,960**	10.36	**128,759,791**	***128,760***	9.00	**100.00%**

Inside 200 Miles

21	25098	0.0	0	0	0.0	0.00%
26	5248	0.1	22,460	22	0.2	0.02%
29	35293	0.4	589,075	589	0.4	0.46%
28	39809	1.0	1,669,648	1,670	1.0	1.30%
26	39674	0.9	1,562,109	1,562	1.1	1.21%
27	27405	1.4	1,653,737	1,654	1.7	1.28%
35	14865	2.5	1,615,906	1,616	2.8	1.25%
21	15000	3.5	2,240,444	2,240	3.5	1.74%
33	21345	5.8	5,261,822	5,262	5.1	4.09%
28	14877	7.9	5,004,439	5,004	7.5	3.89%
35	25446	9.6	10,454,620	10,455	8.3	8.12%
31	18967	15.5	12,581,946	12,582	17.8	9.77%
29	15890	23.5	15,960,793	15,961	19.9	12.40%
30	12413	30.0	15,953,265	15,953	22.2	12.39%
26	11445	53.4	26,136,601	26,137	43.5	20.30%
425	**322,775**	10.36	**100,706,865**	***100,707***	9.00	**78.21%**

Table 2. Biomass of thorny skate in Div. 3LNOPs, based on STRAP estimates for spring (upper) and fall (lower) surveys, 1995 to 1999.

SPRING surveys Biomass (t)														
	Div. 3L			Div. 3N			Div. 3O			Div. 3Ps		Divs. 3LNOPs		
Year	all strata	OUTSIDE	INSIDE	all strata	OUTSIDE	INSIDE	all strata	OUTSIDE	INSIDE	all INSIDE	all INSIDE	all strata	OUTSIDE	INSIDE
1995	1,102	586	516	1,112	683	429	12,726	370	12,356	9,812	8,957	24,752	1,639	23,113
1996	4,992	2,431	2,561	11,010	6,093	4,917	35,529	1,714	33,815	21,851	20,308	73,382	10,238	63,144
1997	3,969	1,010	2,959	9,703	6,165	3,538	28,293	1,891	26,402	20,705	14,252	62,670	9,066	53,604
1998	5,807	2,709	3,098	13,186	9,731	3,455	42,351	5,497	36,854	28,629	n/a	89,973	17,937	72,036
1999	7,278	2,250	5,028	26,254	16,802	9,452	54,045	5,366	48,679	32,062	n/a	119,639	24,418	95,221
2000	14,011	1,944	12,067	27,861	19,705	8,156	40,917	4,318	36,599	22,528	n/a	105,317	25,966	79,350

FALL surveys Biomass (t)												
	Div. 3L			Div. 3N			Div. 3O			Divs. 3LNO		
Year	all strata	OUTSIDE	INSIDE	all strata	OUTSIDE	INSIDE	all strata	OUTSIDE	INSIDE	all strata	OUTSIDE	INSIDE
1995	11,306	1,705	9,601	40,775	23,578	17,197	44,653	1,838	42,815	96,734	27,121	69,613
1996	14,459	3,034	11,425	28,629	16,113	12,516	36,969	1,846	35,123	80,057	20,993	59,064
1997	7,534	1,341	6,193	43,075	21,077	21,998	58,160	2,818	55,342	108,769	25,236	83,533
1998	9,205	1,638	7,567	34,279	16,926	17,353	39,280	2,371	36,909	82,764	20,935	61,829
1999	13,614	2,187	11,427	32,609	14,095	18,514	42,609	1,552	41,057	88,832	17,834	70,998

Table 3. Percent of biomass of thorny skate in NAFO Divisions 3LNPs inside 200 miles as derived from spring and fall research surveys using two methods. The bottom row lists percent of biomass outside 200 miles. All surveys except spring 1995 employed Campelen gear.

	Raw Spring Percent inside 3LNOPs		**Raw Fall Percent inside 3LNO**		**Adjusted Fall Percent inside 3LNOPs**		**Seasonally adjusted annual average**		
Year	**SPANS**	**STRAP**	**SPANS**	**STRAP**	**SPANS**	**STRAP**	**SPANS**	**STRAP**	**Combined**
1995	83.78%	93.38%	78.21%	71.96%	86.76%	83.08%	85.02%	89.09%	87.06%
1996	83.70%	86.05%	73.10%	73.78%	80.96%	81.59%	82.56%	84.19%	83.37%
1997	94.15%	85.53%	83.89%	76.80%	89.01%	84.46%	92.01%	85.09%	88.55%
1998	73.50%	80.06%	77.12%	74.71%	81.00%	82.75%	76.63%	81.18%	78.91%
1999	76.32%	79.59%	77.08%	79.90%	79.34%	85.30%	77.58%	81.97%	79.77%
2000	80.20%	75.34%							
1996-99	81.92%	82.81%	77.80%	76.30%	82.58%	83.53%	82.19%	83.11%	82.65%
1995-99	82.29%	84.92%	77.88%	75.43%	83.41%	83.44%	82.76%	84.30%	83.53%
% Outside	**17.71%**	**15.08%**	**22.12%**	**24.57%**	**16.59%**	**16.56%**	**17.24%**	**15.70%**	**16.47%**

Table 4. Biomass of Redfish in Div. 3O, based on STRAP estimates for spring (upper) and fall (lower) surveys, 1995 to 1999.

	Spring			**Fall**			**Season Combined**		
	Biomass of Total Area	Outside Only	Percent Outside	Biomass of Total Area	Outside Only	Percent Outside	Biomass of Total Area	Outside Only	Percent Outside
1991	15278	1552	10.16%	34618	4472	12.92	49896	6025	12.07%
1992	15961	2347	14.70%	56247	14816	26.34	72207	17163	23.77%
1993	83874	23731	28.29%	51782	3584	6.92	135655	27314	20.14%
1994	172265	8477	4.92%	53324	5008	9.39	225589	13485	5.98%
1995	234649	14641	6.24%	125578	46018	36.64	360226	60658	16.84%
1996	102695	48613	47.34%	22974	3565	15.52	125669	52178	41.52%
1997	15699	410	2.61%	154622	37796	24.44	170322	38206	22.43%
1998	159314	18023	11.31%	75649	11436	15.12	234963	29459	12.54%
1999	122549	19912	16.25%	35002	9636	27.53	157551	29549	18.76%
1995-1999	634906	101599	16.00%	413825	108451	26.21	1048731	210049	20.03%
		Avg. 1995-1999	16.75%			23.85			22.42%

Table 5. Biomass of Roundnose (lower) and Roughhead (upper) grenadier in Div. 3LNO, based on STRAP estimates for fall surveys, 1995 to 1999.

	Division 3L			Division 3N			Division 3O			Divs. 3LNO		
Fall	All strata	Inside	Outside	All strata	Inside	Outside	All strata	Inside	Outside	All strata	Outside	Inside
1995	1713305.95	191894.3	1521412	1433706.63	12237.31	1421469	159518.54	76831.3	82687.24	3306531.12	3025568.17	280962.95
1996	17563128.45	2851492	14711636	327357.13	5075.59	322281.5	48597.35	20728.41	27868.94	17939082.93	15061786.79	2877296.14
1997	12599646.69	1721856	10877791	1549567.82	17174.35	1532393	75369.18	46733.66	28635.52	14224583.69	12438819.91	1785763.78
1998	15912318.16	2697333	13214985	8194377.87	125247.8	8069130	551527.32	347534.4	203992.9	24658223.35	21488107.69	3170115.66
1999	15670404.91	3043081	12627324	1800994.45	36728.81	1764266	172905.21	94420.86	78484.35	17644304.57	14470074.33	3174230.24

	Division 3L			Division 3N			Division 3O			Divs. 3LNO		
Fall	All strata	Inside	Outside	All strata	Inside	Outside	All strata	Inside	Outside	All strata	Outside	Inside
1995	135952.17	1275.891	134676.3	16373.77	0	16373.77	188924.48	53048.11	135876.4	341250.42	286926.42	54324.00
1996	2647542.43	377022.8	2270520	36154.72	0	36154.72	7356.08	1765.459	5590.621	2691053.23	2312264.97	378788.26
1997	5528377.07	279519	5248858	31672.07	0	31672.07	13773.54	12131.46	1642.079	5573822.68	5282172.26	291650.42
1998	2130058.66	215750	1914309	656270.00	0	656270	182394.07	148125	34269.03	2968722.73	2604847.68	363875.05
1999	1817926.86	275415.7	1542511	1824.06	0	1824.06	8449.69	3345.211	5104.479	1828200.61	1549439.65	278760.96

Table 6. Biomass of yellowtail flounder Div. 3LNO, based on STRAP estimates for spring (upper) and fall (lower) surveys, 1995 to 1999.

	Division 3L			Division 3N			Division 3O			Division 3Ps	Divs. 3LNOPs		
Spring	All strata	Inside	Outside	All strata	Inside	Outside	All strata	Inside	Outside	Inside	All strata	Outside	Inside
1995	0.00	0.00	0.00	36571725.26	26016554.48	10555170.78	8222217.55	7377212.12	845005.43	902248.74	45696191.55	11400176.21	34296015.34
1996	1127217.18	1126553.14	664.05	103940005.70	73743943.81	30196061.89	70557637.13	68286784.66	2270852.47	2345406.85	177970266.86	32467578.41	145502688.45
1997	463901.20	463901.20	0.00	121297221.41	80280198.53	41017022.88	53187188.52	51069056.48	2118132.04	840083.55	175788394.68	43135154.92	132653239.76
1998	469959.57	469959.57	0.00	143672522.93	92186515.83	51486007.10	58040726.97	54682620.13	3358106.84	1767425.13	203950634.60	54844113.94	149106520.66
1999	28524859.58	28524859.58	0.00	238451100.95	133946315.31	104504785.64	98724614.87	94903549.43	3821065.44	7601399.83	373301975.23	108325851.08	264976124.15

	Division 3L			Division 3N			Division 3O			Divs. 3LNO		
Fall	All strata	Inside	Outside	All strata	Inside	Outside	All strata	Inside	Outside	All strata	Outside	Inside
1995	1245935.64	1245935.64	0.00	102806472.09	63358729.29	39447742.80	25733763.13	25556760.99	177002.14	129786170.86	39624744.95	90161425.91
1996	2237101.98	2237101.98	0.00	0.00	0.00	0.00	17927248.91	17927248.91	0.00	20164350.89	0.00	20164350.89
1997	1281736.56	1281736.56	0.00	164151542.54	88536835.51	75614707.03	57495783.62	55963820.83	1531962.79	222929062.72	77146669.83	145782392.89
1998	5216489.16	5216489.16	0.00	173616522.13	85964623.24	87651898.89	52814986.27	52807955.52	7030.75	231647997.56	87658929.63	143989067.93
1999	9583226.63	9583226.63	0.00	192953331.83	96459695.44	96493636.39	48364202.40	47561217.07	802985.33	250900760.86	97296621.72	153604139.14

Table 7. Biomass of American plaice Div. 3LNO, based on STRAP estimates for spring (upper) and fall (lower) surveys, 1995 to 1999.

	Division 3L			Division 3N			Division 3O			Division 3Ps	Divs. 3LNOPs		
Spring	All strata	Inside	Outside	All strata	Inside	Outside	All strata	Inside	Outside	Inside	All strata	Outside	Inside
1995	4631161.45	2817154.78	1814006.67	4084597.22	2086704.70	1997892.52	9560014.62	8663897.13	896117.49	4994251.79	23270025.08	4708016.68	18562008.40
1996	30859056.00	27286288.82	3572767.18	26097145.69	12802173.99	13294971.70	49091547.23	45195618.72	3895928.51	12371403.37	118419152.29	20763667.40	97655484.89
1997	13806363.57	12120235.37	1686128.20	27410849.80	11136419.14	16274430.66	51249772.23	45424647.15	5825125.08	8649469.79	101116455.39	23785683.93	77330771.46
1998	19527510.28	15418548.36	4108961.92	25512113.69	9178999.18	16333114.51	58032071.86	53012124.02	5019947.84	14335961.39	117407657.22	25462024.27	91945632.95
1999	57555458.43	54941013.63	2614444.80	59683879.64	24537988.53	35145891.11	75036795.56	65508183.28	9528612.28	14643166.64	206919300.27	47288948.19	159630352.08
	Division 3L			Division 3N			Division 3O				Divs. 3LNO		
Fall	All strata	Inside	Outside	All strata	Inside	Outside	All strata	Inside	Outside		All strata	Outside	Inside
1995	51274434.55	47440829.47	3833605.08	46455009.06	16242795.99	30212213.07	55149947.01	51393884.74	3756062.27		152879390.62	37801880.43	115077510.19
1996	56983940.66	50611528.99	6372411.67	1598578.64	0.00	1598578.64	41525799.76	41020709.84	505089.92		100108319.06	8476080.23	91632238.83
1997	43753178.10	32096711.24	11656466.86	61033190.17	19085487.83	41947702.34	57523436.83	53109196.15	4414240.68		162309805.10	58018409.87	104291395.23
1998	48835388.08	40811643.69	8023744.39	79996717.50	20002849.73	59993867.77	58978999.26	52987366.94	5991632.32		187811104.84	74009244.48	113801860.36
1999	44987239.95	34251937.76	10735302.19	78074403.56	17245485.25	60828918.31	66919105.56	50501803.03	16417302.53		189980749.07	87981523.04	101999226.03

Table 8. Biomass of Greenland halibut Div. 3LNO, based on STRAP estimates for spring (upper) and fall (lower) surveys, 1995 to 1999.

	Division 3L			Division 3N			Division 3O			Division 3Ps	Divs. 3LNOPs		
Spring	All strata	Inside	Outside	All strata	Inside	Outside	All strata	Inside	Outside	Inside	All strata	Outside	Inside
1995	5925005.80	3288843.58	2636162.22	845419.85	8451.18	836968.67	244322.56	124745.45	119577.11	2227585.97	9242334.18	3592708.00	5649626.18
1996	9533491.63	4031873.64	5501617.99	3415467.25	66898.89	3348568.36	2757274.62	1844059.80	913214.82	2572398.59	18278632.09	9763401.17	8515230.92
1997	18466606.34	12411297.03	6055309.31	4681427.36	71094.80	4610332.56	2083747.53	1637686.38	446061.15	5773201.69	31004982.92	11111703.02	19893279.90
1998	40182209.96	18341987.51	21840222.45	5647009.89	57658.35	5589351.54	2010443.67	1480102.64	530341.03	4948338.54	52788002.06	27959915.02	24828087.04
1999	22557047.66	14310457.70	8246589.96	6003083.81	86023.54	5917060.27	1327892.89	868782.08	459110.81	4463814.49	34351838.85	14622761.04	19729077.81
	Division 3L			Division 3N			Division 3O				Divs. 3LNO		
Fall	All strata	Inside	Outside	All strata	Inside	Outside	All strata	Inside	Outside		All strata	Outside	Inside
1995	11283283.38	6251951.87	5031331.51	4611394.58	83353.95	4528040.63	610589.35	421008.00	189581.35		16505267.31	9748953.49	6756313.82
1996	36641787.64	19485378.46	17156409.18	2775475.66	0.00	2775475.66	446678.51	292307.87	154370.64		39863941.81	20086255.48	19777686.33
1997	48595930.57	19592683.09	29003247.48	6447520.62	301714.00	6145806.62	2058410.47	1446898.24	611512.23		57101861.66	35760566.33	21341295.33
1998	55463915.61	31978990.56	23484925.05	14787828.82	596305.91	14191522.91	5402339.85	4341317.22	1061022.63		75654084.28	38737470.60	36916613.68
1999	33954721.17	20181180.94	13773540.23	2738394.90	190226.35	2548168.55	1905288.34	1166415.14	738873.20		38598404.41	17060581.99	21537822.42

Table 9. Biomass of striped wolffish Div. 3LNO, based on STRAP estimates for spring (upper) and fall (lower) surveys, 1995 to 1999.

	Division 3L			Division 3N			Division 3O			Division 3Ps	Divs. 3LNOPs		
Spring	All strata	Inside	Outside	All strata	Inside	Outside	All strata	Inside	Outside	Inside	All strata	Outside	Inside
1995	128889.92	55966.89	72923.03	3213047.32	2452360.73	760686.59	597999.68	561047.83	36951.85	349371.02	4289307.94	870561.47	3418746.47
1996	1134909.69	967660.27	167249.42	3187271.88	2573792.83	613479.05	1350348.84	1350316.53	32.31	1230124.16	6902654.57	780760.77	6121893.80
1997	1066851.30	1037806.90	29044.40	5251693.17	4249551.11	1002142.06	772238.39	771805.38	433.01	183578.18	7274361.04	1031619.47	6242741.57
1998	1109990.28	925101.66	184888.62	3385727.31	2109074.21	1276653.10	2882738.46	2857808.14	24930.32	633024.91	8011480.96	1486472.04	6525008.92
1999	1952857.90	1597174.73	355683.17	4418649.26	3270230.37	1148418.89	3629279.82	3629279.82	0.00	4574488.80	14575275.78	1504102.06	13071173.72
	Division 3L			Division 3N			Division 3O				Divs. 3LNO		
Fall	All strata	Inside	Outside	All strata	Inside	Outside	All strata	Inside	Outside		All strata	Outside	Inside
1995	1109655.81	816330.96	293324.85	1390317.13	627303.02	763014.11	1282945.03	1164236.15	118708.88		3782917.97	1175047.83	2607870.14
1996	784669.15	587837.51	196831.64	65946.78	0.00	65946.78	1317334.48	1317334.48	0.00		2167950.41	262778.42	1905171.99
1997	558898.73	474465.46	84433.27	2159475.69	927193.63	1232282.06	1723703.00	1618881.45	104821.55		4442077.42	1421536.88	3020540.54
1998	1373442.15	950638.34	422803.81	3216682.01	964326.26	2252355.75	1960414.79	1949100.39	11314.40		6550538.95	2686473.96	3864064.99
1999	1678929.37	1053542.85	625386.52	1386806.57	415085.76	971720.81	1121641.09	1109428.73	12212.36		4187377.03	1609319.69	2578057.34

Table 10. Biomass of spotted wolffish Div. 3LNO, based on STRAP estimates for spring (upper) and fall (lower) surveys, 1995 to 1999.

	Division 3L			Division 3N			Division 3O			Division 3Ps	Divs. 3LNOPs		
Spring	All strata	Inside	Outside	All strata	Inside	Outside	All strata	Inside	Outside	Inside	All strata	Outside	Inside
1995	421616.09	182430.59	239185.50	148508.88	0.00	148508.88	10410.66	6920.15	3490.51	16551.66	597087.29	391184.89	205902.40
1996	977661.14	642901.31	334759.83	79604.15	0.00	79604.15	0.00	0.00	0.00	0.00	1057265.29	414363.98	642901.31
1997	675006.84	674259.42	747.42	73191.13	0.00	73191.13	5009.67	4964.33	45.34	265.34	753472.98	73983.89	679489.09
1998	1961148.89	1188968.67	772180.22	358773.45	0.00	358773.45	17714.81	4074.41	13640.40	0.00	2337637.15	1144594.08	1193043.07
1999	1781478.91	942033.62	839445.29	271014.07	0.00	271014.07	275364.43	266893.02	8471.41	2173.47	2330030.88	1118930.77	1211100.11
	Division 3L			Division 3N			Division 3O				Divs. 3LNO		
Fall	All strata	Inside	Outside	All strata	Inside	Outside	All strata	Inside	Outside		All strata	Outside	Inside
1995	1533276.26	1038179.15	495097.11	243632.21	276.12	243356.09	7712.60	1854.40	5858.20		1784621.07	744311.41	1040309.66
1996	52417.75	44509.52	7908.24	10124.50	0.00	10124.50	0.00	0.00	0.00		62542.25	18032.74	44509.52
1997	2250749.13	932580.71	1318168.42	527738.46	8198.64	519539.82	646.53	517.23	129.30		2779134.12	1837837.55	941296.57
1998	2027887.93	1656513.44	371374.49	128605.85	0.00	128605.85	26470.19	6289.02	20181.17		2182963.97	520161.51	1662802.46
1999	1260754.39	881571.83	379182.56	467115.03	0.00	467115.03	175637.99	175637.99	0.00		1903507.41	846297.59	1057209.82

Table 11. Biomass of northern wolffish Div. 3LNO, based on STRAP estimates for spring (upper) and fall (lower) surveys, 1995 to 1999.

	Division 3L			Division 3N			Division 3O			Division 3Ps	Divs. 3LNOPs		
Spring	All strata	Inside	Outside	All strata	Inside	Outside	All strata	Inside	Outside	Inside	All strata	Outside	Inside
1995	352435.80	93463.47	258972.33	23269.90	0.00	23269.90	31664.71	22618.72	9045.99	240449.76	647820.17	291288.22	356531.95
1996	209721.05	72244.29	137476.76	153499.06	0.00	153499.06	1072953.33	1066471.45	6481.88	302801.93	1738975.37	297457.70	1441517.67
1997	733834.28	253854.84	479979.44	2066245.49	1748602.25	317643.24	0.00	0.00	0.00	0.00	2800079.77	797622.68	2002457.09
1998	1491326.03	534206.12	957119.91	325141.84	0.00	325141.84	284876.32	176565.87	108310.45	262259.06	2363603.25	1390572.19	973031.06
1999	1049662.37	656519.54	393142.83	467452.39	0.00	467452.39	157113.10	153379.94	3733.16	213854.07	1888081.93	864328.38	1023753.55
	Division 3L			Division 3N			Division 3O				Divs. 3LNO		
Fall	All strata	Inside	Outside	All strata	Inside	Outside	All strata	Inside	Outside		All strata	Outside	Inside
1995	593094.47	175543.84	417550.63	973136.02	24724.58	948411.44	493952.97	362321.78	131631.19		2060183.46	1497593.26	562590.20
1996	2533761.08	1093597.35	1440163.73	138103.69	0.00	138103.69	101017.98	36685.34	64332.64		2772882.75	1642600.06	1130282.69
1997	2234472.15	782051.31	1452420.84	1001463.20	155245.94	846217.26	63121.74	40295.77	22825.97		3299057.09	2321464.07	977593.02
1998	2439617.60	1604592.58	835025.02	1702128.16	246404.00	1455724.16	576037.06	284990.12	291046.94		4717782.82	2581796.12	2135986.70
1999	3083106.48	1504879.22	1578227.26	1152620.15	5364.88	1147255.27	110491.46	30645.39	79846.07		4346218.09	2805328.59	1540889.50

Table 12. Biomass of black dogfish in Div. 3LNO, based on STRAP estimates for spring (upper) and fall (lower) surveys, 1995 to 1999.

	Division 3L			Division 3N			Division 3O			Division 3Ps	Divs. 3LNOPs		
Spring	All strata	Inside	Outside	All strata	Inside	Outside	All strata	Inside	Outside	Inside	All strata	Outside	Inside
1995	0.00	0.00	0.00	0.00	0.00	0.00	249.96	249.96	0.00	13428712.32	13428962.28	0.00	13428962.28
1996	0.00	0.00	0.00	0.00	0.00	0.00	219773.71	219773.71	0.00	114252660.93	114472434.64	0.00	114472434.64
1997	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	22142470.53	22142470.53	0.00	22142470.53
1998	0.00	0.00	0.00	0.00	0.00	0.00	10887.19	10887.19	0.00	9635943.91	9646831.10	0.00	9646831.10
1999	0.00	0.00	0.00	0.00	0.00	0.00	167525.41	135926.25	31599.16	9468971.72	9636497.13	31599.16	9604897.97
	Division 3L			Division 3N			Division 3O				Divs. 3LNO		
Fall	All strata	Inside	Outside	All strata	Inside	Outside	All strata	Inside	Outside		All strata	Outside	Inside
1995	34201.12	0.00	34201.12	47761.21	0.00	47761.21	32677.94	32677.94	0.00		114640.27	81962.33	32677.94
1996	1986434.81	849379.18	1137055.63	0.00	0.00	0.00	9749.64	9749.64	0.00		1996184.45	1137055.63	859128.82
1997	724027.79	83472.07	640555.72	177239.21	0.00	177239.21	27649.78	27649.78	0.00		928916.78	817794.93	111121.85
1998	1772436.79	33789.82	1738646.97	896664.42	0.00	896664.42	2403726.37	2354883.02	48843.35		5072827.58	2684154.74	2388672.84
1999	2796480.26	1112192.20	1684288.06	24307.04	0.00	24307.04	1474.65	1474.65	0.00		2822261.95	1708595.10	1113666.85

Table 13. Biomass of monkfish in Div. 3LNO, based on STRAP estimates for spring (upper) and fall (lower) surveys, 1995 to 1999.

	Division 3L			Division 3N			Division 3O			Division 3Ps	Divs. 3LNOPs		
Spring	All strata	Inside	Outside	All strata	Inside	Outside	All strata	Inside	Outside	Inside	All strata	Outside	Inside
1995	0.00	0.00	0.00	0.00	0.00	0.00	221455.33	221455.33	0.00	1192795.76	1414251.09	0.00	1414251.09
1996	0.00	0.00	0.00	0.00	0.00	0.00	589516.89	589516.89	0.00	1136117.98	1725634.87	0.00	1725634.87
1997	0.00	0.00	0.00	0.00	0.00	0.00	1515390.18	1290901.13	224489.05	2881182.78	4396572.96	224489.05	4172083.91
1998	0.00	0.00	0.00	0.00	0.00	0.00	273522.87	256973.72	16549.15	1187112.23	1460635.10	16549.15	1444085.95
1999	0.00	0.00	0.00	0.00	0.00	0.00	1164890.00	1101316.14	63573.86	640293.60	1805183.60	63573.86	1741609.74
	Division 3L			Division 3N			Division 3O				Divs. 3LNO		
Fall	All strata	Inside	Outside	All strata	Inside	Outside	All strata	Inside	Outside		All strata	Outside	Inside
1995	0.00	0.00	0.00	0.00	0.00	0.00	845599.99	758291.90	87308.09		845599.99	87308.09	758291.90
1996	0.00	0.00	0.00	0.00	0.00	0.00	1165943.68	1165943.68	0.00		1165943.68	0.00	1165943.68
1997	0.00	0.00	0.00	0.00	0.00	0.00	585492.31	585492.31	0.00		585492.31	0.00	585492.31
1998	0.00	0.00	0.00	112381.22	12370.18	100011.04	154062.69	95712.71	58349.98		266443.91	158361.02	108082.89
1999	0.00	0.00	0.00	938.85	0.00	938.85	255679.96	248554.30	7125.66		256618.81	8064.51	248554.30

Table 14. Biomass of longfin hake in Div. 3LNO, based on STRAP estimates for spring (upper) and fall (lower) surveys, 1995 to 1999.

	Division 3L			Division 3N			Division 3O			Division 3Ps	Divs. 3LNOPs		
Spring	All strata	Inside	Outside	All strata	Inside	Outside	All strata	Inside	Outside	Inside	All strata	Outside	Inside
1995	1945.67	0.00	1945.67	1824.06	0.00	1824.06	52423.40	49242.98	3180.42	440010.98	496204.11	6950.15	489253.96
1996	29344.00	3842.08	25501.92	22065.04	13.56	22051.48	4624637.61	4613073.56	11564.05	5571836.72	10247883.37	59117.45	10188765.93
1997	12047.21	9706.31	2340.90	26464.89	0.00	26464.89	1518948.55	1465443.71	53504.84	5319106.86	6876567.51	82310.63	6794256.88
1998	104207.85	59209.76	44998.09	26818.29	0.00	26818.29	1518558.57	1481071.12	37487.45	4214897.97	5864482.68	109303.83	5755178.85
1999	31330.91	1122.50	30208.41	71353.36	298.40	71054.96	10145868.46	9955588.01	190280.45	3823168.11	14071720.84	291543.82	13780177.02
	Division 3L			Division 3N			Division 3O				Divs. 3LNO		
Fall	All strata	Inside	Outside	All strata	Inside	Outside	All strata	Inside	Outside		All strata	Outside	Inside
1995	19743.45	187.08	19556.37	88565.93	0.00	88565.93	2273212.45	2159114.15	114098.30		2381521.83	222220.60	2159301.23
1996	15051.79	4.97	15046.82	62983.73	0.00	62983.73	684148.37	643827.43	40320.94		762183.89	118351.50	643832.39
1997	48393.87	17177.68	31216.19	25236.11	0.00	25236.11	1930316.62	1841025.26	89291.36		2003946.60	145743.65	1858202.95
1998	29021.16	7830.83	21190.33	73726.53	110.05	73616.48	2505076.02	2416997.42	88078.60		2607823.71	182885.41	2424938.30
1999	66112.02	20922.72	45189.30	73640.58	0.00	73640.58	2749216.57	2686107.87	63108.70		2888969.17	181938.58	2707030.59

Table 15. Summary of biomass partitioning inside vs. outside Canada's 200 mile limit.

SPECIES	FALL % OF 3LNO Stock OUTSIDE 200 mile limit	SPRING % OF 3LNOPs Stock OUTSIDE 200 mile limit
Thorny Skate	25	19
Redfish	24	27
Roundnose grenadier	22	
Roughead grenadier	57	
Yellowtail flounder	35	26
American plaice	34	22
Greenland halibut	53	46
Northern wolffish	63	39
Striped wolffish	34	14
Spotted wolffish	46	44
Black dogfish	59	0.02
Monkfish	8	3
Longfin hake	8	2

Table 16. Catches of SA 3 skate (NS) as reported in the NAFO STATLANT 21A Reports by country for the period 1990 to 1999. Lower table shows the percent taken by each country in each year.

Catches (t)

COUNTRY	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	TOTAL
Canada - NF	8	19	89	74	3,007	4,311	1,624	2,709	2,200		14,041
Canada - Mar	86	13	25	38	322	101	339	362	107		1,393
Canada - TOTAL	94	32	114	112	3,329	4,412	1,963	3,071	2,307		15,434
EU - Portugal	13,557	23,304	7,019	7,604	6,239	2,060	794	904	1,104		62,585
EU - U.K.	0	1	3	0	0	0	0	0	5		9
EU - Spain	5,322	7,095	209	2,126	5,485	4,511	4,578	9,329	8,106		46,761
EU - TOTAL	18,879	30,400	7,231	9,730	11,724	6,571	5,372	10,233	9,215		109,355
USSR/Russia	131	70	65	6	0	6	0	0	3		281
ROK (NCP - before 95)	748	770	1,045	5	0	0	0	0	0		2,568
Farores	2	0	0	0	0						2
France - SPM	576	648	46	11	4	12	2	3	9		1,311
Norway	0	30	0	0	0	0	0	0	0		30
USA	1	0	0	0	0	0	0	0	0		1
Other countries (above)	1,327	1,448	1,091	16	4	12	2	3	9		3,912
TOTAL:	**20,431**	**31,950**	**8,501**	**9,864**	**15,057**	**11,001**	**7,337**	**13,307**	**11,534**		**128,982**

Percent of total catch

COUNTRY	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	1990-99
Canada - NF	0.0%	0.1%	1.0%	0.8%	20.0%	39.2%	22.1%	20.4%	19.1%		10.9%
Canada - Mar	0.4%	0.0%	0.3%	0.4%	2.1%	0.9%	4.6%	2.7%	0.9%		1.1%
Canada - TOTAL	0.5%	0.1%	1.3%	1.1%	22.1%	40.1%	26.8%	23.1%	20.0%		12.0%
EU - Portugal	66.4%	72.9%	82.6%	77.1%	41.4%	18.7%	10.8%	6.8%	9.6%		48.5%
EU - U.K.	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%		0.0%
EU - Spain	26.0%	22.2%	2.5%	21.6%	36.4%	41.0%	62.4%	70.1%	70.3%		36.3%
EU - TOTAL	92.4%	95.1%	85.1%	98.6%	77.9%	59.7%	73.2%	76.9%	79.9%		84.8%
USSR/Russia	0.6%	0.2%	0.8%	0.1%	0.0%	0.1%	0.0%	0.0%	0.0%		0.2%
ROK (NCP - before 95)	3.7%	2.4%	12.3%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%		2.0%
Farores	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%		0.0%
France - SPM	2.8%	2.0%	0.5%	0.1%	0.0%	0.1%	0.0%	0.0%	0.1%		1.0%
Norway	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%		0.0%
USA	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%		0.0%
Other countries (above)	6.5%	4.5%	12.8%	0.2%	0.0%	0.1%	0.0%	0.0%	0.1%		3.0%
TOTAL:	**15.8%**	**24.8%**	**6.6%**	**7.6%**	**11.7%**	**8.5%**	**5.7%**	**10.3%**	**8.9%**		**100.0%**

Table 17. Catches of skate in Canadian and non-Canadian waters of NAFO Divisions 3LNOPs, 1985-1999. Landings inside 200 miles were extracted from ZIF (Canadian Zonal Interchange Format) files and were combined with fisheries observer data (Canadian discards and non-Canadian catches). Catches in non-Canadian waters were estimated based on Fisheries and Oceans Conservation & Protection surveillance boardings.

	3L		3N		3O		3Ps	**Canadian & Non-Canadian**				
Year	Canadian	Non-Can.	Canadian	Non-Can.	Canadian	Non-Can.	Canadian	3L	3N	3O	3PS	**Total**
1985	1,676	1,850	870	13,000	1,126	900	1,299	3,526	13,870	2,026	1,299	20,722
1986	1,830	1,500	1,314	10,500	1,596	700	1,105	3,330	11,814	2,296	1,105	18,546
1987	2,307	1,200	1,708	8,500	935	600	4,999	3,507	10,208	1,535	4,999	20,249
1988	9,785	950	1,431	6,500	1,567	400	2,006	10,735	7,931	1,967	2,006	22,639
1989	1,367	1,000	1,910	7,400	1,324	500	2,424	2,367	9,310	1,824	2,424	15,925
1990	2,033	1,800	485	12,400	953	900	3,396	3,833	12,885	1,853	3,396	21,966
1991	1,710	1,550	549	10,500	771	700	4,023	3,260	11,049	1,471	4,023	19,803
1992	436	600	343	5,800	1,953	200	2,385	1,036	6,143	2,153	2,385	11,717
1993	303	1,100	853	4,600	3,417	150	711	1,403	5,453	3,567	711	11,135
1994	269	650	63	6,700	1,219	150	1,238	919	6,763	1,369	1,238	10,290
1995	182	250	3	2,600	2,603	50	1,959	432	2,603	2,653	1,959	7,647
1996	58	1,200	6	3,000	1,218	200	645	1,258	3,006	1,418	645	6,328
1997	26	650	81	7,950	2,086	275	860	676	8,031	2,361	860	11,928
1998	**63**	**250**	**49**	**7,200**	**1,043**	**300**	**1,469**	**313**	**7,249**	**1,343**	**1,469**	**10,374**
1999	**70**	**1,100**	**82**	**5,200**	**1,165**	**500**	**1,278**	**1,170**	**5,282**	**1,665**	**1,278**	**9,395**

Table 18. Catches of SA 3 redfish as reported in the NAFO STATLANT 21A Reports by country for the period 1990 to 1999. Lower table shows the percent taken by each country in each year.

Catches(t)

COUNTRY	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	TOTAL
Canada - NF	10926	12146	15029	17530	11876	3892	9683	6188	10188	6751	104209
Canada - Mar.	3413	3938	7733	17422	7101	581	4168	2209	7166	2912	56643
Canada - Total	14339	16084	22762	34952	18977	4473	13851	8397	17354	9663	160852
EU - Portugal	17803	12165	6584	9831	8614	3297	2152	1126	2370	6080	70022
EU - U.K .		31	31						1		63
EU - Spain	3173	2109	948	136	870	629	558	1388	2683	5776	18270
EU- Total	20976	14305	7563	9967	9484	3926	2710	2514	5054	11856	88355
USSR/Russia	45764	35044	12368	14541	5060	5395	86	375	15	546	119194
ROK	14866	5761	15215	3687							39529
Farores			19	61	12						92
France-SPM	126	131	344					428	654	423	2106
Norway		42			8						50
USA											0
Other Countries	18141	15406	24933	22288	1007	2035	1184	566	894	463	86917
Total	114212	86773	83204	85496	34548	15829	17831	12280	23971	22951	497095

PercentCatches(t)

COUNTRY	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	1990-99
Canada - NF	9.57	14.00	18.06	20.50	34.38	24.59	54.30	50.39	42.50	29.41	20.96
Canada - Mar.	2.99	4.54	9.29	20.38	20.55	3.67	23.38	17.99	29.89	12.69	11.39
Canada - Total	12.55	18.54	27.36	40.88	54.93	28.26	77.68	68.38	72.40	42.10	32.36
EU - Portugal	15.59	14.02	7.91	11.50	24.93	20.83	12.07	9.17	9.89	26.49	14.09
EU - U.K .	0.00	0.04	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
EU - Spain	2.78	2.43	1.14	0.16	2.52	3.97	3.13	11.30	11.19	25.17	3.68
EU- Total	18.37	16.49	9.09	11.66	27.45	24.80	15.20	20.47	21.08	51.66	17.77
USSR/Russia	40.07	40.39	14.86	17.01	14.65	34.08	0.48	3.05	0.06	2.38	23.98
ROK	13.02	6.64	18.29	4.31	0.00	0.00	0.00	0.00	0.00	0.00	7.95
Farores	0.00	0.00	0.02	0.07	0.03	0.00	0.00	0.00	0.00	0.00	0.02
France-SPM	0.11	0.15	0.41	0.00	0.00	0.00	0.00	3.49	2.73	1.84	0.42
Norway	0.00	0.05	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.01
USA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Other Countries	15.88	17.75	29.97	26.07	2.91	12.86	6.64	4.61	3.73	2.02	17.48
Total	22.98	17.46	16.74	17.20	6.95	3.18	3.59	2.47	4.82	4.62	100.00

Table 19. Nominal catches (t) of reported roundnose grenadier with an adjustment for misclassification in Subarea 2+3 by country and year.

Country	1990	1991	1992	1993	1994*	1995*	1996*	1997*	1998*	1999*
Canada	155	152	409	273	54	42	28	3	-	-
E/GER	-	2	35	-	-	-	-	-	-	-
Former GDR	1	-	-	-	-	-	-	-	-	-
Poland	-	-	-	-	-	-	-	-	-	-
E/ESP	-	-	4,970	2,054	1,720	2,521	256	-	-	-
Former USSR	538	132	-	-	-	-	-	-	-	-
Russia	-	-	4	-	-	130	53	-	91	43
Japan	125	156	80	134	63	57	26	42	37	40
E/FRA	-	-	-	-	-	-	-	4	-	-
Faroes	-	-	3	4	-	-	-	-	-	-
Norway	-	24	-	-	-	-	-	-	-	-
Cuba	-	-	-	-	-	-	-	-	-	-
Den(GRL)	-	-	2	-	-	-	-	-	-	-
									-	-
TOTAL Reported	819	466	5,503	2,465	1,837	2,750	363	49	128	83
Excluding E/ESP	819	466	1,378	411	117	229	363	49	128	83

* Provisional.

NOTE: Catches for Spain from (1992-1996) listed under Roundnose grenadier in NAFO statistics have been adjusted for Roughhead grenadier according to Junquera (1988).

Table 20. Catches of SA 3 roughead grenadier as reported in the NAFO STATLANT 21A Reports by country for the period 1990 to 1999. Lower table shows the percent taken by each country in each year.

Roughhead grenadier nominal catches (t.) in Subarea 2+3, updated from Power and Parsons (1998), Junquera et al. (1999), Vargas et al. (2000) and Vaskov et al. (2000).

Country / Year	1990	1991	1992	1993	1994[a]	1995[a]	1996[a]	1997[a]	1998[a]	1999[a]
Canada	31	215	595	345	79	84		240		108
Former GDR										
EU-ESP			4125[b]	2054[b]	1720[b]	2521[b]	3090[b]	3738	6050	5704
EU-PRT	3211[b]	4486[b]	2000[b]	1969[b]	2223[b]	1402[b]	784[b]	762	1089	1299
Norway	2									
Russia									92[c]	49
TOTAL	3244	4701	6720	4368	4022	4007	4131	4740	7231	7160

[a] Provisional.

[b] First reported as roundnose grenadier

Table 21. Catches of SA 3 yellowtail flounder as reported in the NAFO STATLANT 21A Reports by country for the period 1990 to 1999. Lower table shows the percent taken by each country in each year.

Catches(t)

COUNTRY	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	TOTAL
Canada - NF	4903	6895	6417	6283	1	3	7	6	3586	5201	33302
Canada - Mar.	215	529	718	486	22	3			207	278	2458
Canada - Total	5118	7424	7135	6769	23	6	7	6	3793	5479	35760
EU - Portugal	11			21					87	426	545
EU - U.K .											0
EU - Spain	213	246	122	14	315	64	261	656	562	752	3205
EU- Total	224	246	122	35	315	64	261	656	649	1178	3750
USSR/Russia											0
ROK	3647	4144	3826								11617
Farores											0
France-SPM	168	148	36					18	59	33	462
Norway											0
USA	6			68							74
Other Countries		36		20						96	152
Total	9163	11998	11119	6892	338	70	268	680	4501	6786	51815

PercentCatches(t)

COUNTRY	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	1990-99
Canada - NF	53.51	57.47	57.71	91.16	0.30	4.29	2.61	0.88	79.67	76.64	64.27
Canada - Mar.	2.35	4.41	6.46	7.05	6.51	4.29	0.00	0.00	4.60	4.10	4.74
Canada - Total	55.86	61.88	64.17	98.22	6.80	8.57	2.61	0.88	84.27	80.74	69.01
EU - Portugal	0.12	0.00	0.00	0.30	0.00	0.00	0.00	0.00	1.93	6.28	1.05
EU - U.K .	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
EU - Spain	2.32	2.05	1.10	0.20	93.20	91.43	97.39	96.47	12.49	11.08	6.19
EU- Total	2.44	2.05	1.10	0.51	93.20	91.43	97.39	96.47	14.42	17.36	7.24
USSR/Russia	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ROK	39.80	34.54	34.41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	22.42
Farores	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
France-SPM	1.83	1.23	0.32	0.00	0.00	0.00	0.00	2.65	1.31	0.49	0.89
Norway	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
USA	0.07	0.00	0.00	0.99	0.00	0.00	0.00	0.00	0.00	0.00	0.14
Other Countries	0.00	0.30	0.00	0.29	0.00	0.00	0.00	0.00	0.00	1.41	0.29
Total	17.68	23.16	21.46	13.30	0.65	0.14	0.52	1.31	8.69	13.10	100.00

Table 22. Catches of SA 3 American plaice as reported in the NAFO STATLANT 21A Reports by country for the period 1990 to 1999. Lower table shows the percent taken by each country in each year.

Catches(t)

COUNTRY	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	TOTAL
Canada - NF	27067	27020	12182	8302	193	179	177	382	643	973	77118
Canada - Mar.	496			5	22	10	4	10	25	16	588
Canada - Total	27563	27020	12182	8307	215	189	181	392	668	989	77706
EU - Portugal	715	1183	453	323	346	170	289	389	361	719	4948
EU - U.K .		2	44								46
EU - Spain	396	1391	802	443	394	554	660	1002	1133	1462	8237
EU- Total	1111	2576	1299	766	740	724	949	1391	1494	2181	13231
USSR/Russia	23		50	8						151	232
ROK	716	1919	528	16							3179
Farores			1	244							245
France-SPM	79	361	45					23	27	24	559
Norway											0
USA	8			84							92
Other Countries	338	581	89	49	1		11	7	16	21	1113
Total	29838	32457	14194	9474	956	913	1141	1813	2205	3366	96357

PercentCatches(t)

COUNTRY	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	1990-99
Canada - NF	90.71	83.25	85.82	87.63	20.19	19.61	15.51	21.07	29.16	28.91	80.03
Canada - Mar.	1.66	0.00	0.00	0.05	2.30	1.10	0.35	0.55	1.13	0.48	0.61
Canada - Total	92.38	83.25	85.82	87.68	22.49	20.70	15.86	21.62	30.29	29.38	80.64
EU - Portugal	2.40	3.64	3.19	3.41	36.19	18.62	25.33	21.46	16.37	21.36	5.14
EU - U.K .	0.00	0.01	0.31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05
EU - Spain	1.33	4.29	5.65	4.68	41.21	60.68	57.84	55.27	51.38	43.43	8.55
EU- Total	3.72	7.94	9.15	8.09	77.41	79.30	83.17	76.72	67.76	64.80	13.73
USSR/Russia	0.08	0.00	0.35	0.08	0.00	0.00	0.00	0.00	0.00	4.49	0.24
ROK	2.40	5.91	3.72	0.17	0.00	0.00	0.00	0.00	0.00	0.00	3.30
Farores	0.00	0.00	0.01	2.58	0.00	0.00	0.00	0.00	0.00	0.00	0.25
France-SPM	0.26	1.11	0.32	0.00	0.00	0.00	0.00	1.27	1.22	0.71	0.58
Norway	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
USA	0.03	0.00	0.00	0.89	0.00	0.00	0.00	0.00	0.00	0.00	0.10
Other Countries	1.13	1.79	0.63	0.52	0.10	0.00	0.96	0.39	0.73	0.62	1.16
Total	30.97	33.68	14.73	9.83	0.99	0.95	1.18	1.88	2.29	3.49	100.00

Table 23. Catches of SA 3 Greenland halibut as reported in the NAFO STATLANT 21A Reports by country for the period 1990 to 1999. Lower table shows the percent taken by each country in each year.

Catches(t)

COUNTRY	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	TOTAL
Canada - NF	6426	3826	5934	4126	1620	1153	3946	4115	2335	2986	36467
Canada - Mar.	37	71	72	10	14	3	3	6	28	16	260
Canada - Total	6463	3897	6006	4136	1634	1156	3949	4121	2363	3002	36727
EU - Portugal	11171	13961	10547	8811	5970	1942	3313	3347	3245	3994	66301
EU - U.K .		4	9								13
EU - Spain	1730	6653	34520	35640	40772	8608	7309	7945	7236	9023	159436
EU- Total	12901	20618	45076	44451	46742	10550	10622	11292	10481	13017	225750
USSR/Russia	490	265	1		89	114	311		1890	3117	6277
ROK	7	7	49	5							68
Farores	6	481	638	386	70	99	26				1706
France-SPM		3	203					210	850	886	2152
Norway	69	5		22		1					97
USA											0
Other Countries	88	454	3902	2513	1181	1777	2038	1876	2053	2420	18302
Total	20024	25730	55875	51513	49716	13697	16946	17499	17637	22442	291079

PercentCatches(t)

COUNTRY	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	1990-99
Canada - NF	32.09	14.87	10.62	8.01	3.26	8.42	23.29	23.52	13.24	13.31	12.53
Canada - Mar.	0.18	0.28	0.13	0.02	0.03	0.02	0.02	0.03	0.16	0.07	0.09
Canada - Total	32.28	15.15	10.75	8.03	3.29	8.44	23.30	23.55	13.40	13.38	12.62
EU - Portugal	55.79	54.26	18.88	17.10	12.01	14.18	19.55	19.13	18.40	17.80	22.78
EU - U.K .	0.00	0.02	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
EU - Spain	8.64	25.86	61.78	69.19	82.01	62.85	43.13	45.40	41.03	40.21	54.77
EU- Total	64.43	80.13	80.67	86.29	94.02	77.02	62.68	64.53	59.43	58.00	77.56
USSR/Russia	2.45	1.03	0.00	0.00	0.18	0.83	1.84	0.00	10.72	13.89	2.16
ROK	0.03	0.03	0.09	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.02
Farores	0.03	1.87	1.14	0.75	0.14	0.72	0.15	0.00	0.00	0.00	0.59
France-SPM	0.00	0.01	0.36	0.00	0.00	0.00	0.00	1.20	4.82	3.95	0.74
Norway	0.34	0.02	0.00	0.04	0.00	0.01	0.00	0.00	0.00	0.00	0.03
USA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Other Countries	0.44	1.76	6.98	4.88	2.38	12.97	12.03	10.72	11.64	10.78	6.29
Total	6.88	8.84	19.20	17.70	17.08	4.71	5.82	6.01	6.06	7.71	100.00

Table 24. Catches of SA 3 striped wolffish as reported in the NAFO STATLANT 21A Reports by country for the period 1990 to 1999. Lower table shows the percent taken by each country in each year.

Catches(t)

COUNTRY	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	TOTAL
Canada - NF											0
Canada - Mar.											0
Canada - Total	0	0	0	0	0	0	0	0	0	0	0
EU - Portugal											0
EU - U.K .											0
EU - Spain	283	388			8	116	7	23	4		829
EU- Total	283	388	0	0	8	116	7	23	4	0	829
USSR/Russia											0
ROK											0
Farores											0
France-SPM											0
Norway											0
USA											0
Other Countries	1				1					1	3
Total	284	388	0	0	9	116	7	23	4	1	832

PercentCatches(t)

COUNTRY	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	1990-99
Canada - NF	0.00	0.00			0.00	0.00	0.00	0.00	0.00	0.00	0.00
Canada - Mar.	0.00	0.00			0.00	0.00	0.00	0.00	0.00	0.00	0.00
Canada - Total	0.00	0.00			0.00	0.00	0.00	0.00	0.00	0.00	0.00
EU - Portugal	0.00	0.00			0.00	0.00	0.00	0.00	0.00	0.00	0.00
EU - U.K .	0.00	0.00			0.00	0.00	0.00	0.00	0.00	0.00	0.00
EU - Spain	99.65	100.00			88.89	100.00	100.00	100.00	100.00	0.00	99.64
EU- Total	99.65	100.00			88.89	100.00	100.00	100.00	100.00	0.00	99.64
USSR/Russia	0.00	0.00			0.00	0.00	0.00	0.00	0.00	0.00	0.00
ROK	0.00	0.00			0.00	0.00	0.00	0.00	0.00	0.00	0.00
Farores	0.00	0.00			0.00	0.00	0.00	0.00	0.00	0.00	0.00
France-SPM	0.00	0.00			0.00	0.00	0.00	0.00	0.00	0.00	0.00
Norway	0.00	0.00			0.00	0.00	0.00	0.00	0.00	0.00	0.00
USA	0.00	0.00			0.00	0.00	0.00	0.00	0.00	0.00	0.00
Other Countries	0.35	0.00			11.11	0.00	0.00	0.00	0.00	100.00	0.36
Total	34.13	46.63	0.00	0.00	1.08	13.94	0.84	2.76	0.48	0.12	100.00

Table 25. Catches of SA 3 spotted wolffish as reported in the NAFO STATLANT 21A Reports by country for the period 1990 to 1999. Lower table shows the percent taken by each country in each year.

Catches(t)

COUNTRY	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	TOTAL
Canada - NF											0
Canada - Mar.											0
Canada - Total	0	0	0	0	0	0	0	0	0	0	0
EU - Portugal											0
EU - U.K .											0
EU - Spain											0
EU- Total	0	0	0	0	0	0	0	0	0	0	0
USSR/Russia											0
ROK											0
Farores											0
France-SPM											0
Norway											0
USA											0
Other Countries					1						1
Total	0	0	0	0	1	0	0	0	0	0	1

PercentCatches(t)

COUNTRY	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	1990-99
Canada - NF					0.00						0.00
Canada - Mar.					0.00						0.00
Canada - Total					0.00						0.00
EU - Portugal					0.00						0.00
EU - U.K .					0.00						0.00
EU - Spain					0.00						0.00
EU- Total					0.00						0.00
USSR/Russia					0.00						0.00
ROK					0.00						0.00
Farores					0.00						0.00
France-SPM					0.00						0.00
Norway					0.00						0.00
USA					0.00						0.00
Other Countries					100.00						100.00
Total	0.00	0.00	0.00	0.00	100.00	0.00	0.00	0.00	0.00	0.00	100.00

Table 26. Catches of SA 3 wolffish (NS) as reported in the NAFO STATLANT 21A Reports by country for the period 1990 to 1999. Lower table shows the percent taken by each country in each year.

Catches(t)

COUNTRY	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	TOTAL
Canada - NF		630	258	288	27	28	22	163	142	304	1862
Canada - Mar.		40	93	35	7		1	1	7	8	192
Canada - Total	0	670	351	323	34	28	23	164	149	312	2054
EU - Portugal		2842	1697	2303	3219	1358	121	184	139	550	12413
EU - U.K .											0
EU - Spain					184	195	693	535	472	435	2514
EU- Total	0	2842	1697	2303	3403	1553	814	719	611	985	14927
USSR/Russia		1				51			38		90
ROK											0
Farores				5				3			8
France-SPM		42	27						3	2	74
Norway		7		3							10
USA											0
Other Countries		4	1								5
Total	0	3566	2076	2634	3437	1632	837	886	801	1299	17168

PercentCatches(t)

COUNTRY	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	1990-99
Canada - NF		17.67	12.43	10.93	0.79	1.72	2.63	18.40	17.73	23.40	10.85
Canada - Mar.		1.12	4.48	1.33	0.20	0.00	0.12	0.11	0.87	0.62	1.12
Canada - Total		18.79	16.91	12.26	0.99	1.72	2.75	18.51	18.60	24.02	11.96
EU - Portugal		79.70	81.74	87.43	93.66	83.21	14.46	20.77	17.35	42.34	72.30
EU - U.K .		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
EU - Spain		0.00	0.00	0.00	5.35	11.95	82.80	60.38	58.93	33.49	14.64
EU- Total		79.70	81.74	87.43	99.01	95.16	97.25	81.15	76.28	75.83	86.95
USSR/Russia		0.03	0.00	0.00	0.00	3.13	0.00	0.00	4.74	0.00	0.52
ROK		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Farores		0.00	0.00	0.19	0.00	0.00	0.00	0.34	0.00	0.00	0.05
France-SPM		1.18	1.30	0.00	0.00	0.00	0.00	0.00	0.37	0.15	0.43
Norway		0.20	0.00	0.11	0.00	0.00	0.00	0.00	0.00	0.00	0.06
USA		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Other Countries		0.11	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03
Total	0.00	20.77	12.09	15.34	20.02	9.51	4.88	5.16	4.67	7.57	100.00

Table 27. Catches of SA 3 dogfish (NS) as reported in the NAFO STATLANT 21A Reports by country for the period 1990 to 1999. Lower table shows the percent taken by each country in each year.

Catches(t)

COUNTRY	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	TOTAL
Canada - NF	1			1	4	5	5		3		19
Canada - Mar.											0
Canada - Total	1	0	0	1	4	5	5	0	3	0	19
EU - Portugal											0
EU - U.K .											0
EU - Spain							135	211	605	549	1500
EU- Total	0	0	0	0	0	0	135	211	605	549	1500
USSR/Russia											0
ROK											0
Farores											0
France-SPM											0
Norway											0
USA											0
Other Countries					2	14	36	3	2		57
Total	1	0	0	1	6	19	176	214	610	549	1576

PercentCatches(t)

COUNTRY	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	1990-99
Canada - NF	100.00			100.00	66.67	26.32	2.84	0.00	0.49	0.00	1.21
Canada - Mar.	0.00			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Canada - Total	100.00			100.00	66.67	26.32	2.84	0.00	0.49	0.00	1.21
EU - Portugal	0.00			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
EU - U.K .	0.00			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
EU - Spain	0.00			0.00	0.00	0.00	76.70	98.60	99.18	100.00	95.18
EU- Total	0.00			0.00	0.00	0.00	76.70	98.60	99.18	100.00	95.18
USSR/Russia	0.00			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ROK	0.00			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Farores	0.00			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
France-SPM	0.00			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Norway	0.00			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
USA	0.00			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Other Countries	0.00			0.00	33.33	73.68	20.45	1.40	0.33	0.00	3.62
Total	0.06	0.00	0.00	0.06	0.38	1.21	11.17	13.58	38.71	34.84	100.00

Table 28. Catches of SA 3 monkfish as reported in the NAFO STATLANT 21A Reports by country for the period 1990 to 1999. Lower table shows the percent taken by each country in each year.

Catches(t)

COUNTRY	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	TOTAL
Canada - NF	3	186	334	482	514	291	255		429	164	2658
Canada - Mar.	18	7	15	11	6	1	2		5	4	69
Canada - Total	21	193	349	493	520	292	257	0	434	168	2727
EU - Portugal		7	37								44
EU - U.K .									282		282
EU - Spain	192	279						1	2		474
EU- Total	192	286	37	0	0	0	0	1	284	0	800
USSR/Russia											0
ROK											0
Farores						3					3
France-SPM	52	42	4						1		99
Norway											0
USA											0
Other Countries	1	1	1	2	0						5
Total	266	522	391	495	520	295	257	1	719	168	3634

PercentCatches(t)

COUNTRY	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	1990-99
Canada - NF	1.13	35.63	85.42	97.37	98.85	98.64	99.22	0.00	59.67	97.62	73.14
Canada - Mar.	6.77	1.34	3.84	2.22	1.15	0.34	0.78	0.00	0.70	2.38	1.90
Canada - Total	7.89	36.97	89.26	99.60	100.00	98.98	100.00	0.00	60.36	100.00	75.04
EU - Portugal	0.00	1.34	9.46	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.21
EU - U.K .	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	39.22	0.00	7.76
EU - Spain	72.18	53.45	0.00	0.00	0.00	0.00	0.00	100.00	0.28	0.00	13.04
EU- Total	72.18	54.79	9.46	0.00	0.00	0.00	0.00	100.00	39.50	0.00	22.01
USSR/Russia	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ROK	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Farores	0.00	0.00	0.00	0.00	0.00	1.02	0.00	0.00	0.00	0.00	0.08
France-SPM	19.55	8.05	1.02	0.00	0.00	0.00	0.00	0.00	0.14	0.00	2.72
Norway	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
USA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Other Countries	0.38	0.19	0.26	0.40	0.00	0.00	0.00	0.00	0.00	0.00	0.14
Total	7.32	14.36	10.76	13.62	14.31	8.12	7.07	0.03	19.79	4.62	100.00

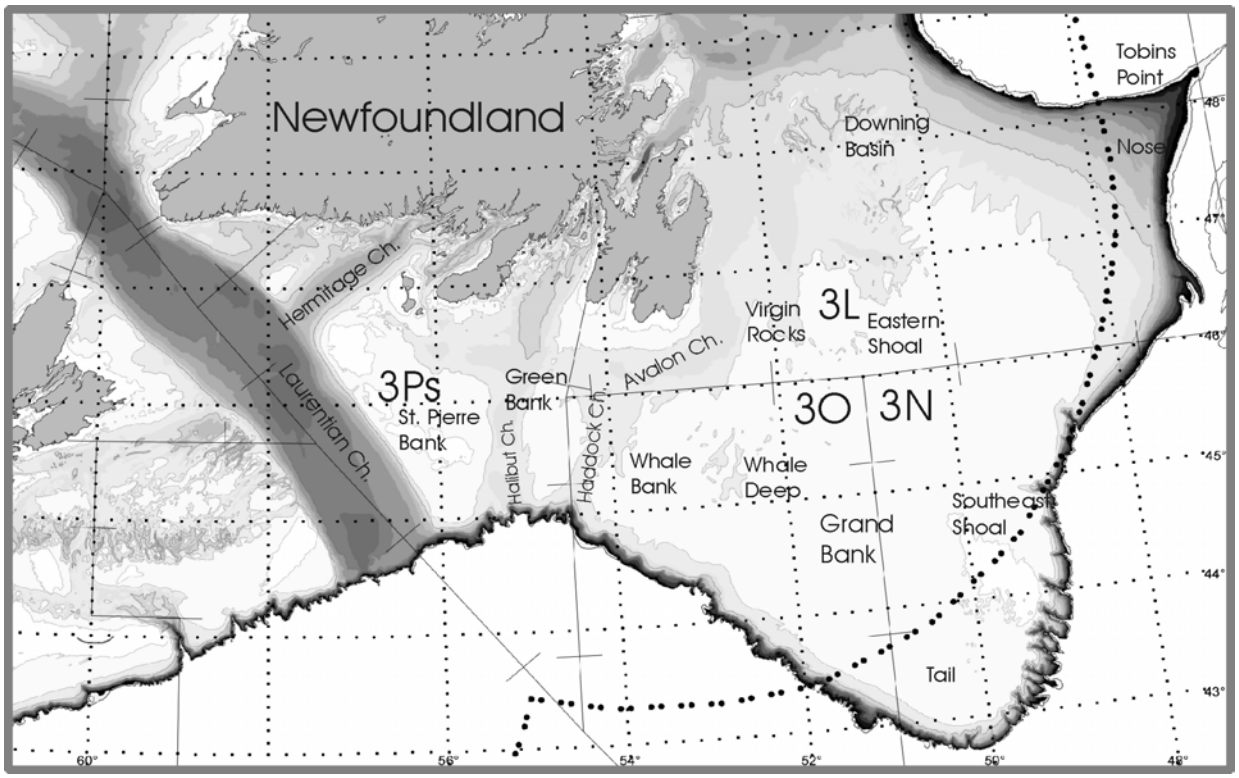


Fig. 1. The Grand Banks showing locations referenced in the text, bathymetry, the 200 mile limit (dotted line) and statistical (NAFO) Divisions.

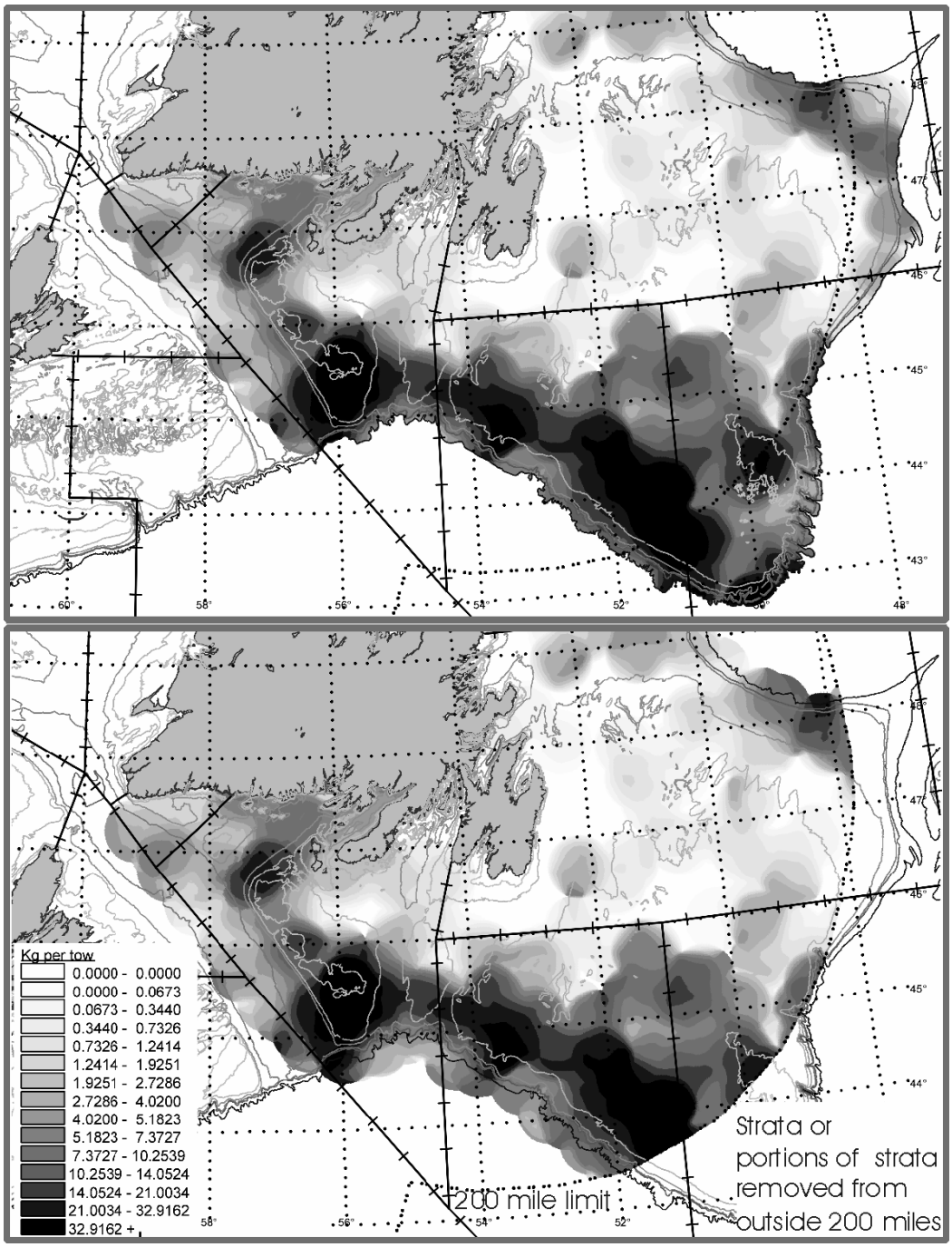


Fig. 2. Density distribution map of thorny skate in the spring of 1999 produced by potential mapping (SPANS) to illustrate how the area outside 200 miles was eliminated from the biomass calculation. Upper figure shows entire strata, lower figure shows outside 200 miles cropped. Refer to Table 1 for an example of the biomass calculation using the SPANdex method, cropped and uncropped.

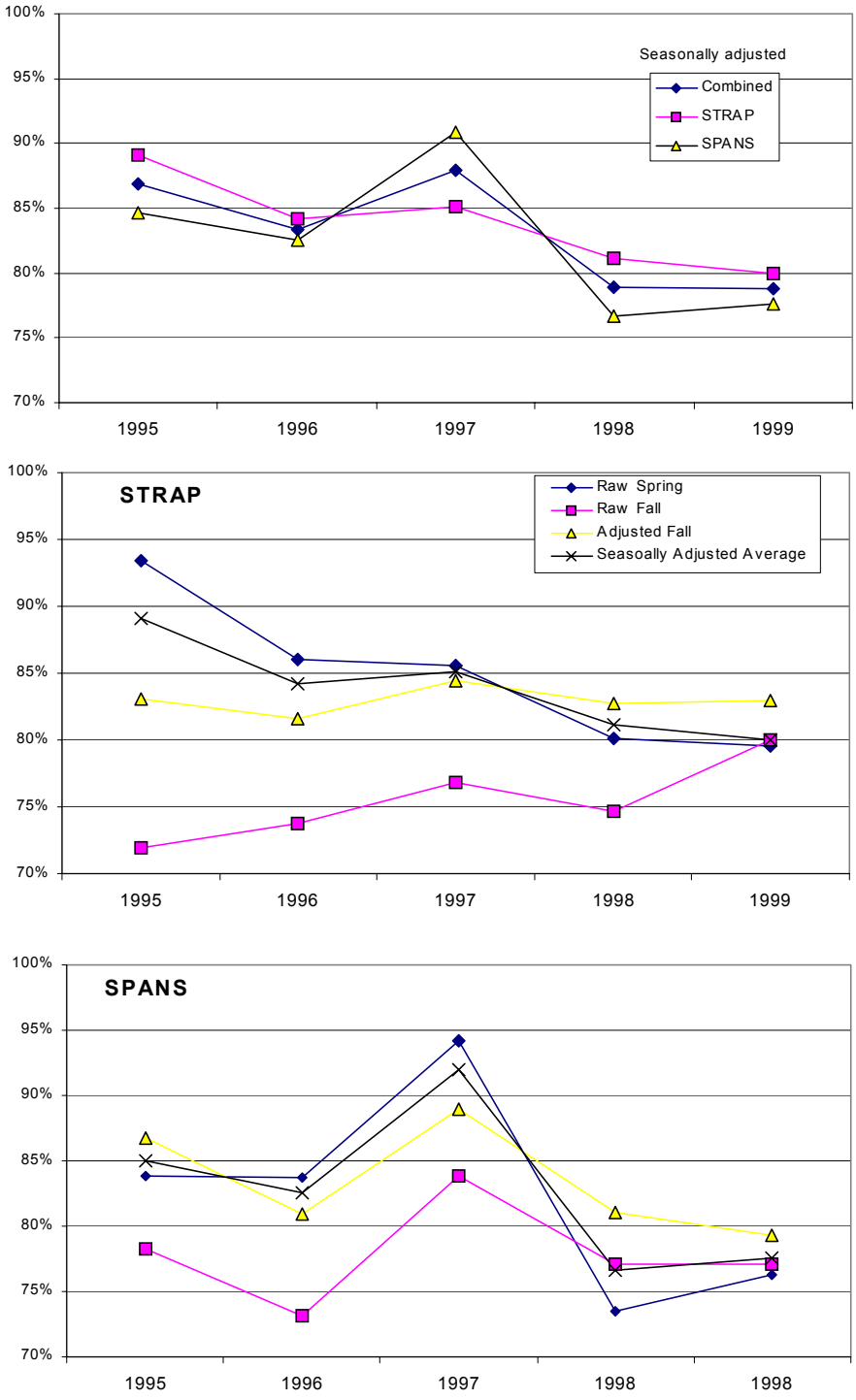


Fig. 3 Biomass of thorny skate occurring inside the 200 mile limit. The lower two figures show the various seasonal methods broken out by method used.

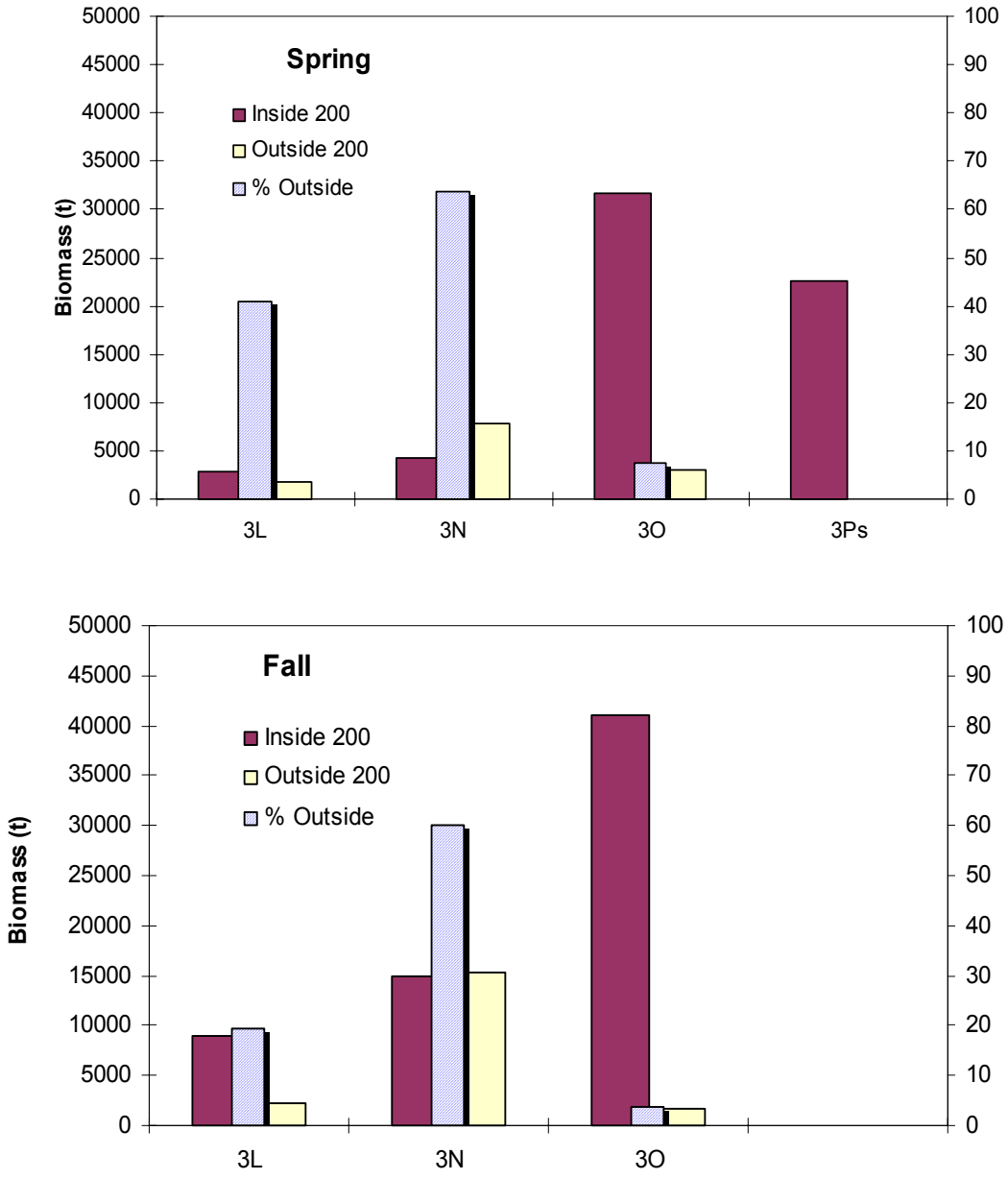


Fig. 4. Distribution of biomass of thorny skate across the 200 miles limit by NAFO Division. Estimates are based on the STRAP method only since the SPANS method does not differentiate among NAFO Divisions.

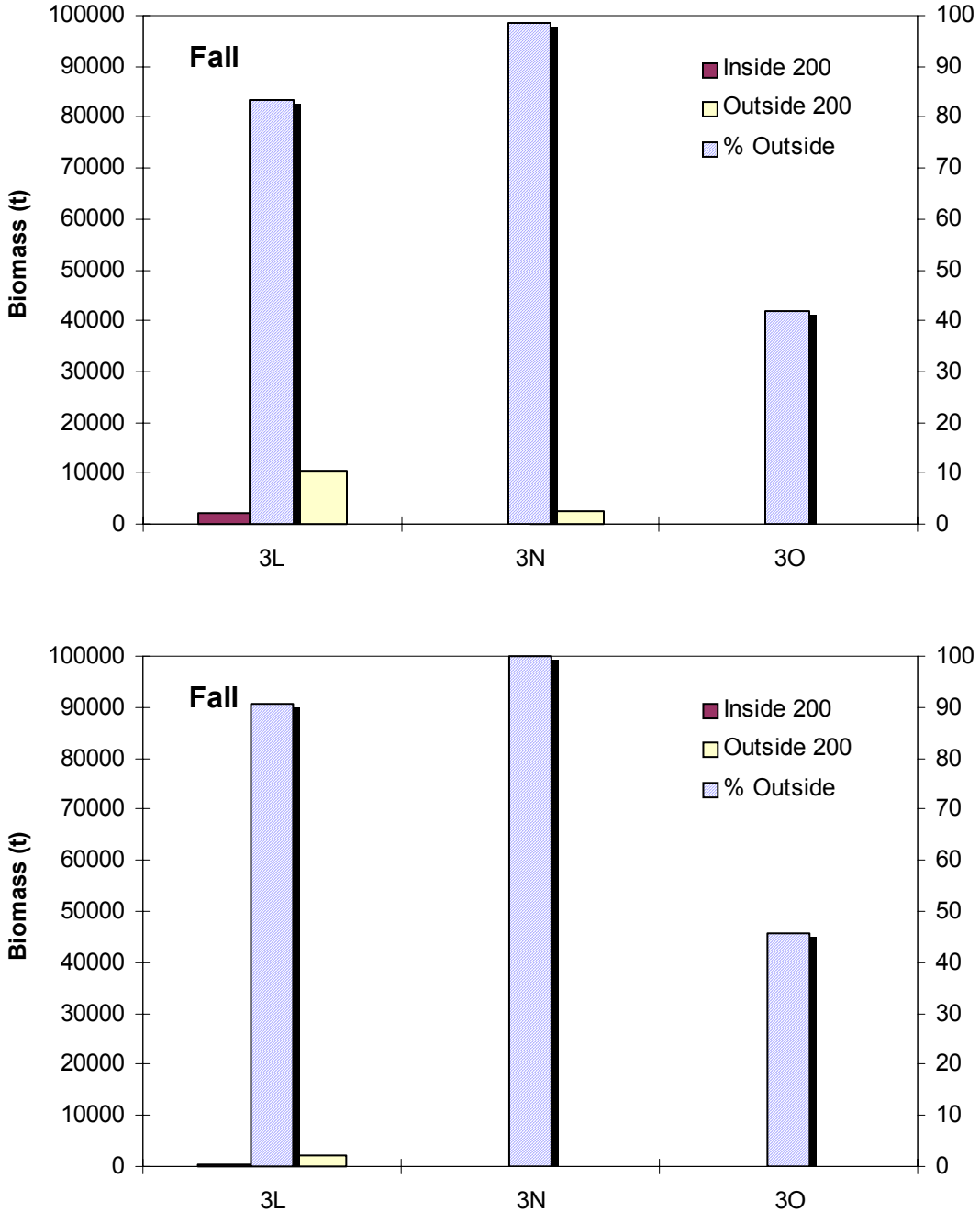


Fig. 5. Distribution of biomass of grenadier (upper panel is roundnose, lower is roughead) across the 200 miles limit by NAFO Division. Estimates are based on the STRAP method only since the SPANS method does not differentiate among NAFO Divisions.

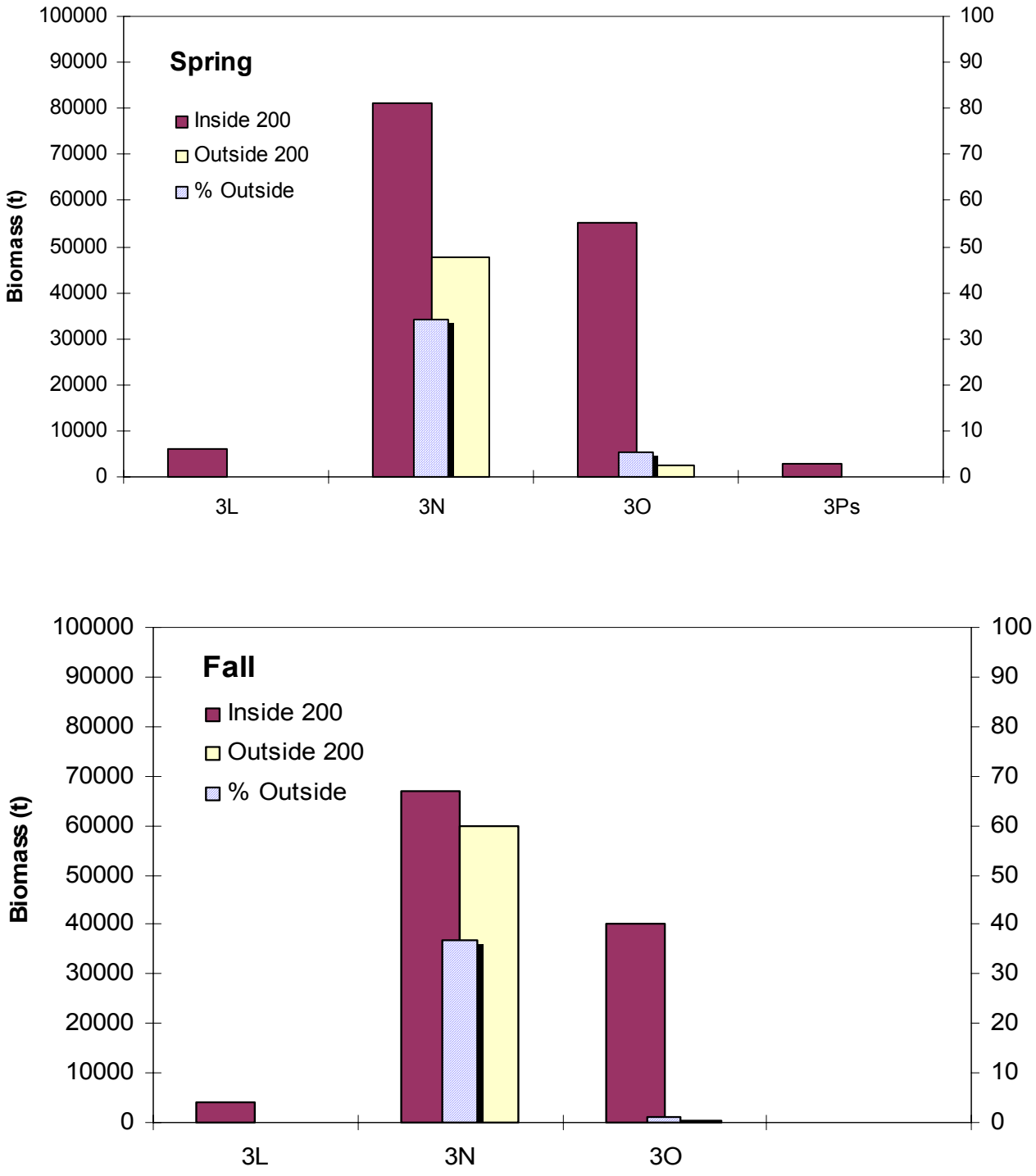


Fig. 6: Distribution of yellowtail flounder biomass across the 200 mile limit by NAFO division.

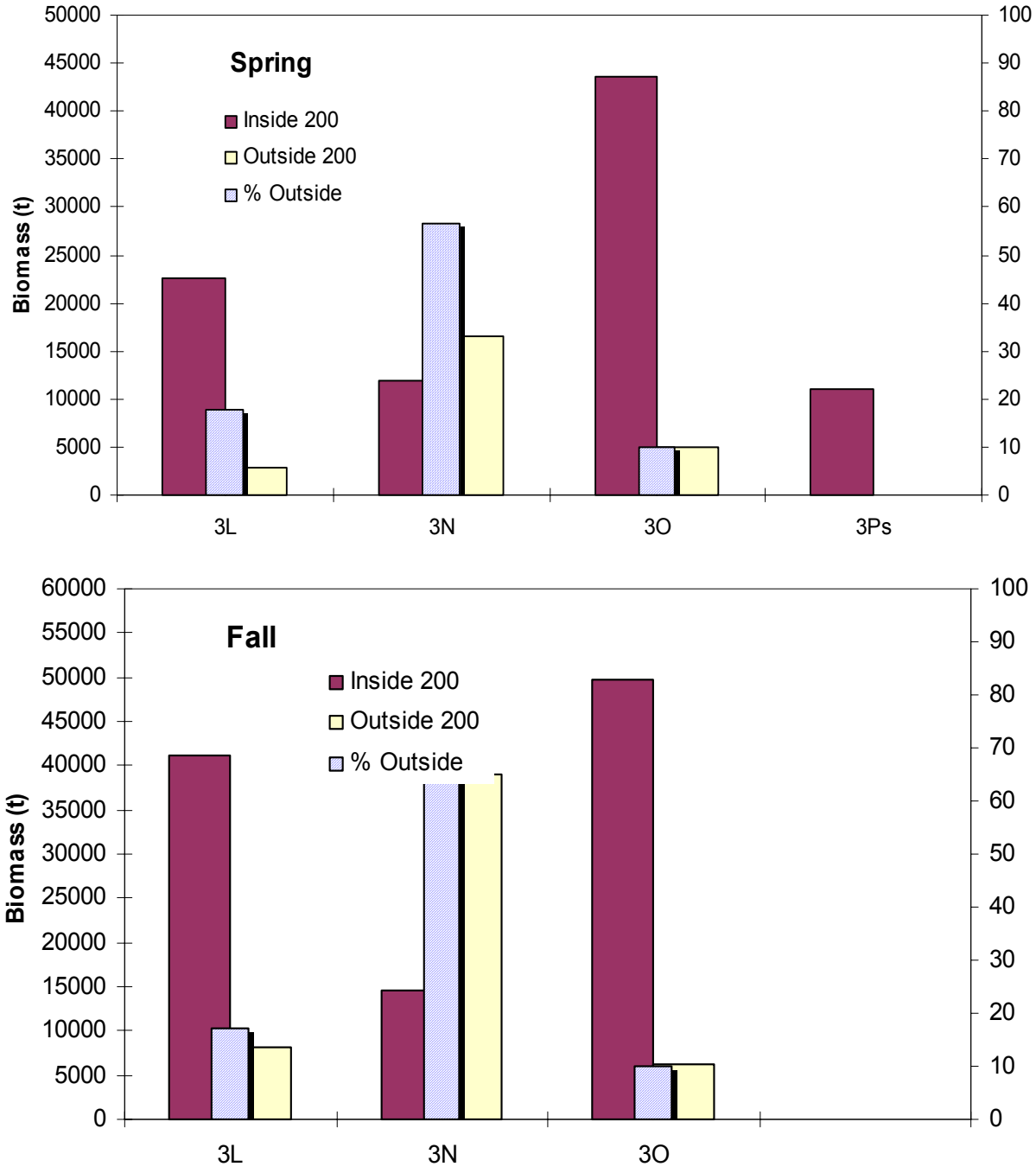


Fig. 7: Distribution of American plaice biomass across the 200 mile limit by NAFO division.

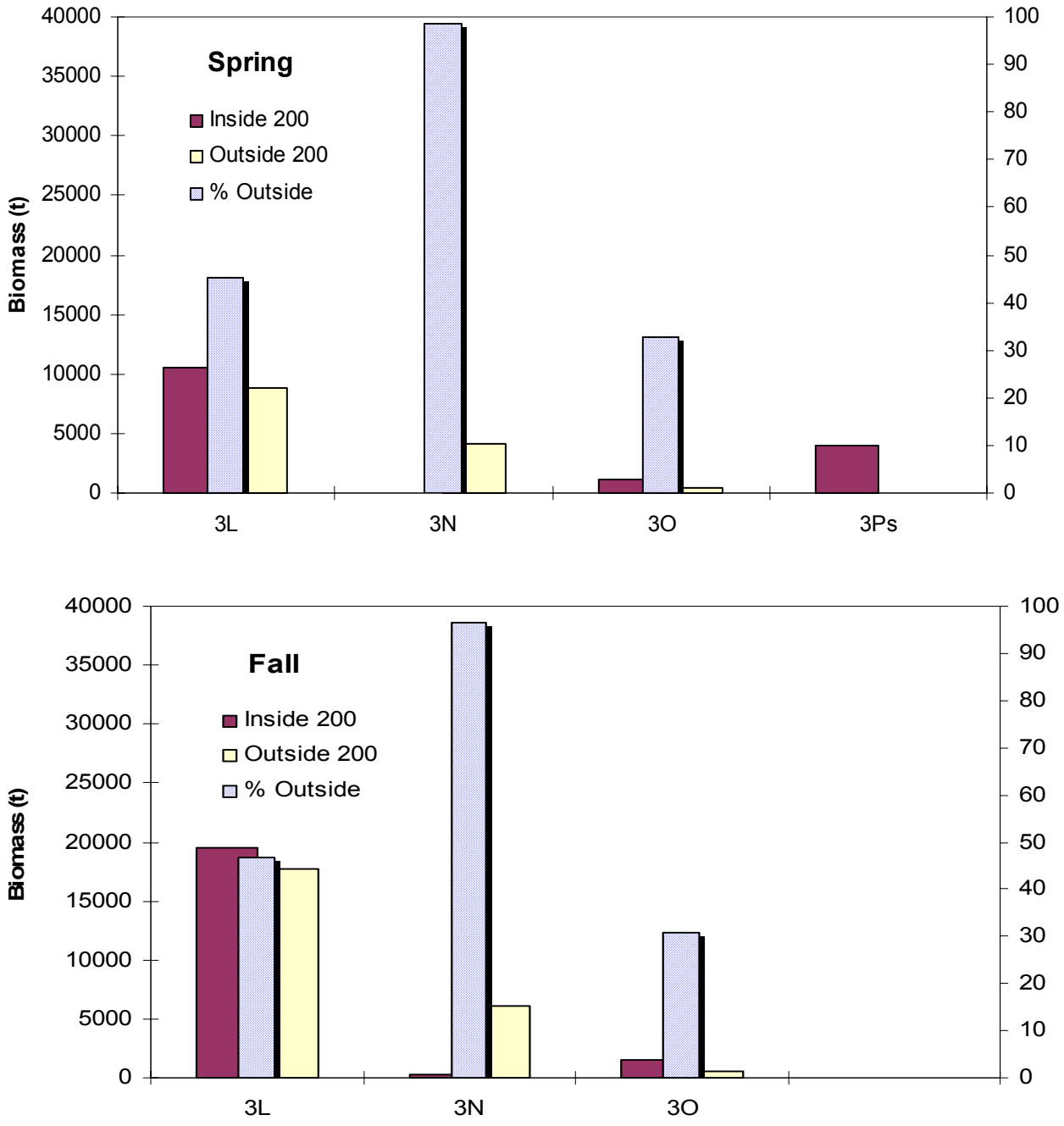


Fig. 8: Distribution of Greenland halibut biomass across the 200 mile limit by NAFO division.

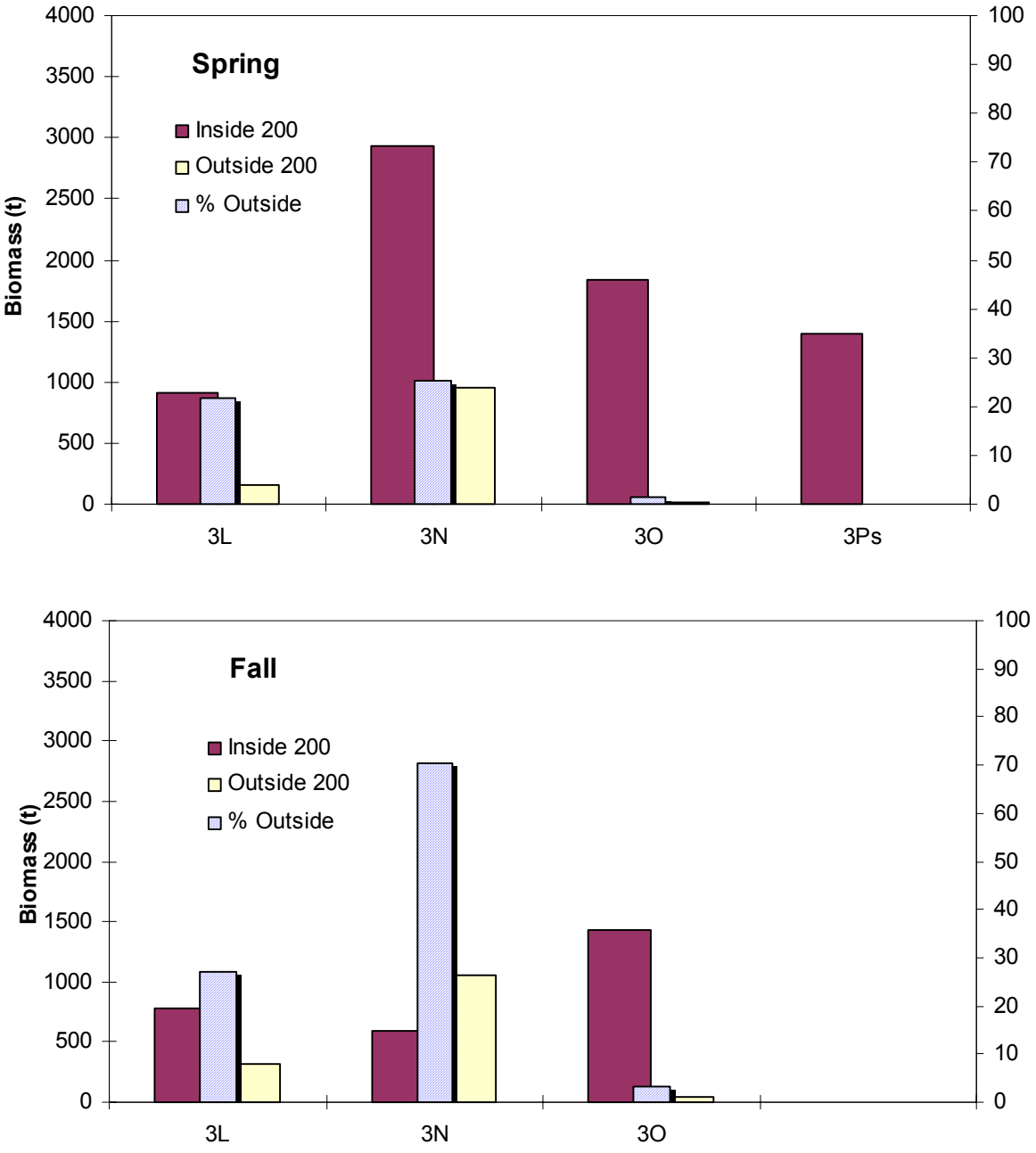


Fig. 9: Distribution of striped wolffish biomass across the 200 mile limit by NAFO division.

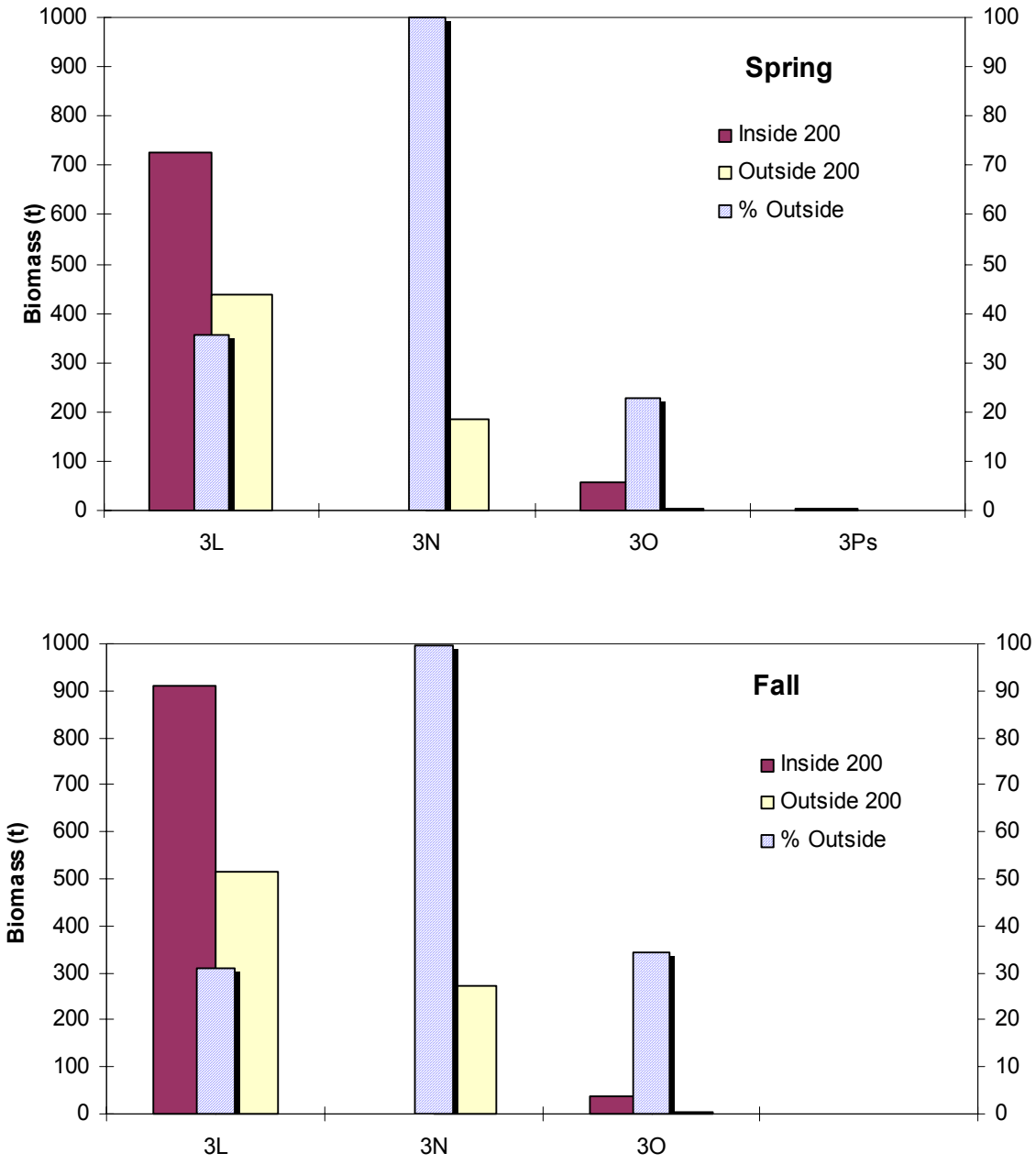


Fig. 10: Distribution of spotted wolffish biomass across the 200 mile limit by NAFO division.

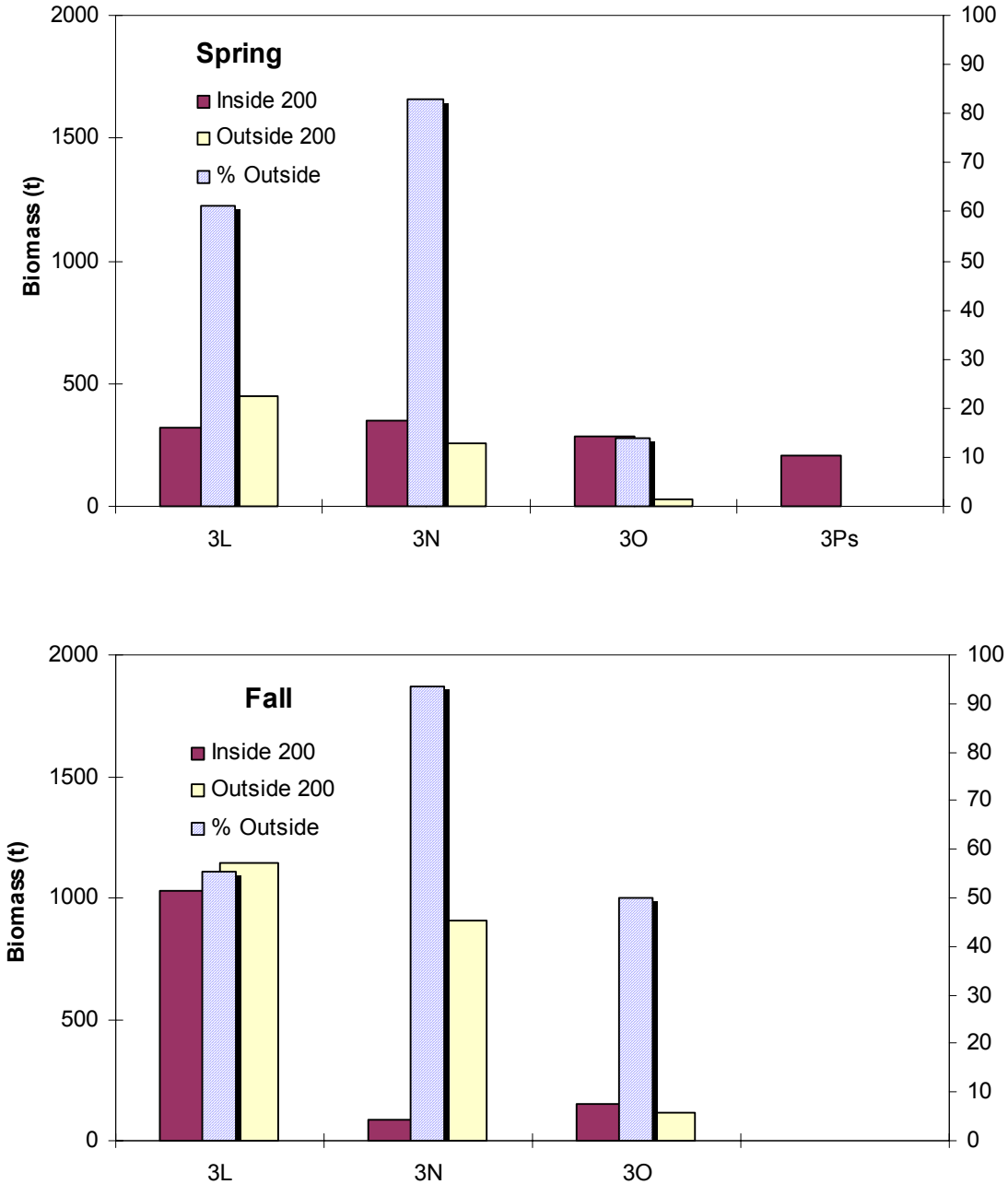


Fig. 11: Distribution of northern wolffish biomass across the 200 mile limit by NAFO division.

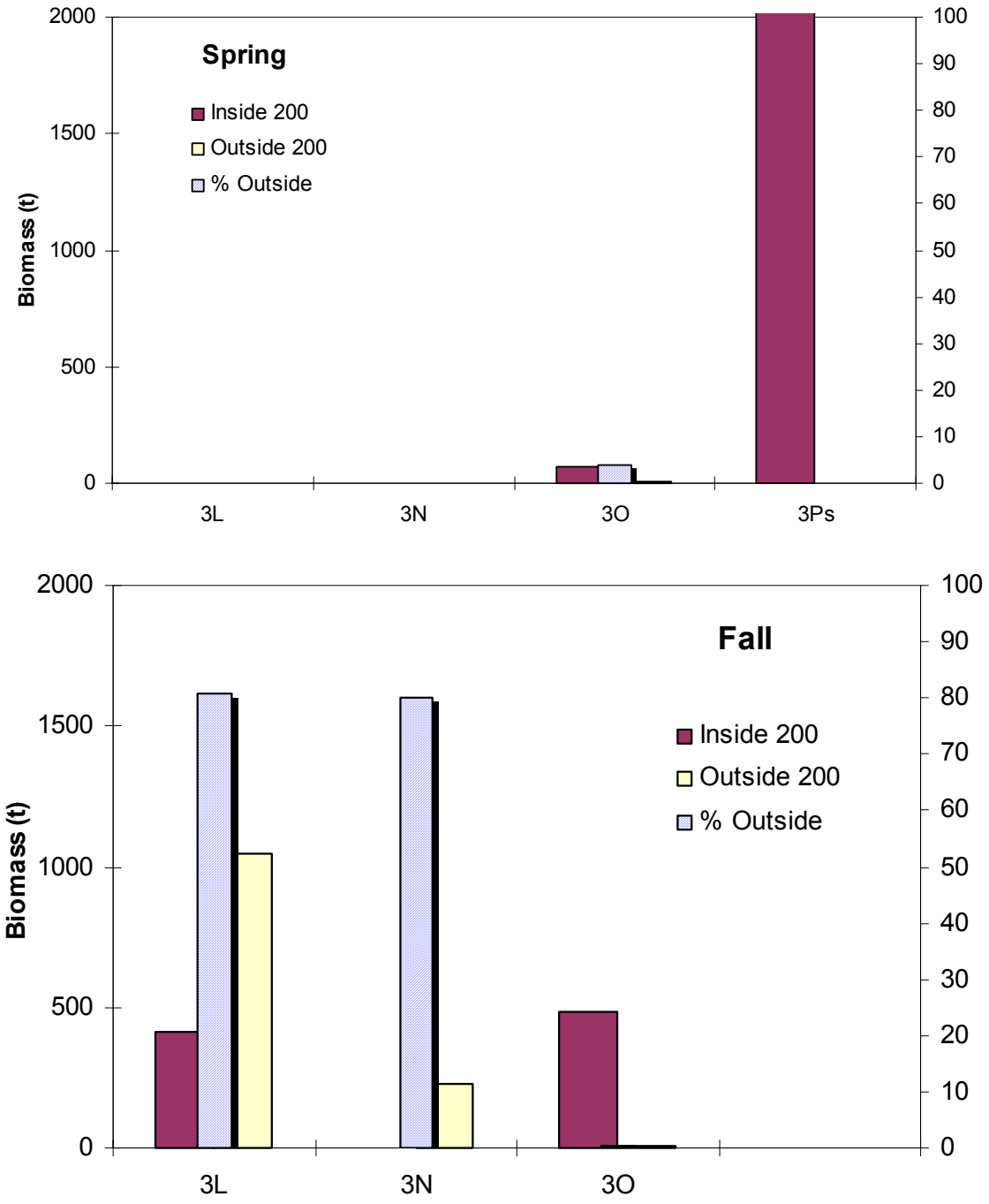


Fig. 12: Distribution of black dogfish biomass across the 200 mile limit by NAFO division.

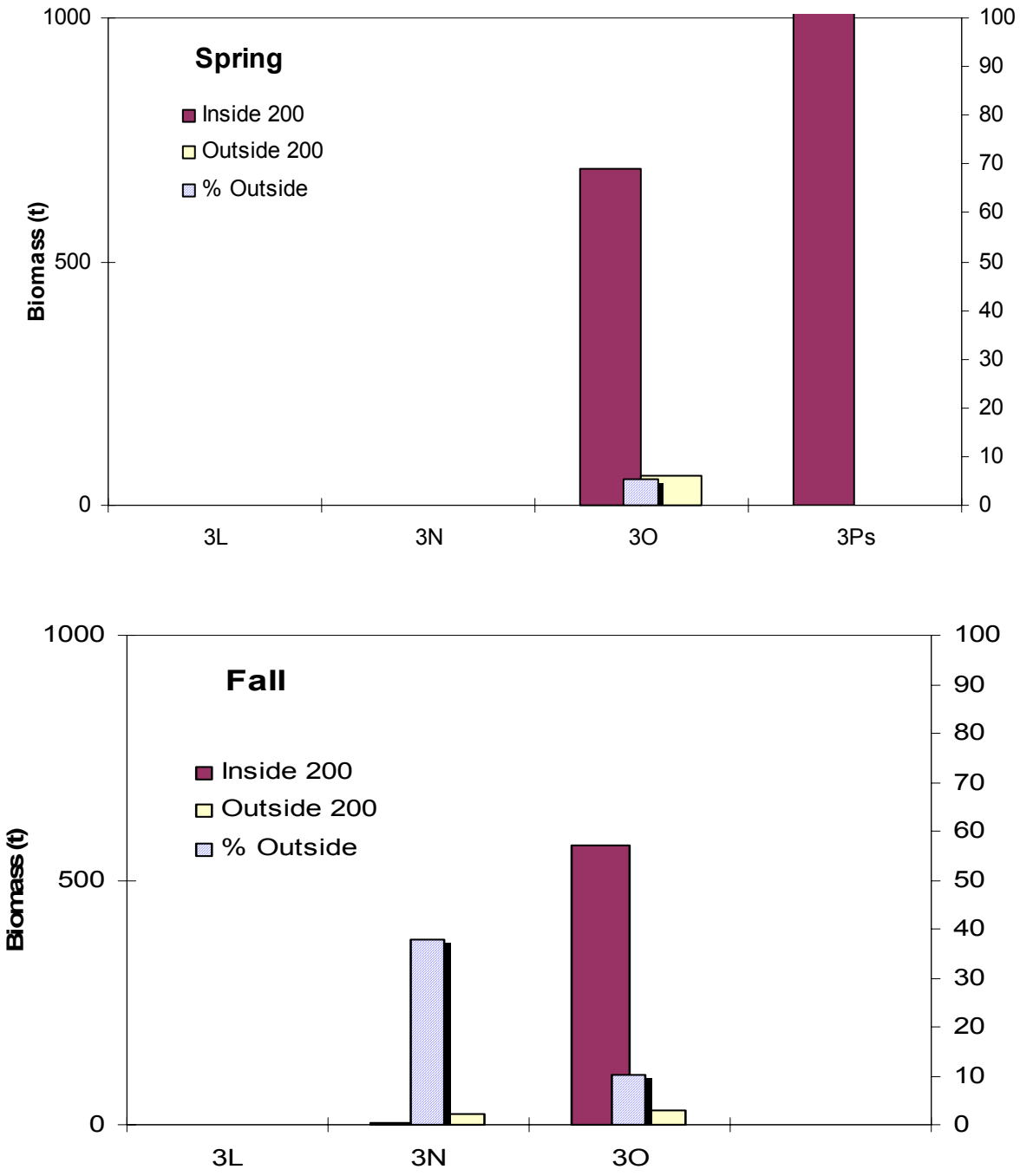


Fig. 13: Distribution of Monkfish biomass across the 200 mile limit by NAFO division.

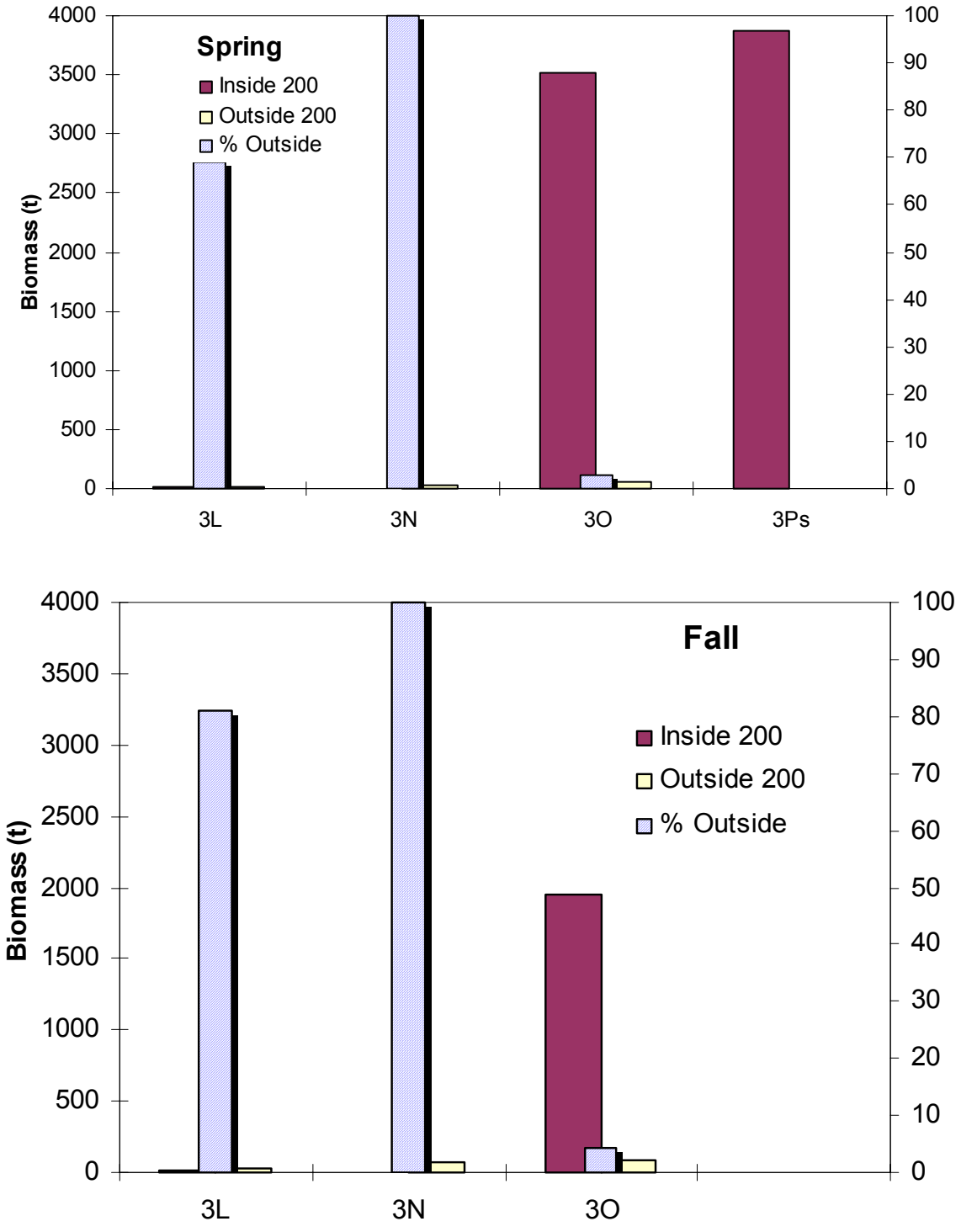


Fig. 14: Distribution of longfin hake biomass across the 200 mile limit by NAFO division.

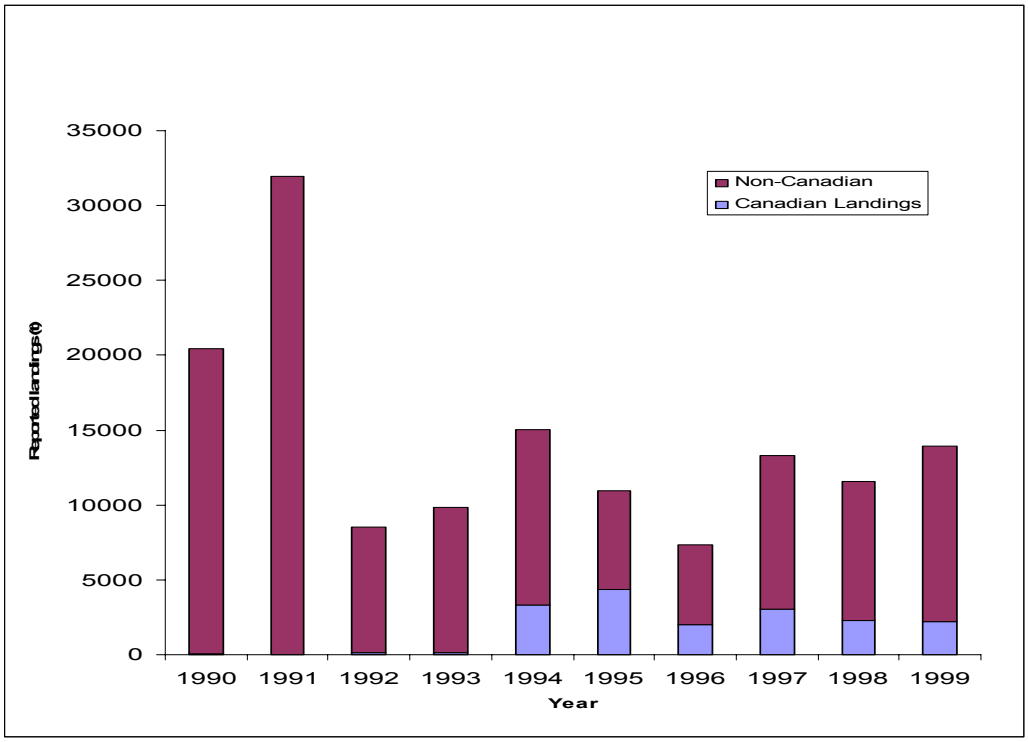


Fig. 15. Catches of thorny skate as reported in NAFO STATLAN 21A 1990-1999 showing Canadian vs. non-Canadian catches.

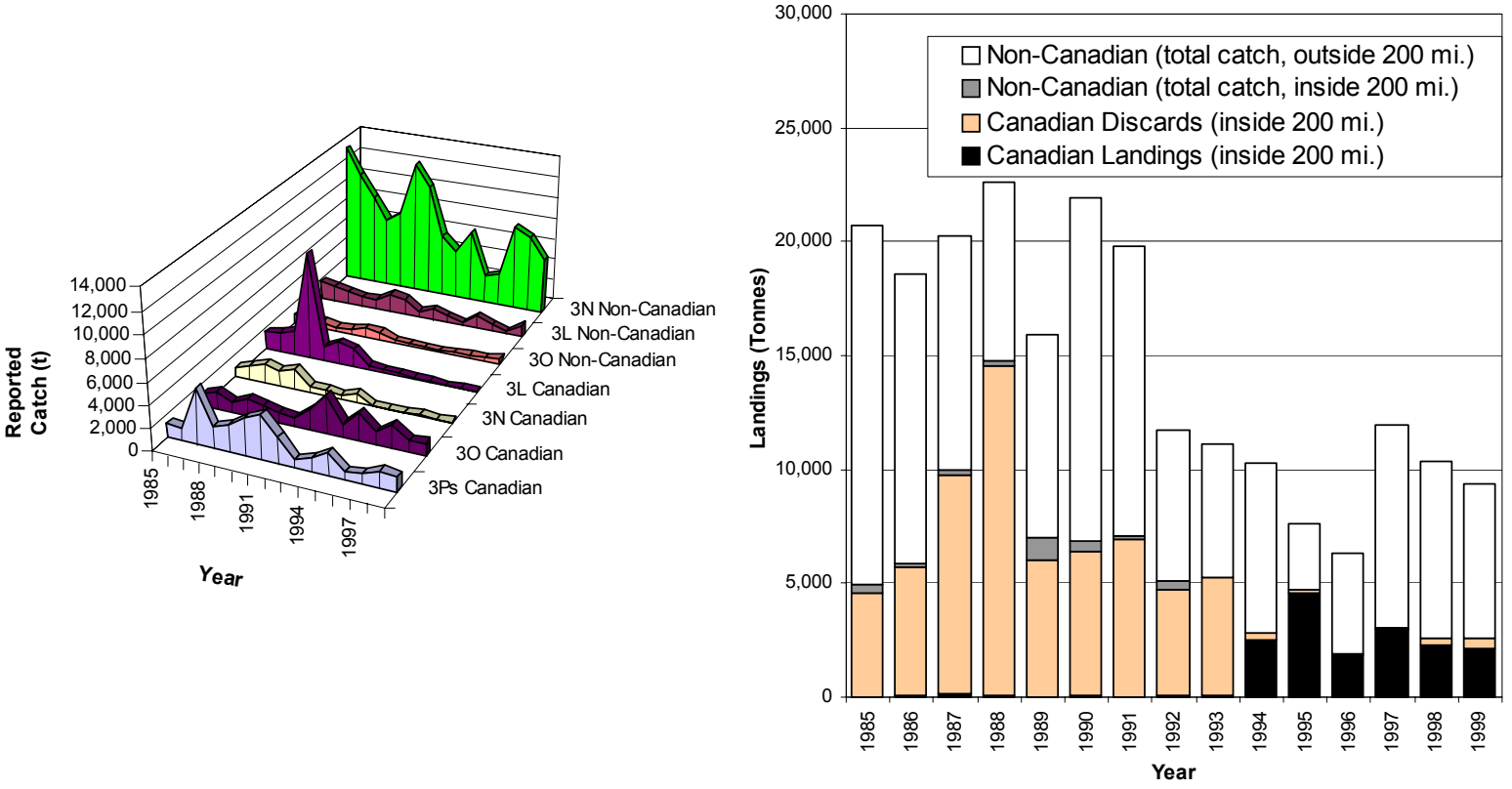
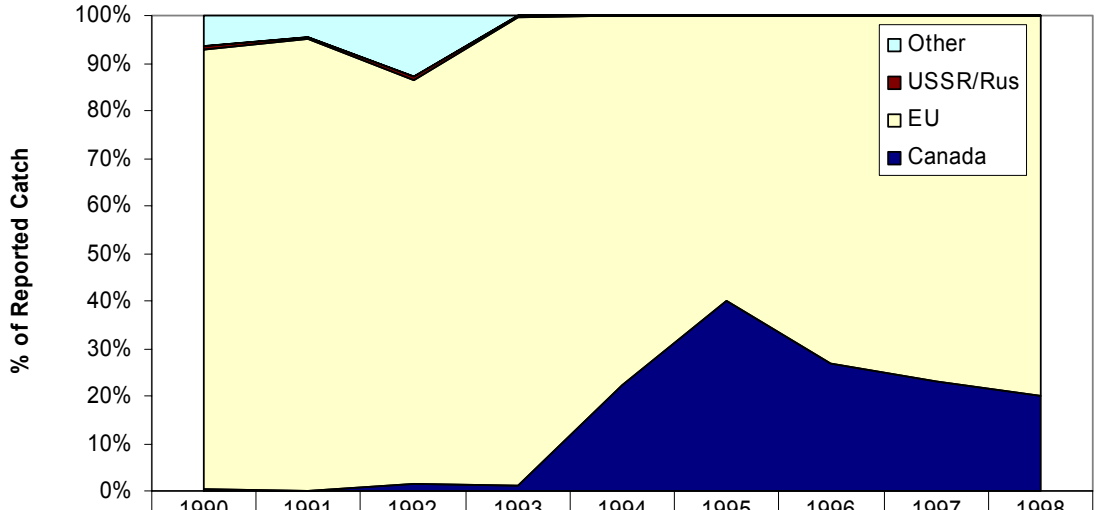


Fig. 16. Catches of skate in Canadian and non-Canadian waters of NAFO Divisions 3LNOPs, 1985-1999. Canadian Catches inside 200 miles comprise intut from ZIF (Zonal Interchange Format) files and observer data (Canadian discards and non-Canadian catches). Catches for non-Canadian waters were estimated from Conservation & Protection (Fisheries & Oceans) surveillance boarding data.



	1990	1991	1992	1993	1994	1995	1996	1997	1998
Other	1,327	1,448	1,091	16	4	12	2	3	9
USSR/Rus	131	70	65	6	0	6	0	0	3
EU	18,879	30,400	7,231	9,730	11,724	6,571	5,372	10,233	9,215
Canada	94	32	114	112	3,329	4,412	1,963	3,071	2,307

Fig. 17. Proportion of skate catch taken by various countries since 1990 as reported in NAFO STATLANT 21a.

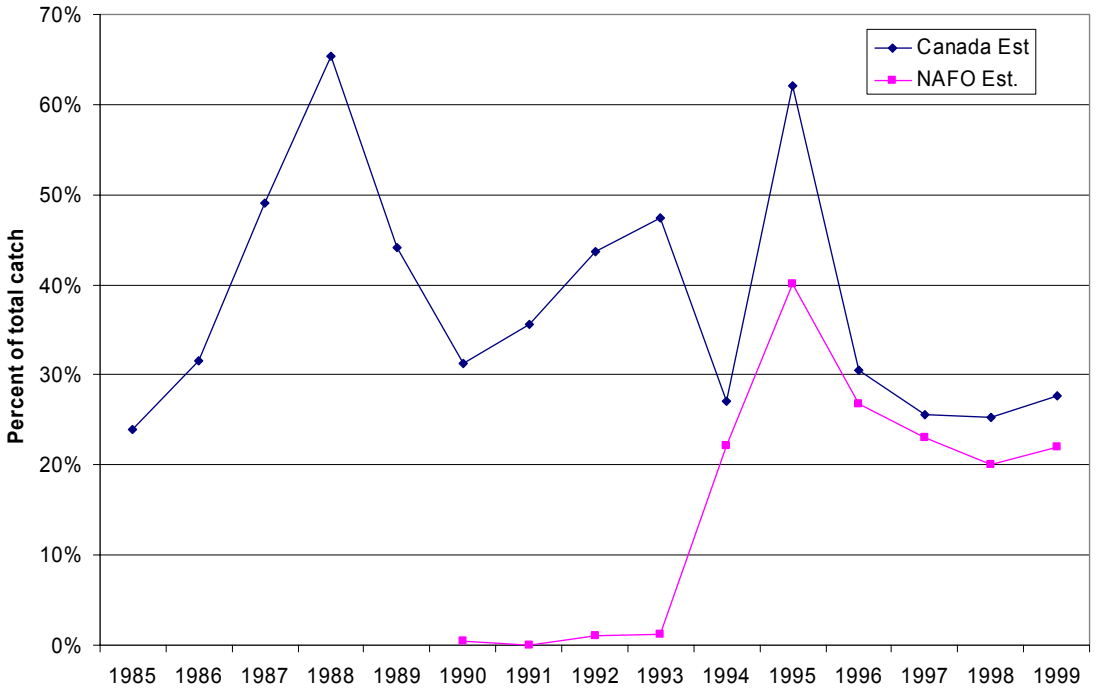


Fig. 18. Percent of skate catch taken by Canada as reported in NAFO STATLANT 21a (NAFO Est.) vs. Canada's estimate (see Table x).

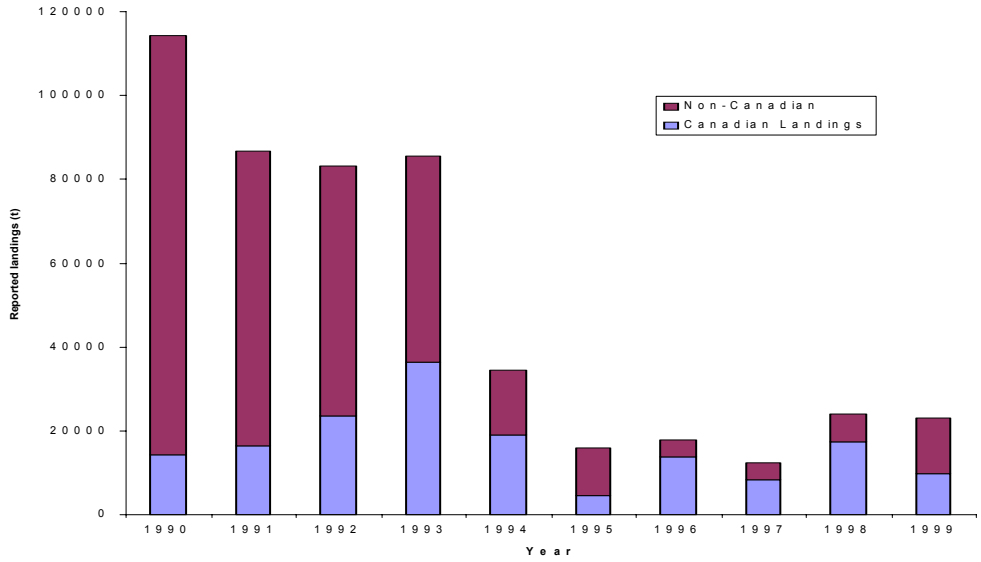


Fig. 19. Catches of Redfish as reported in NAFO STATLAN 21A 1990-1999 showing Canadian vs. non-Canadian catches.

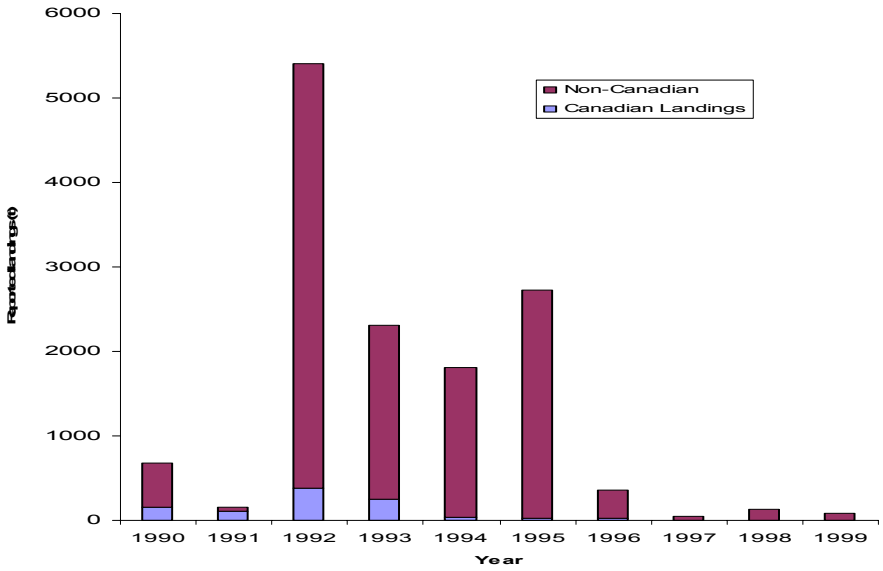


Fig. 20. Catches of Roundnose grenadier as reported in NAFO STATLAN 21A 1990-1999 showing Canadian vs. non-Canadian catches.

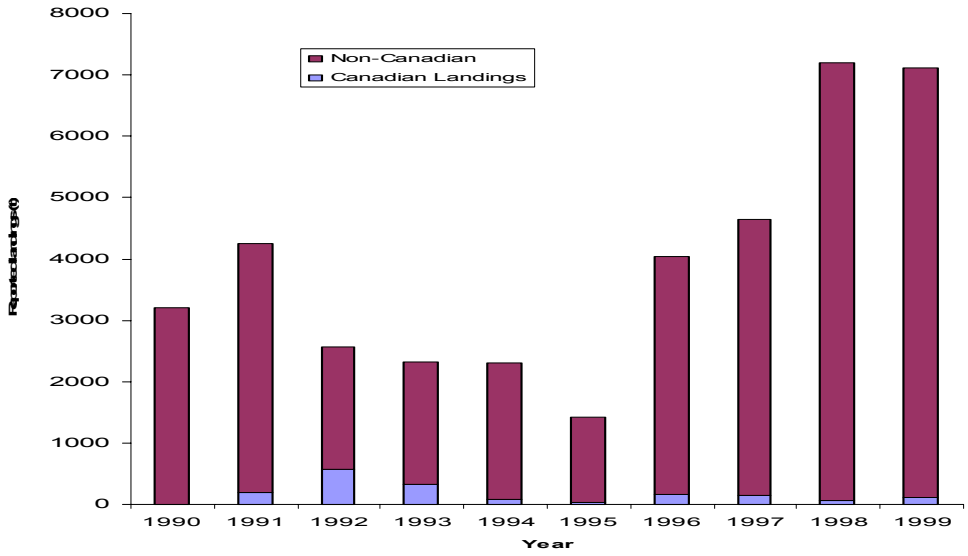


Fig. 21. Catches of Roughhead grenadier as reported in NAFO STATLAN 21A 1990-1999 showing Canadian vs. non-Canadian catches.

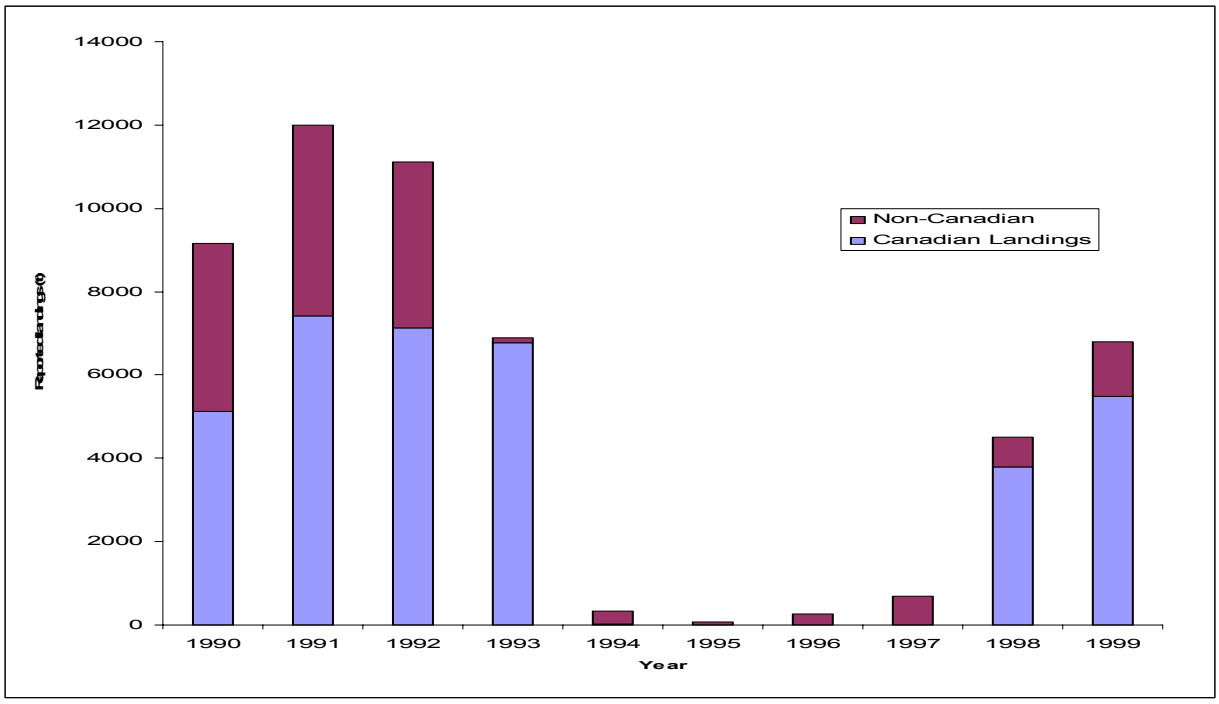


Fig. 22. Catches of yellowtail flounder as reported in NAFO STATLAN 21A 1990-1999 showing Canadian vs. non-Canadian catches.

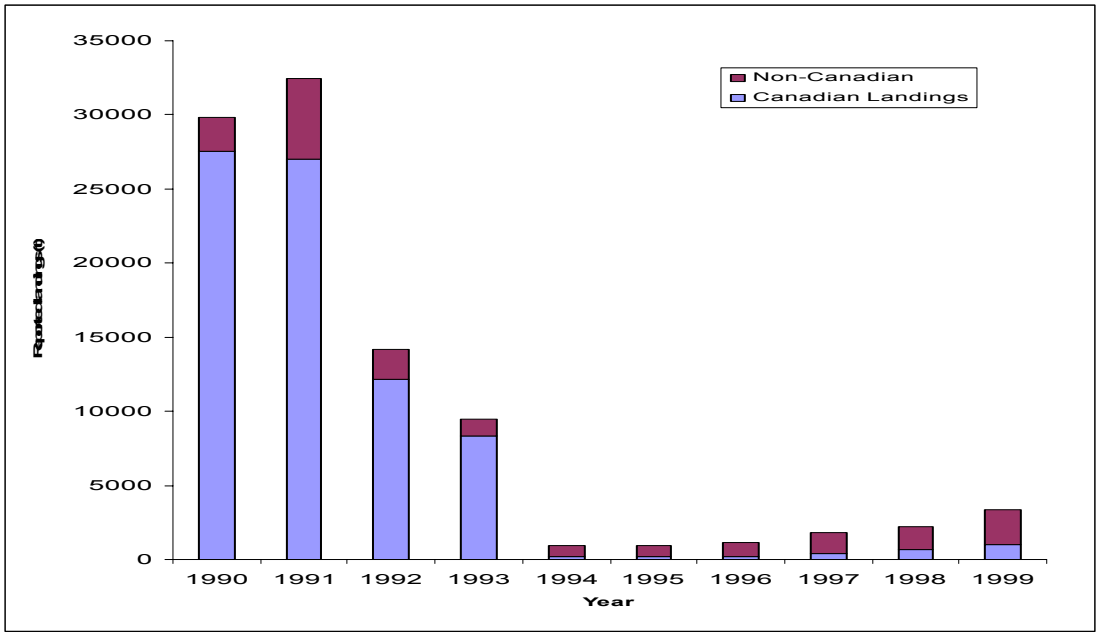


Fig. 23. Catches of American plaice as reported in NAFO STATLAN 21A 1990-1999 showing Canadian vs. non-Canadian catches.

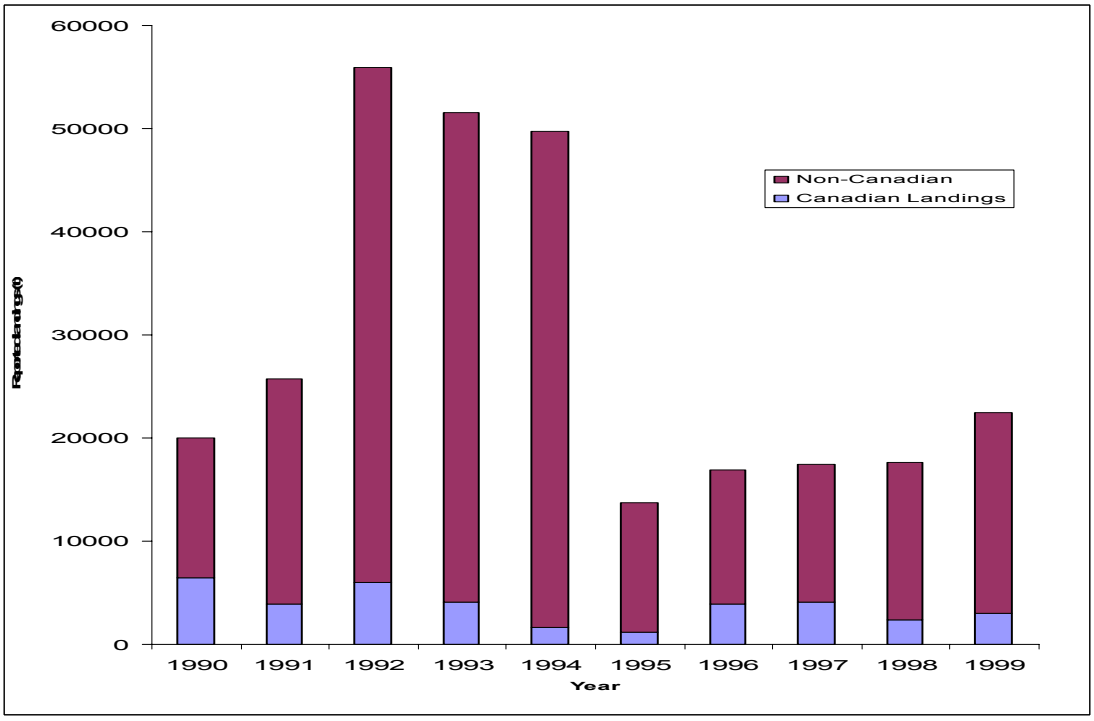


Fig. 24. Catches of Greenland halibut as reported in NAFO STATLAN 21A 1990-1999 showing Canadian vs. non-Canadian catches.

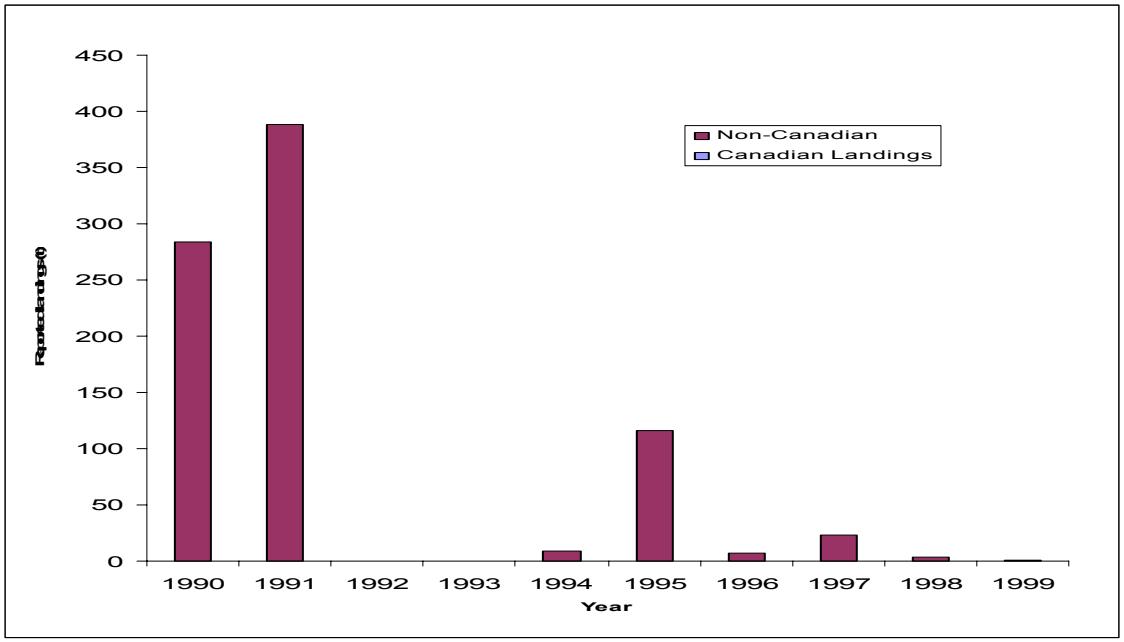


Fig. 25. Catches of striped wolffish as reported in NAFO STATLAN 21A 1990-1999 showing Canadian vs. non-Canadian catches.

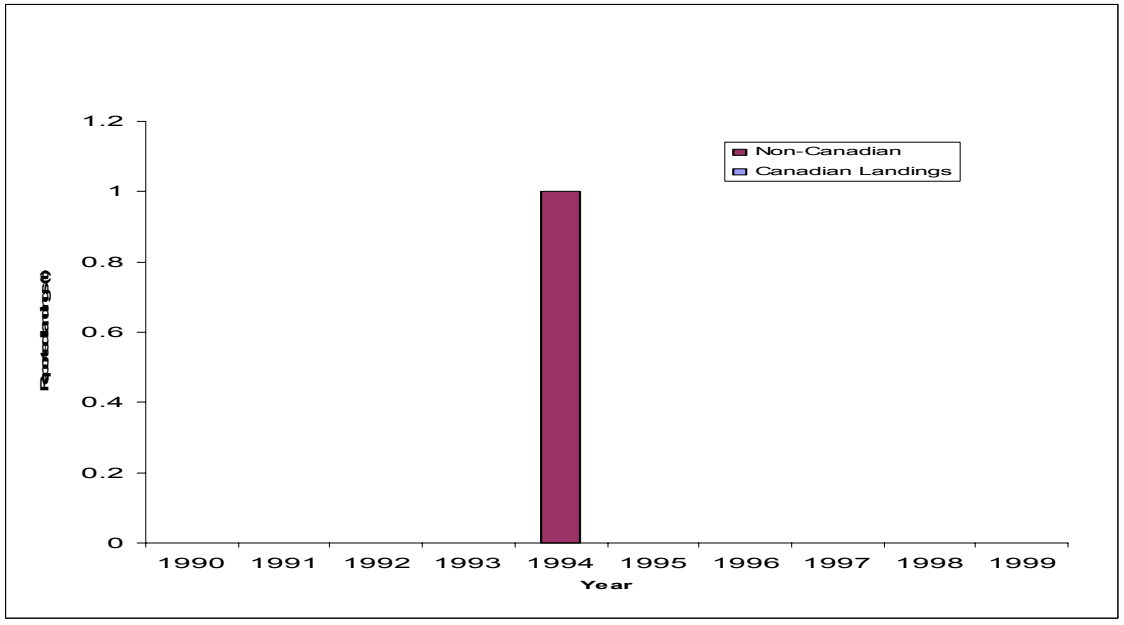


Fig. 26. Catches of spotted wolffish as reported in NAFO STATLAN 21A 1990-1999 showing Canadian vs. non-Canadian catches.

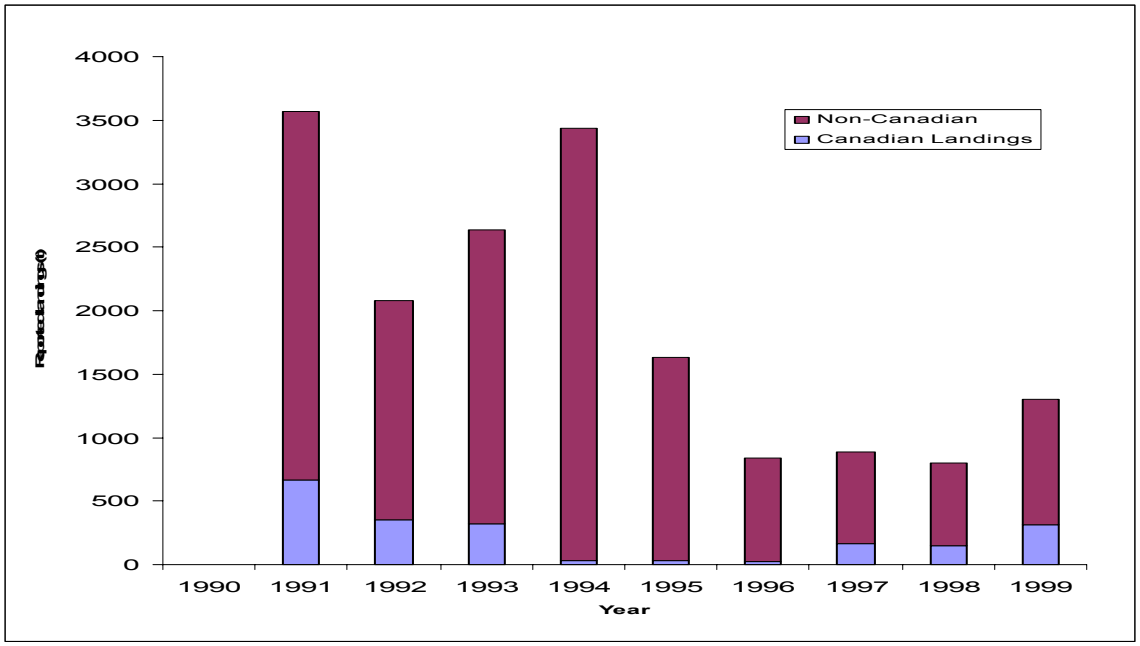


Fig. 27. Catches of wolffish (unspecified) as reported in NAFO STATLAN 21A 1990-1999 showing Canadian vs. non-Canadian catches.

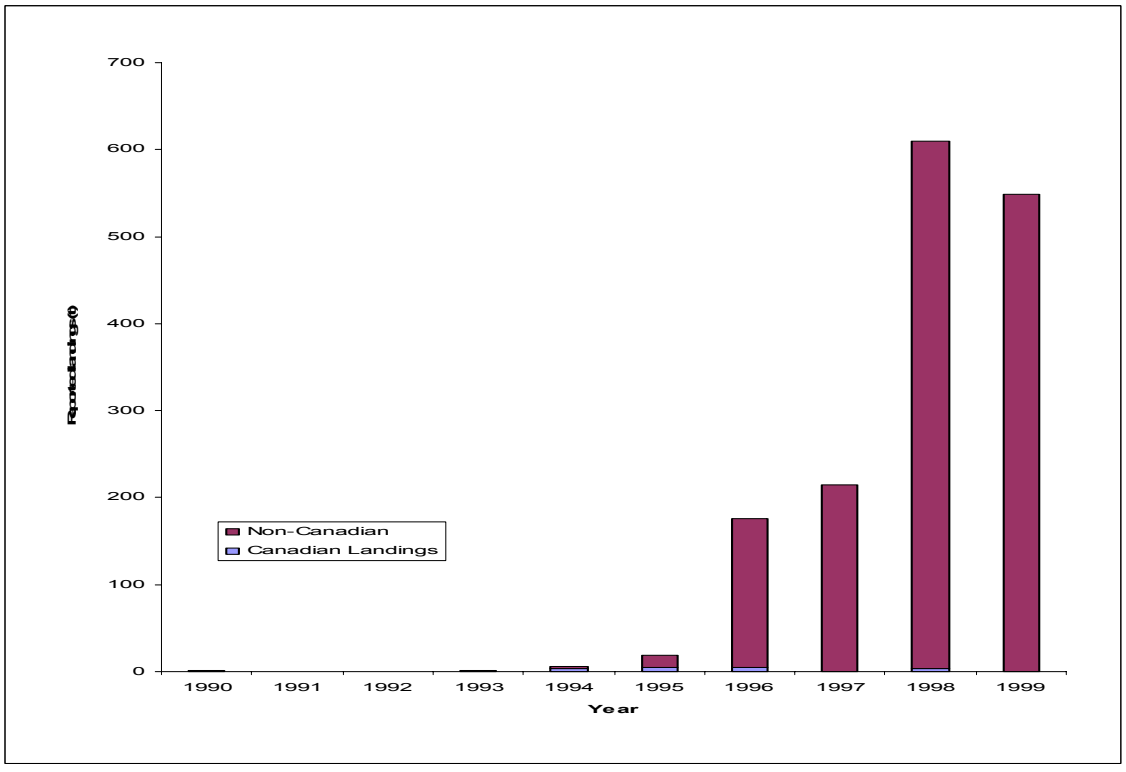


Fig. 28. Catches of black dogfish as reported in NAFO STATLAN 21A 1990-1999 showing Canadian vs. non-Canadian catches.

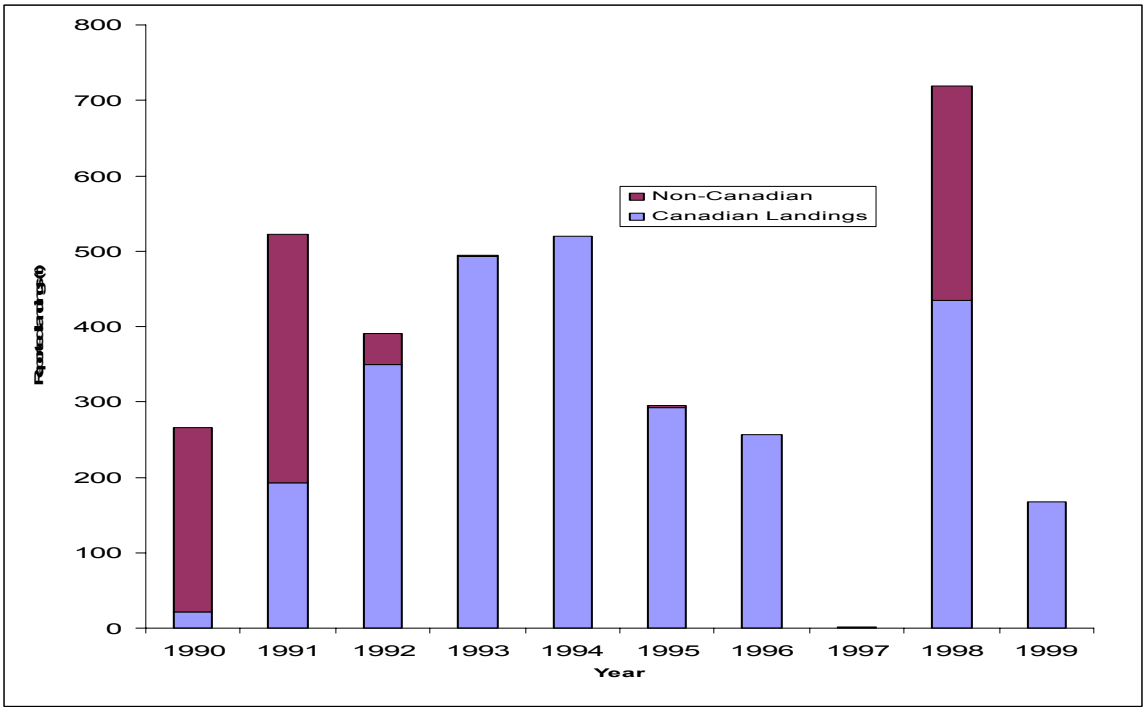


Fig. 29. Catches of monkfish as reported in NAFO STATLAN 21A 1990-1999 showing Canadian vs. non-Canadian catches.