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**Stock Assessment Information
for Pollock, *Pollachius virens* (L.),
in the Scotian Shelf, Georges Bank,
and Gulf of Maine Regions**

**U.S. DEPARTMENT OF COMMERCE
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Northeast Fisheries Center
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Table of Contents

	Page
Abstract	1
Introduction	1
Assessment and Management History	1
International Management	1
Domestic Management	2
Commercial Fishery	3
Data Sources	3
Landings Trends	3
Age Composition of Commercial Landings	4
Canadian Catch at Age	4
USA Catch at Age	5
Distant-Water Fleet Catch at Age	5
Commercial Catch per Unit Effort	6
Recreational Fishery	6
Data Sources	6
Catch Trends	6
Research Vessel Surveys	7
Data Sources and Methods	7
Indices of Abundance and Biomass	7
Catch per Tow at Age	7
Summary	8
Acknowledgements	8
References Cited	8

Tables

Table 1. Commercial landings of pollock (metric tons, live) by Canada and the USA, 1928 to 1959	11
Table 2. Commercial landings of pollock (metric tons, live) from NAFO Divisions 4VWX and Subareas 5 and 6 by country, 1960 to 1987	12
Table 3. Commercial landings of pollock (metric tons, live) from NAFO Divisions 4VWX and Subareas 5 and 6 by area, 1960 to 1987	13
Table 4. Commercial landings of pollock (metric tons, live) from NAFO Divisions 4VWX and Subareas 5 and 6 by gear type and country, 1970 to 1987	14
Table 5. Catch at age (000s of fish) of pollock in the commercial fishery in NAFO Divisions 4VWX and Subareas 5 and 6 by country, 1970 to 1987	15
Table 6. Weight at age (metric tons) of pollock in the commercial fishery in NAFO Divisions 4VWX and Subareas 5 and 6 by country, 1970 to 1987	16
Table 7. Average weight (kg) at age for pollock in the commercial fishery in NAFO Divisions 4VWX and Subareas 5 and 6 by country, 1970 to 1987	17
Table 8. Total catch at age in numbers and weight, and average weight at age of pollock in the commercial fishery in NAFO Divisions 4VWX and Subareas 5 and 6, 1970 to 1987	18
Table 9. USA and Canadian commercial CPUE indices for pollock based on otter trawl trips in which pollock comprised 50% or more of the total catch, 1970 to 1987	19
Table 10. USA catches of pollock in numbers and weight, and mean weights estimated from data collected in USA recreational fishery surveys, 1960 to 1987	20

	Page
Table 11. Stratified mean catch per tow in numbers and weight (kg) for Scotian Shelf, Gulf of Maine, and Georges Bank pollock in NEFC offshore spring, summer, and autumn bottom trawl surveys, 1963 to 1987	21
Table 12. Stratified mean catch per tow at age in numbers and weight for Scotian Shelf, Gulf of Maine, and Georges Bank pollock in Canadian summer bottom trawl surveys, 1970 to 1988	22
Table 13. Stratified mean catch per tow at age (numbers) for Scotian Shelf, Gulf of Maine, and Georges Bank pollock in NEFC offshore spring, summer, and autumn bottom trawl surveys, 1970 to 1987	23
Table 14. Stratified mean catch per tow in numbers and weight for pollock in Massachusetts spring inshore surveys, 1978 to 1987	24

Figures

Figure 1. NAFO Subareas and Divisions referenced in this report	25
Figure 2. Commercial landings of pollock from NAFO Divisions 4VWX and Subareas 5 and 6 for Canada, USA, and distant-water fleets (DWF), 1928 to 1987	26
Figure 3. Strata sampled during USA NEFC offshore spring, summer, and autumn bottom trawl surveys	27
Figure 4. Areas sampled during Commonwealth of Massachusetts DMF spring inshore bottom trawl surveys	28
Figure 5. Strata sampled during Canadian DFO summer bottom trawl surveys	29
Figure 6. Trends in stratified mean catch per tow in numbers and weight for pollock derived from USA spring and autumn, and Canadian summer bottom trawl surveys conducted in NAFO Divisions 4VWX and Subareas 5 and 6, 1963 to 1988	30

ABSTRACT

Exploitation of pollock in the Scotian Shelf, Georges Bank, and Gulf of Maine region (Northwest Atlantic Fisheries Organization (NAFO) Divisions 4VWX and Subareas 5 and 6) has increased considerably over the past two decades as abundance of traditional groundfish species has declined. Total landings have increased from less than 25,000 metric tons (t) per year during the late 1960s to almost 69,000 t in 1986. Two-thirds of the 1960-1987 total has been taken by Canada. The majority of the catch has been taken on the western Scotian Shelf and in the Gulf of Maine (NAFO Divisions 4X and 5Y).

Since the mid-1970s, Canadian and USA scientists have cooperated closely in assessment-related research on this species, and have devoted considerable effort to developing the commercial, recreational, and research vessel survey databases needed for such studies. This document summarizes historical landings data by country, area, and gear type, and provides composite tabulations of landings and mean weights at age for 1970-1987 for Canada, the USA, and distant-water fleets. It also provides commercial catch-per-unit-effort indices and research vessel survey indices including catch-per-tow-at-age data for Canada and the USA. Data sources and methods used to derive each data set are also described, and relevant information is provided as appropriate.

INTRODUCTION

The pollock, *Pollachius virens* (L), constitutes a significant portion of the groundfish biomass in the Scotian Shelf and Gulf of Maine regions; its economic importance has increased considerably in recent years with declines in abundance of traditional species. Nominal catches (landings) have tripled in the last two decades from 22,800 metric tons (t) in 1968 to 68,900 t in 1986. Canada has accounted for 66% of the total nominal catch since 1960, followed by the USA with 26%. Distant-water fleets, primarily from Eastern European countries, have accounted for the remainder. USA recreational fisheries have also taken minor quantities (usually <1000 t in recent years, much of which was released alive).

Pollock in the Scotian Shelf, Georges Bank, and Gulf of Maine region (Northwest Atlantic Fisheries Organization (NAFO) Divisions 4V, 4W, 4X, and Subarea 5, see Figure 1) have been assessed as a unit stock since 1974 (ICNAF 1973b). Pollock caught in NAFO Subarea 6 have since been included, although landings from that area have been insignificant. Canadian and USA scientists have cooperated closely in conducting assessments and related research on this stock for many years, and have invested considerable time and effort in developing commercial and recreational landings estimates, commercial catch rate and catch-at-age series, and research vessel survey abundance indices required for stock assessments. Much of this material has been used in prior assessments, but has recently been revised as analytical procedures and data bases have been refined (Mayo and Clark 1984; McGlade and Annand 1986).

The purpose of this report is to document in a single reference the state of baseline information currently employed in stock assessments of the Scotian Shelf - Gulf of Maine pollock resource. Data sets include commercial landings by country, area, and gear type, commercial catch and weight-at-age data for Canada, the USA, and distant-water fleets, recreational catches and discard estimates, and

commercial and research vessel survey abundance indices. Data sources and methods used for compiling catch at age and commercial catch rates are also described. In addition, assessment results based on previous data sets are summarized and evaluated in the context of international and domestic management actions.

ASSESSMENT AND MANAGEMENT HISTORY

INTERNATIONAL MANAGEMENT

Specific management measures for pollock in the Northwest Atlantic were first introduced in 1973. In January of that year, a preemptive total allowable catch (TAC) of 50,000 t was placed on pollock in Division 4X and Subarea 5 at the International Commission for the Northwest Atlantic Fisheries (ICNAF) Special Commission Meeting (ICNAF 1973a). For 1974, coverage was extended to encompass the entire Division 4VWX and Subarea 5 region, and the TAC increased to 55,000 t (ICNAF 1973b) as there was no evidence to suggest the existence of separate stocks on the Scotian Shelf (Halliday 1973). The TAC remained at 55,000 t during 1975 and 1976, as Canadian and USA commercial catch-per-unit-effort (CPUE) and research vessel survey data provided no evidence of adverse effects under existing exploitation levels. A single management unit was accepted during these years because only one major spawning ground (Jeffreys Ledge in Division 5Y) had been identified (Steele 1963). Although there was some evidence for spawning in Subarea 4, the available information was considered insufficient to support different TACs for different areas.

The first analytical assessment for this stock was completed in 1976. The hypothesis of a unit stock in Divisions 4VWX and Subarea 5 was examined and again accepted (ICNAF 1976); however, assessment results indicated that

instantaneous fishing mortality (F) had exceeded levels providing maximum yield per recruit (F_{max}) during 1973-1975, and that abundance had begun to decline (Clark et al. 1977). Consequently, the TAC for 1977 was reduced to 30,000 t in an attempt to stabilize fishing mortality at F_{max} .

DOMESTIC MANAGEMENT

Both of the major participants in the fishery, Canada and the USA, extended their fisheries jurisdiction in 1977. The USA withdrew from ICNAF in December 1976 and, since that year, USA pollock landings have been unregulated. A draft Fishery Management Plan was prepared for the USA fishery in 1978 (New England Regional Fishery Management Council 1978), but was not implemented. In 1986, the Northeast Multispecies Fishery Management Plan was implemented for stocks within the USA Exclusive Economic Zone, and included pollock among the 10 regulated species. The objective of this plan is the maintenance of target spawning stock biomass levels through minimum fish size, mesh, and area regulations. Landings, however, remain unrestricted in the USA fishery.

With the establishment of extended jurisdiction on January 1, 1977, Canada assumed management responsibility for stocks within the Canadian zone. The Canadian Atlantic Fisheries Scientific Advisory Committee (CAFSAC) was established with the responsibility for advising on the short- and long-term scientific aspects of fisheries management. In order to set more conservative TACs to allow rebuilding of the stocks to levels considered necessary to meet management objectives, Canada adopted an $F_{0.1}$ management strategy (i.e., the instantaneous fishing mortality (F) at which an increase in yield per recruit for a given increase in F is 1/10th of that which would be obtained from an unexploited fishery) (Gulland and Boerema 1973). To meet these objectives, a 30,000 t annual TAC was maintained by Canada through 1979.

The concept of a management plan was also introduced by Canada in 1977 to allocate the resource more equitably with restoration and conservation of the stocks as the predominant principle. Annual plans were developed through extensive consultation with representatives of fishermen's organizations, unions, processors, and provincial governments via the mechanism of the Atlantic Groundfish Advisory Committee (AGAC). Under this plan, a portion of the TAC was initially set aside to account for the USA and distant-water fleet catches. A treaty with the USA was signed on March 29, 1979, providing for allocations between Canada and the USA to be made on a 74.4% to 25.6% basis, respectively. Although this treaty was not ratified, Canadian management plans continued to indicate a division of the resource consistent with these proportions until 1984.

Separate USA and Canadian assessments (Clark et al. 1979; Cleary 1980) indicated improved stock biomass and

recruitment levels during the late 1970s, suggesting that a catch of about 40,000 t could be achieved in 1980 from fishing at $F_{0.1}$. Accordingly, the combined TAC for 1980 was set at this level. Continued improvements in the analytical data base, i.e., extension of the catch-at-age and commercial CPUE time series, led to further refinements in stock size and recruitment estimates (McGlade et al. 1981; McGlade and Beanlands 1982). These assessments indicated TACs corresponding to $F_{0.1}$ of 54,000, 55,000, and 45,000 t for 1981, 1982, and 1983, respectively; subsequent analyses, however, indicated that a TAC of 52,000 t was more appropriate for 1983 due to the strength of the 1979 year class (McGlade et al. 1984). The 1984 TAC corresponding to fishing at $F_{0.1}$ was set at 53,000 t.

Management plans through 1980 placed mobile gear fleets under quota management while fixed gear fisheries were given an allowance (a nonregulated portion of the TAC). The 1981 plan placed all fleets defined by vessel size and gear type, i.e., vessels > 125 ft employing mobile gear, vessels < 125 ft employing mobile gear, and all vessels employing fixed gears, under quota management, thus gaining greater assurances that biological limits would not be exceeded. In 1982, enterprise allocations (company quotas) were established for the offshore fleet (i.e., vessels > 100 ft) to avoid the "rush to fish" and to establish more orderly harvesting and marketing controls. Vessels < 65 ft were placed under sector management to allow expansion or restriction of the inshore fishery in a particular sector without affecting the management of fisheries in other sectors. Management plans through 1985 remained essentially unchanged although large companies imposed trip limits on pollock, generally because of low market values.

Given the unrestricted catch of pollock by the USA, the annual allocation previously set aside for the USA was removed in 1985 and Canadian management shifted from a TAC for the entire fishery to simply a Canadian allocation. Recent assessments have indicated substantial declines in stock biomass since 1984 (Mayo and Clark 1984; McGlade et al. 1985, 1986; Annand et al. 1987), and, accordingly, allocations were set at or below 43,000 t between 1985 and 1988.

Trips limits and seasonal closures for all vessels < 65 ft were introduced in 1986 management plans to reduce fishing effort and to distribute the catch over the year. In 1988, enterprise allocations were established for the mid-shore fleet (i.e., vessels of 65-100 ft) while separate quotas were introduced for mobile and fixed gear vessels < 45 ft, and mobile and fixed gear vessels in the 45-65 ft range. This division was initiated to combine similar fleets for better management and to protect the interests of small vessel operators. A summary of TACs and catches for the 1973-1988 period is provided in the table on page 3.

From 1974 to 1980, nominal catches show no obvious relationship to established TACs, and, since 1977, there is evidence of misreporting of pollock and other species in both Canadian and USA fisheries to circumvent landings

Summary of TACs and catches (000s t) for 1973-1988

	1973	1974	1975	1976	1977	1978	1979	1980
TAC	50 ¹	55 ¹	55 ¹	55 ¹	30	30	30	40
Nominal Catch	43	38	39	38	38	45	47	55
Canadian Catch	27	25	27	24	25	27	30	36
USA Catch	6	9	9	11	13	18	16	18

	1981	1982	1983	1984	1985	1986	1987	1988
TAC	54	55	52	53	43 ²	40 ²	43 ²	43 ²
Nominal Catch	59	53	47	52	63	69	66	58
Canadian Catch	40	38	33	33	43	43	45	42
USA Catch	18	14	14	18	19	25	20	15

¹ ICNAF TACs. Subsequent TACs are Canadian.

² Canadian allocation only.

restrictions. Since 1985, Canadian landings have remained relatively constant, generally close to their allocation, while unregulated USA landings have shown a sharp increase. Thus, allocations established for Canada between 1985 and 1988 have not been restrictive in terms of total catch for the entire fishery.

COMMERCIAL FISHERY

DATA SOURCES

Nominal catch data are presented in this document for 1928-1987 for Canada, the USA, and other countries. Data for Canada and the USA prior to 1960 have been taken from the *Fisheries Statistics of Canada*, and the *Fisheries Industries of the United States* and *Fisheries Statistics of the United States* series, respectively (Table 1). Data for 1960-1987 (all countries) have been taken from ICNAF and NAFO statistical bulletins and data files (Table 2). Data are not available for other countries prior to 1960 as pollock catches were usually reported to ICNAF in "mixed groundfish" categories, but catches by these countries during these years do not appear to have been large. The above time series is presented in Figure 2.

Landings data for New England fisheries have been collected at principal ports (Boston and Gloucester, Massachusetts, and Portland, Maine) since the late 1800s (Sette and Fiedler 1929). Data were occasionally collected in surveys or canvasses of other ports in the New England and Middle Atlantic areas, but this practice was not implemented on a regular basis until the late 1920s (Power 1961). For earlier years, data for principal ports are usually the only statistics available.

Beginning in 1928, surveys were completed in every year except for 1934, 1936, and 1941. USA data reported in

this document for 1928-1959 were taken from the *Fishery Industries of the United States* series for 1929-1939 and the *Fishery Statistics of the United States* series for 1939-1959 (summarized for New England states by Lyles (1967)). References providing data for surveys completed between 1880 and 1956 are summarized by Power (1958).

Landings presented in Table 1 for 1934, 1936, and 1941 were estimated by adjusting the corresponding "principal port" landings by the ratio of total landings to landings at principal ports for adjacent years, e.g., the 1936 estimate was derived using data for 1935 and 1937. During the 1930s and 1940s, regular coverage was extended to other New England ports and canvas coverage was improved. A review of historical data collection procedures and coverage prior to 1960 is given by Power (1961).

Landings data for Canada prior to 1960 (Table 1) have been extracted from the *Fishery Statistics of Canada* series. For years prior to 1953, data are for New Brunswick and Nova Scotia only; for 1953-1955, the total reported figure excluding Newfoundland has been used. Since a breakout for Newfoundland was not provided for the remaining years, the 1956 and 1957 values were estimated by applying the 1953-1955 ratio of total landings excluding Newfoundland to total landings to the reported totals; 1958 and 1959 values were estimated by applying the 1960-1962 ratio of Canadian landings for ICNAF Divisions 4VWX and Subarea 5 to the Canadian total as reported to ICNAF to the reported totals. All data were corrected from gutted weight (as reported) to live weight by applying the appropriate conversion factor (1.20).

LANDINGS TRENDS

Trends in landings for this resource have been strongly influenced by technological innovations, market demand, and trends in fisheries directed towards other demersal

species. Historically, pollock were of minor importance for many years and it was not until the mid-1930s that landings for the Scotian Shelf-Georges Bank-Gulf of Maine resource exceeded 20,000 t. For Canada, landings were relatively constant during 1928-1942, averaging about 5,000 t, and then increased to an average of 29,300 t during 1960-1964 (Tables 1 and 2, Figure 2). Landings subsequently declined to only 10,800 t in 1970, but have since increased more or less continually to a peak of 45,300 t in 1987. USA landings during 1935-1960 were relatively stable about an annual average of 13,400 t, and then decreased to less than 4,000 t in the late 1960s; landings have since increased steadily to an annual average of 18,000 t during 1978-1987 (Tables 1 and 2, Figure 2).

Nominal catches by other nations (primarily eastern European countries) have fluctuated considerably, increasing from zero in 1962 to 12,300 t in 1966, and then declining sharply to only 1,500 t in 1968. The combined total averaged 9,800 t during 1970-1973, but has since declined to less than 1,000 t annually (Table 2, Figure 2). Most of this catch has been taken by the Union of Soviet Socialist Republics (USSR), the German Democratic Republic (GDR), Spain, and the Federal Republic of Germany (FRG). Japan, the United Kingdom, France, Cuba, and Poland have also taken small quantities.

Total landings for this stock have increased from about 9,000 t annually during the late-1920s to an annual average of 38,000 t during 1960-1966. Landings then declined to an average of 24,500 t during 1967-1971, but have since increased more or less continually to well over 65,000 t in 1986 and 1987; the 1986 total (68,500 t) was the highest on record. The general increase observed in the past two decades appears to reflect a general increase in directed effort associated with increased Canadian and USA harvesting capacity and declining abundance of traditional groundfish stocks.

The distribution of nominal catch by area is given in Table 3. Since 1960, 60% of the total has been taken on the western Scotian Shelf and in the Gulf of Maine (NAFO Divisions 4X and 5Y), the apparent center of distribution of this stock (Table 3). Almost 90% of the Canadian nominal catch has been taken on the Scotian Shelf; USA landings were taken primarily on Georges Bank and in the Gulf of Maine during the 1960s and early 1970s, but in more recent years have come primarily from the western Gulf of Maine.

Commercial landings of pollock by gear type and country are given in Table 4. Historically, most of the catch has been taken by bottom trawling; bottom trawls have remained the predominant gear in recent years in spite of a substantial increase in gill net effort by Canadian and USA fleets beginning in the mid-1970s. Since 1970, over 70% of the nominal catch has been taken by bottom trawling, with most of the remainder (18%) being taken by gill nets. Pollock have also been taken with a variety of other gears (such as line trawls, hand lines, and purse seines).

AGE COMPOSITION OF COMMERCIAL LANDINGS

Numerous additions and revisions to the pollock catch-at-age matrix have occurred since the initial analyses were completed. While earlier assessments were limited to very short 3- to 5-year time series (Halliday 1976, Clark et al. 1977, 1978), recent revisions and extensions of the matrix back to 1970 (McGlade and Annand 1986), and continuing updates forward through time have resulted in an 18-year series available for current analyses. Commercial length-frequency samples are now available from the Canadian fishery for most months since the beginning of 1970; Canadian age-length keys are also available, at least by quarter, for 1970-1975 and for most months thereafter. Length-frequency samples from the USA trawl fishery are generally available by quarter since 1974. Sampling of USA pollock landings was intensified in 1977, and length frequencies have generally been available for USA trawl landings on a monthly basis, and age-length keys on a quarterly basis since that year. Sampling of the USA gillnet catch has been limited primarily to the period since 1977. Sampling of catches by distant-water fleets has also been minor.

Vessel tonnage class (TC) and gear categories for which catch-at-age estimates were developed are as shown in the table on page 5.

Canadian Catch at Age

The Canadian portion of the pollock catch at age from 1970 through 1987 includes landings from three regions: Maritimes, Quebec, and Newfoundland. Age compositions of Canadian commercial landings were estimated by applying Canadian length frequencies and age-length keys using seasonal (where possible) length-weight regression parameters obtained annually on spring, summer, or autumn research vessel surveys as described by McGlade and Annand (1986).

Sampling has generally been good for most gears. Age-length keys for January-April, May-August, and September-December have been generated for tonnage class 4+ otter trawlers by area (Division 4X + Subarea 5 and Divisions 4VW); annual keys are compiled for both fixed gears and small trawlers (TC 1-3) for the entire area (Divisions 4VWX and Subarea 5). When this stratification was not possible because of sampling limitations, missing blocks were estimated by proration according to the following criteria:

1. Otter Trawlers (OTB-1,2; TC 4+) in Division 4X and Subarea 5. Data available for the whole time series (1970-1987).
2. Otter Trawlers (OTB-1,2; TC 4+) in Divisions 4VW. Estimates based on the proportions in #1 for 1971 and 1972.

Vessel tonnage class and gear categories for catch-at-age estimates

Tonnage Class	Country	Gross Registered Tons	Gear Type	Description
1	Canada	0 - 24.9	OTB-1	Side trawler
2	Canada	25 - 49.9	OTB-2	Stern trawler
2	Others	0 - 49.9	GN	Gillnet
3	All	50 - 149.9	LL	Longline
4+	All	150 - 999.9		

3. Otter Trawlers (OTB-1,2; TC 1-3) in Divisions 4VWX and Subarea 5. Estimates based on proportions in #1 and #2 for 1970-1978.
4. Fixed Gear (Gillnet (GN), Longline (LL), etc.) in Divisions 4VWX and Subarea 5, 1970-1974. Estimates based on proportions in #1 for 1970-1974.

USA Catch at Age

Sampling of USA catches was limited prior to 1974, and age-length keys were not available until 1977. Consequently, estimates of the age composition of USA catches from 1970 through 1976 were based on proportions derived on an annual basis from Canadian Division 4X and Subarea 5 TC 4+ otter trawl catch-at-age compositions. Since 1977, USA length frequencies and age-length keys have been applied independently to the otter trawl and gillnet components, except for 1980, when Canadian gillnet length frequencies were applied to USA gillnet landings.

Catch-at-age estimates for the USA otter trawl fleet are computed on a quarterly basis by market category, and weighted age compositions of the entire otter trawl catch are derived for each year. All USA gillnet samples are pooled and applied on an annual basis due to the limited number of samples available. Whenever possible, length frequencies derived from sampling trawl and gillnet catches have been applied independently, as gillnet samples have generally contained higher proportions of larger fish (Clark et al. 1981; Mayo and Clark 1984). USA catches by gear other than otter trawl and gillnet are prorated annually by the overall USA age composition.

Distant-Water Fleet (DWF) Catch at Age

Estimates of catch at age by distant-water fleets other than USSR prior to extended jurisdiction (1970-1976) were based on Canadian TC 4+ otter trawl samples from Divisions 4VWX and Subarea 5. All catches after this period were taken by small-mesh gear and were included with the USSR data. Small-mesh catches include landings by the USSR from 1970 through 1987, and by all other

nations since 1977. Pollock have been caught primarily as by-catch associated with the Division 4VWX silver hake fishery which, in recent years, has accounted for less than 1% of the total. The age composition of this component, therefore, has been derived from proportions and weights at age computed by Stratified Analyses Programs (STRAP) using data from Canadian research vessel surveys conducted on the Scotian Shelf from 1970 through 1987.

Catch and mean weight-at-age matrices for the Canadian, USA, and distant-water fleet components of the fishery from 1970 through 1987 are given in Tables 5 through 7. The combined catch and mean weight-at-age matrices for all countries and gear types are presented in Table 8. Combined mean weights at age represent averages taken over the three fleet components weighted by numbers landed on an annual basis. Catch biomass estimates are computed as the product of numbers-at-age and mean weights-at-age.

Canadian and USA catches by number have been dominated by age 3-7 fish throughout the series, although considerable interannual variability is evident as dominant year classes progress through the fishery (Table 5). The relatively high proportion of age 2 pollock during the early years of the distant-water-fleet fishery is attributable to the use of small-mesh gear by the USSR fleet. Landings by Canada and USA have been supported by the same dominant year classes (1971, 1976, 1979, and 1982), and catches of the 1969, 1974, and 1980 year classes have also been reasonably high.

The total weight over all ages (Table 6) represents a sum of products which compares favorably with annual landings by country listed in Table 2. In most years, sums of products are within 1% of the tabulated landings.

Catch biomass is generally dominated by ages 4 through 8, although the impact of strong recruitment is evident at age 3 during several years. Average weights at age (Table 7) during 1977-1987 for Canada appear to be slightly lower at a given age than the USA weights, particularly at the intermediate ages. This is likely due to the different length-weight relationships employed in the computations and the different areas fished by each country. Average weights for both countries, however, do not exhibit any consistent trends over time. Average weights for the distant-water fleet are more variable over age and time

than those for either Canada or USA, particularly during the most recent years when landings were substantially lower.

Combined results for all countries (Table 8) reveal that several moderate-to-strong year classes have supported the fishery over the past decade. The substantial increase in landings since 1985 was supported by recruitment from the very strong 1979 year class, augmented by further contributions from the 1980 and 1982 year classes. In 1987, the total catch was well distributed among several year classes with ages ranging from 4 to 8.

COMMERCIAL CATCH PER UNIT EFFORT

Commercial CPUE indices were calculated for USA TC 3 and 4 side and stern trawlers and Canadian TC 5 stern trawlers using 1970-1987 landings and effort data from trips in which pollock comprised 50% or more of the total landed weight or was recorded as the main species for the trip (Table 9). Indices for USA TC 3 and 4 vessels were computed on a seasonal basis (March through September) for trips which fished in Divisions 5Y and 5Z. CPUE calculations for Canadian vessels were based on trips which fished from April to November by composite areas of Divisions 4V, 4W, and 4X, and Subarea 5.

USA indices increased between 1970 and 1977, declined slightly between 1977 and 1984, then dropped sharply from 1985 through 1987. The Canadian catch-rate series reflects the same general trend, i.e., an increase in CPUE from the early 1970s through the early 1980s, followed by a decline in recent years. The Canadian series, however, has exhibited considerable interannual variability since the early 1980s, a possible result of trip limits and other regulatory measures imposed since 1983 (Annand et al. 1988).

RECREATIONAL FISHERY

DATA SOURCES

No recreational catch data are available for Canada, and it is assumed that Canadian recreational catches are of minor significance. Recreational catch information for the USA has been collected in a series of National Saltwater Angling Surveys for 1960, 1965, and 1970 (Clark 1962; Deuel and Clark 1968; Deuel 1973); in a regional survey of the northeastern United States in 1974 (Ridgeley and Deuel 1975); and, more recently, in a series of Marine Recreational Fishery Statistics Surveys for the Atlantic and Gulf Coasts initiated in 1979. Published data are available from these surveys for 1979-1986 (United States Department of Commerce 1980, 1984, 1985a, 1985b, 1986, 1987).

These surveys differed considerably in methodology and, consequently, results are only generally comparable. The National Saltwater Angling Surveys were based on personal interviews in which participants were asked to provide data on numbers and average weights taken by species over a recall period of one year; the 1974 regional survey was based on a combination telephone and mail survey conducted at two-month intervals. The Marine Recreational Fishery Statistics Surveys have combined telephone interviews to identify fishermen and to determine effort levels over a two-month recall period with an intercept (creel) survey to determine species and size composition of the catch. This approach avoids many methodological problems of earlier surveys, e.g., species misidentification and recall inaccuracies of numbers and average weights caught, and consequently results appear to be considerably more reliable (Pileggi and Thompson 1980).

CATCH TRENDS

Recreational catch estimates obtained for 1960, 1965, and 1970 totalled 4.3 million fish (9,800 t), 3.8 million fish (4,200 t), and 2.5 million fish (2,500 t), respectively (Table 10). These figures are considered to be biased upwards by recall inaccuracies and species identification problems, although the magnitude of this bias is unknown (United States Department of Commerce 1980). The 1974 survey indicated a total recreational pollock catch of 0.5 million fish (500 t) and may not be overestimated (United States Department of Commerce 1980).

Estimates from Marine Recreational Fishery Statistics Surveys including pollock reportedly caught and released alive declined from a 1979-1980 average of 4.1 million fish to 0.6 million in 1984. Catches temporarily increased in 1985 to 2.1 million fish before declining sharply to an average of 0.6 million in 1986-1987 (United States Department of Commerce 1984, 1985a, 1985b, 1986, 1987; see Table 10). Total weight, however, increased from about 1,000 t in 1979 to 2,800 t in 1983 as mean size increased. Total weights have declined substantially since 1983 as have mean weights. Much of the variability in mean size appears to be linked to recruitment of strong year classes of pollock as juveniles to inshore regions of the Gulf of Maine.

Since 1979, over 90% of the total USA recreational catch by number was taken off Maine, New Hampshire, and Massachusetts, and over 70% was caught within three miles of the coast in bays and estuaries. Approximately 80% of this catch was taken from small boats or from the shore or shore-based structures (United States Department of Commerce 1984, 1985a, 1985b, 1986, 1987). Length frequencies derived from sampling New Hampshire recreational pollock catches for 1979-1982 (Fawcett 1983) and intercept creel sampling of the 1979-1984 catch dur-

ing Marine Recreational Fishery Statistics Surveys reveal a predominance of age 0 and 1 fish (Witzig, pers. comm.)¹. It follows that, in recent years, juvenile "harbor" pollock have been the major component of the recreational fishery. The importance of the inshore "juvenile" component of the fishery is further evidenced by the fact that between 1979 and 1987, over 40% of the catch has been discarded live (Table 10), a substantially higher percentage than observed for most other species in these surveys.

RESEARCH VESSEL SURVEYS

DATA SOURCES AND METHODS

Bottom trawl surveys of the Gulf of Maine and western Scotian Shelf region (Figure 3) have been conducted by the Northeast Fisheries Center (NEFC) each autumn since 1963 and each spring since 1968 using the research vessels *Albatross IV* and *Delaware II*; summer and winter cruises have been conducted occasionally (Azarovitz 1981). The Commonwealth of Massachusetts Division of Marine Fisheries (DMF) has surveyed inshore waters of the western Gulf of Maine between Cape Cod and the Merrimack River (Figure 4) each spring and autumn since 1978. Summer surveys of the entire Scotian Shelf and Bay of Fundy (Figure 5) have been conducted since 1970 by Canadian research vessels operated by the Department of Fisheries and Oceans (DFO) (Doubleday 1981). The 12-year *A.T. Cameron* series terminated in 1981, but was overlapped by the 1981-1983 *Lady Hammond* series. A conversion factor of 1.0 between these vessels has been derived for pollock from comparative fishing power experiments. Since 1983, summer surveys have been conducted solely by the *Alfred Needler*. Data from comparative fishing power studies proved insufficient to derive a conversion factor for pollock, and, consequently, a factor of 1.0 has been assumed. Results from the series of autumn surveys carried out by the *Lady Hammond* since 1979 are also available, but are not examined in this document.

A stratified random sampling design based on depth and geographic area has been employed during all cruises. Further details concerning sampling design, survey operations, and data preparation procedures in these surveys are provided by Grosslein (1969, 1974), Howe et al. (1979), Azarovitz (1981), Doubleday (1981), and Halliday and Koeller (1981).

Abundance and biomass indices for pollock (stratified mean catch per tow in number and weight, respectively) have been calculated from each of the above data sets. In addition, catch data obtained from NEFC surveys were transformed to $\ln(x+1)$, and retransformed estimates in original units were calculated as suggested by Bliss (1967:128) according to the relation:

$$E(\bar{y}_{st}) = \exp(\bar{y}_{st} + S^2/2) - 1$$

where $E(\bar{y}_{st})$ represents the estimated (retransformed) stratified mean catch per tow, and \bar{y}_{st} and S^2 represent the stratified mean and the estimated population variance, respectively, in logarithmic units. Survey catch-per-tow-at-age information was also obtained by applying age-length keys derived from sampling of survey catches to catch-per-tow-at-length data.

INDICES OF ABUNDANCE AND BIOMASS

Pollock abundance and biomass indices exhibit considerable interannual variability due to schooling behavior and changes in spatial distribution patterns. Computation of NEFC stratified mean catch-per-tow estimates on a logarithmic scale with subsequent retransformation to original units reduced the interannual variation, while general trends remained similar to those based on linear data (Table 11). Canadian summer survey indices suggest that abundance remained relatively stable between 1970 and 1984 except for a sharp increase in 1980 (Table 12, Figure 6). Peak values evident in 1977 and 1980 resulted from extremely large catches in two survey strata and do not reflect overall abundance levels (McGlade et al. 1981). Canadian abundance and biomass indices began to increase in 1984 and have remained relatively high through 1988 (Table 12).

Retransformed biomass indices derived from NEFC surveys are more variable over time than corresponding abundance indices, although results from both spring and autumn surveys indicate a gradual increase in biomass through the mid-1970s, followed by a sharp decline (Figure 6). The autumn series has remained relatively low through 1987, while spring indices suggest a recent increase in biomass in 1985 and 1986.

Despite these differences, survey indices may be used to track dominant year classes, compute total mortality rates, and provide fishery-independent confirmation of trends observed in commercial data, although trends may not be exactly synchronous. Survey indices may also be useful as leading indicators of impending changes in the fishery; for example, recent declines in USA survey abundance and biomass indices preceded the rather abrupt reduction in USA commercial CPUE by several years.

CATCH PER TOW AT AGE

Much of the variation in USA and Canadian offshore survey abundance indices may be explained by differences in year-class strength, e.g., peak abundance levels evident from NEFC spring surveys in 1972, 1976, and 1982, and from NEFC autumn surveys in 1972-1973 and 1976-1977 were due to recruitment of strong 1970, 1971, 1975, and 1979 year classes to offshore survey areas

¹ Witzig, J. 1985. National Marine Fisheries Service, Washington, D.C. 20235

(Table 13). Biomass indices are affected by recruitment and growth, e.g., increases in NEFC spring biomass indices during 1973-1975 and 1977-1981 resulted from growth in weight of individual fish from the 1971 and 1975 year classes. Relative strengths of dominant year classes derived from bottom trawl surveys (Tables 12 and 13) are consistent with commercial catch-at-age data (Tables 5-8).

Indices from Massachusetts DMF surveys also fluctuate considerably, but results for individual year classes appear to track incoming recruitment reasonably well (Table 14). Given the limited area involved in these surveys compared to the distribution of the stock as a whole, it is doubtful whether such indices will accurately reflect overall trends in stock abundance and biomass. But, the proximity of the inshore survey region to known western Gulf of Maine spawning grounds provides a biological basis for utilizing the results as means for predicting future pollock recruitment. Age 0 and 1 abundance estimates from the 1979 and 1980 DMF spring inshore surveys identified the strong 1979 year class, and the 1982 and 1983 surveys detected the comparatively strong 1982 year class.

SUMMARY

Pollock landings from the Scotian Shelf - Gulf of Maine region have been regulated by TACs imposed under ICNAF between 1973 and 1976 and by Canadian domestic management plans since 1977. During this period, total commercial landings have increased from about 25,000 t in the late 1960s to more than 65,000 t in 1986 and 1987. Distant-water fleets accounted for approximately 10,000 t annually between 1970 and 1973, but have recently averaged less than 1,000 t per year. Since 1985, allocations imposed by Canada have limited Canadian landings to 43-45,000 t, while unrestricted USA landings have ranged from 15,000 to 25,000 t. Pollock have been included in USA management schemes since 1986 under the Northeast Multispecies Fishery Management Plan which seeks to maintain target spawning stock biomass levels through a combination of minimum fish size, mesh, and area regulations.

Estimates of relative abundance and biomass based on commercial CPUE indices and results from Canadian and USA research vessel bottom trawl surveys have fluctuated considerably over the past two decades. Canadian CPUE and survey indices reveal an increasing trend throughout the 1970s followed by a more recent period of relatively high abundance characterized by sharp annual oscillations. Indices derived from USA commercial and survey data, however, have declined steadily since the 1970s and recent abundance levels are among the lowest in each series.

Improved sampling of commercial landings since 1977 has allowed more sophisticated methods to be applied in

estimating the age composition of Canadian and USA commercial landings. Catch-at-age estimates for distant-water fleets, particularly those employing small-mesh gear, have also been extensively revised since 1977. The internal consistency of each catch-at-age matrix may be evaluated by summing weight-at-age estimates, computed as a product of numbers-at-age and mean weight-at-age, over all ages on an annual basis. In most years, these sums of products are within 1% of the tabulated annual landings for each country.

The combined catch-at-age matrix, extending from 1970 to 1987, provides a comprehensive basis for evaluating changes in stock size and fishing mortality during this period of increased exploitation. Several relatively strong year classes, notably those of 1971, 1975, 1979, and 1982, have recruited to the fishery at 3-4 year intervals since 1970. The 1987 catch composition was dominated by the 1982 year class, with remnants of the strong 1979 and several other moderate year classes also contributing.

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Table 1. Commercial landings of pollock (metric tons, live) by Canada¹ and the USA², 1928 to 1959

Year	Canada	USA	Total	Year	Canada	USA	Total
1928	3521	5008	8529	1944	11004	10438	21442
1929	2949	6512	9461	1945	14500	17070	31570
1930	2848	8135	10973	1946	15393	20807	36200
1931	2768	4876	7644	1947	11354	9521	20875
1932	4225	5124	9349	1948	13082	17172	30254
1933	2880	7168	10048	1949	10116	13078	23194
1934	4629	11526 ³	16155	1950	15776	11634	27410
1935	4466	15157	19623	1951	9706	10304	20010
1936	6877	19619 ³	26496	1952	15457	12227	27684
1937	13055	17093	30148	1953	16550	10846	27396
1938	5516	18458	23974	1954	17503	9258	26761
1939	5154	16789	21943	1955	21128	10505	31633
1940	5612	17022	22634	1956	22384	10442	32826
1941	4867	18446 ³	23313	1957	19958	9994	29951
1942	4782	14527	19309	1958	26621	14920	41541
1943	8145	10099	18244	1959	24497	11133	35630

¹ As reported in *Fisheries Statistics of Canada* for Nova Scotia and New Brunswick (1928-1952) and for totals excluding Newfoundland (1953-1955). Values for 1956-1957 were derived by adjusting reported totals by the total excluding Newfoundland to total ratio for 1953-1955; totals for 1958-1959 were derived by adjusting reported totals by the ICNAF Divisions 4VWX+5 to total ratio as reported to ICNAF for 1960-1962. All data adjusted to round weight.

² As reported in *Fishery Industries of the United States* (1929-1939) and *Fishery Statistics of the United States* (1939-1959), all areas.

³ Data available only for principal ports (Boston and Gloucester, MA, and Portland, ME): total values adjusted by the total to principal port ratio for adjacent years.

Table 2. Commercial landings of pollock (metric tons, live) from NAFO Divisions 4VWX and Subareas 5 and 6 by country, 1960 to 1987

Year	Canada	FRG ¹	GDR ²	Japan	Spain	USSR	UK	USA	Other	Total
1960	29470	-	-	-	783	-	-	10132	1	40386
1961	26323	-	-	-	982	-	-	10265	1	37571
1962	31721	-	-	-	-	-	-	7391	-	39112
1963	28999	126	-	-	-	906	28	6653	-	36712
1964	30007	208	-	-	-	4603	374	6006	55	41253
1965	27316	71	-	-	1361	2667	11	5303	-	36729
1966	18271	-	-	-	2384	9865	12	3791	-	34323
1967	17567	-	-	-	1779	644	1	3312	14	23317
1968	18062	-	-	-	1128	372	-	3280	7	22849
1969	15968	1188	2195	-	1515	227	-	3943	7	25043
1970	10753	3233	4710	40	532	527	-	3976	-	23771
1971	11757	633	6849	15	912	2216	-	4890	3	27275
1972	18022	475	4816	8	616	3495	4	5729	54	33219
1973	26990	1124	948	1570	3113	3092	-	6303	36	43176
1974	24975	149	2	40	1500	2348	48	8726	14	37802
1975	26548	236	96	-	709	2004	-	9318	124	39035
1976	23568	994	24	-	303	1466	-	10863	390	37608
1977	24654	368	-	1	2	268	-	13056	53	38402
1978	26801	-	-	110	-	502	-	17714	180	45307
1979	29967	7	-	19	-	1025	-	15541	73	46632
1980	35986	-	-	81	-	950	-	18280	131	55428
1981	40270	-	-	15	-	358	-	18171	90	58904
1982	38029	-	-	3	-	297	-	14357	128	52814
1983	32749	-	-	6	-	226	-	13967	283	47231
1984	33465	-	1	1	-	97	-	17903	169	51636
1985	43300	-	-	17	-	336	-	19457	143	63253
1986 ³	42975	-	-	51	-	564	-	24549	391	68530
1987 ³	45308	-	-	84	-	314	-	20393	392	66491

¹ Federal Republic of Germany.² German Democratic Republic.³ Provisional.

Table 3. Commercial landings of pollock (metric tons, live) from NAFO Divisions 4VWX and Subareas 5 and 6 by area, 1960 to 1987

Year	4V	4W	4X	Total 4VWX	5Y	5Ze	5Zw	Total 5Z	5NK	Total SA5	SA6	Total
1960	1503	8354	20132	29988	6545	-	-	3834	18	10397	-	40386
1961	1864	13167	14321	29352	5017	-	-	3177	25	8219	-	37571
1962	1292	12045	19624	32961	2560	-	-	3576	15	6151	-	39112
1963	674	9152	20645	30471	2168	-	-	3947	10	6125	116	36712
1964	474	12488	19283	32245	1754	-	-	7250	-	9004	4	41253
1965	1205	13134	13390	27729	1933	-	-	7065	-	8998	2	36729
1966	788	11040	12648	24476	953	-	-	8846	-	9799	48	34323
1967	657	5836	8290	14783	1728	-	-	6790	14	8532	2	23317
1968	1013	5954	10656	17623	1416	3724	82	3806	-	5222	4	22849
1969	300	3938	10983	15221	4635	5025	162	5187	-	9822	-	25043
1970	649	2952	8194	11795	6281	5157	123	5280	-	11561	415	23771
1971	531	1802	9739	12072	7016	7096	142	7238	58	14312	891	27275
1972	597	3419	16190	20206	6419	6519	51	6570	-	12989	24	33219
1973	1004	5871	23225	30100	5202	6235	1618	7853	-	13055	21	43176
1974	307	4740	20362	25409	6106	6233	5	6238	-	12344	49	37802
1975	799	5697	18668	25164	6015	7848	3	7851	-	13866	5	39035
1976	1102	3424	19700	24226	6441	6915	11	6926	12	13379	3	37608
1977	1347	6082	14700	22129	8278	7846	79	7925	36	16239	34	38402
1978	2931	4910	15161	23002	12238	9943	17	9960	91	22289	16	45307
1979	4877	4963	18340	28180	9856	8356	11	8367	221	18444	8	46632
1980	3893	7511	20485	31889	11388	11883	20	11900	245	23536	3	55428
1981	2316	15678	18842	36836	12475	9298	21	9319	247	22041	27	58904
1982	2939	9375	21036	33348	9416	9903	15	9918	129	19463	3	52814
1983	5491	5787	18137	29415	8458	9217	25	9242	113	17813	3	47231
1984	5474	6043	19486	31003	12543	7819	28	7847	236	20626	7	51636
1985	12085	3262	26837	42184	15615	5169	19	5188	261	21064	5	63253
1986 ¹	15045	4015	23290	42350	18573	7387	14	7401	204	26178	2	68530
1987 ¹	12845	4424	25719	42988	15957	7393	11	7404	141	23502	1	66491

¹ Provisional.

Table 4. Commercial landings of pollock (metric tons, live) from NAFO Divisions 4VWX and Subareas 5 and 6 by gear type and country, 1970 to 1987

Year	Bottom Trawls			Gill Nets			Other Gear			All Gear			
	Canada	USA	Others	Canada	USA	Total	Canada	USA	Others	Canada	USA	Others	Total
			NA ¹						NA			NA	
1970	8874	3555	NA ¹	258	285	543	1621	136	NA	10753	3976	9042	23771
1971	10039	4447	9464	270	163	433	1448	280	1164	11757	4890	10628	27275
1972	15935	4926	8761	484	699	1183	1603	104	707	18022	5729	9468	33219
1973	23204	4959	6754	501	1033	1534	3285	311	3129	26990	6303	9883	43176
1974	20449	6249	2448	2211	1906	4117	2315	571	1653	24975	8726	4101	37802
1975	20217	5877	2147	4146	2613	6759	2185	828	1022	26548	9318	3169	39035
1976	15881	6868	1975	5060	3177	8237	2627	818	1202	23568	10863	3177	37608
1977	19774	7483	291	2866	4560	7426	2014	1013	401	24654	13056	692	38402
1978	20649	9283	672	4196	7227	11423	1956	1204	120	26801	17714	792	45307
1979	22281	7729	1075	4840	6305	11145	2846	1507	49	29967	15541	1124	46632
1980	26486	10384	1107	3709	6041	9750	5791	1855	55	35986	18280	1162	55428
1981	30233	9685	461	7684	7937	15621	2353	549	2	40270	18171	463	58904
1982	26929	9793	428	8029	4342	12371	3071	222	-	38029	14357	428	52814
1983	24342	10630	515	6149	3121	9270	2258	216	-	32749	13967	515	47231
1984	26379	12871	268	4974	4736	9710	2112	296	-	33465	17903	268	51636
1985	31559	13658	496	8680	5609	14289	3061	190	-	43300	19457	496	63253
1986 ²	28236	16531	1006	8912	7762	16674	5827	256	-	42975	24549	1006	68530
1987 ²	31123	12101	790	10202	8060	18262	3983	232	-	45308	20393	790	66491

¹ Landings by year not available for countries other than Canada and USA prior to 1971.

² Provisional.

Table 5. Catch at age (000s of fish) in the commercial fishery in NAFO Divisions 4VWX and Subareas 5 and 6 by country, 1970 to 1987

Age	Canada													USA																							
	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	
2	10	177	484	191	182	165	124	36	23	97	126	41	129	52	21	24	4	8	5	74	154	16	67	87	58	20	92	202	192	595	105	29	42	198	54	82	
3	206	636	1316	1563	4709	973	1189	1415	773	2717	241	1303	3440	1786	685	477	317	428	93	264	418	364	1804	390	847	293	726	1359	416	1162	815	510	1852	943	957		
4	673	1009	1491	5793	2327	3521	1712	2818	3019	5510	1712	657	1550	8951	3322	2179	2868	2231	282	420	474	1338	820	1319	1136	943	550	1773	1955	694	2071	1859	681	3107	862		
5	580	924	964	3562	2092	1828	3123	1737	2971	3298	4975	1997	551	1200	6805	4126	4859	4859	260	384	307	855	711	500	1712	681	649	1039	1556	296	659	2962	1652	881	2723		
6	398	739	560	487	939	1639	925	2101	1202	1624	3076	3929	1832	228	608	6178	3489	3489	159	307	178	114	286	517	379	826	631	500	964	762	193	641	1852	1612	550		
7	350	249	293	195	269	785	986	701	1123	489	1035	2377	2245	503	87	1102	2372	2372	98	104	93	47	91	216	268	326	936	243	542	372	376	364	115	289	1176	642	
8	261	109	67	68	142	130	191	390	242	245	266	696	1044	801	205	298	1672	1672	52	45	21	14	52	69	67	261	349	285	298	177	161	82	178	416	57	95	
9	109	1	57	64	63	44	34	89	132	46	163	202	381	412	197	134	82	175	30	45	21	18	17	25	5	99	114	114	172	128	125	99	99	57	95		
10	68	4	16	59	50	55	12	19	17	15	32	145	168	157	85	221	113	35	30	2	5	15	17	29	5	62	134	47	78	123	105	123	146	43	43		
11	24	0	36	10	32	34	16	25	19	14	9	30	85	48	17	78	165	44	3	0	12	3	8	21	3	20	84	25	36	95	83	42	52	88	99		
12+	6	0	52	3	10	30	41	79	18	0	2	23	22	56	20	57	113	95	0	0	16	1	5	18	8	195	211	112	76	125	206	115	118	134	162	162	
Total	2685	3848	5336	11995	10815	9204	8353	9410	9539	14055	11637	11400	11447	14194	12052	14702	14345	15408	996	1601	1696	2782	3879	3191	4484	3726	4632	5699	6178	6312	4257	4845	6677	6998	8376	6631	
Age	Distant-Water Fleet													Distant-Water Fleet																							
	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	
2	552	1267	160	961	12	8	52	0	0	0	43	63	13	13	1	26	2	3	2	552	1267	160	961	12	8	52	0	0	0	43	63	13	13	1	26	2	3
3	290	1528	436	769	819	73	154	43	49	11	47	5	222	131	2	74	31	58	290	1528	436	769	819	73	154	43	49	11	47	5	222	131	2	74	31	58	
4	588	963	690	2000	298	457	237	18	49	204	131	7	1	144	10	18	44	87	588	963	690	2000	298	457	237	18	49	204	131	7	1	144	10	18	44	87	
5	520	693	581	862	231	238	479	25	62	141	271	44	0	4	26	20	53	131	520	693	581	862	231	238	479	25	62	141	271	44	0	4	26	20	53	131	
6	335	529	186	122	134	244	150	53	54	60	56	29	0	6	2	51	47	52	335	529	186	122	134	244	150	53	54	60	56	29	0	6	2	51	47	52	
7	238	188	97	47	44	40	88	22	25	33	28	12	10	3	4	7	43	25	238	188	97	47	44	40	88	22	25	33	28	12	10	3	4	7	43	25	
8	151	78	22	21	19	64	14	22	11	1	8	10	7	16	8	3	18	29	151	78	22	21	19	64	14	22	11	1	8	10	7	16	8	3	18	29	
9	73	1	280	177	16	11	2	18	9	0	3	8	11	6	8	5	0	1	73	1	280	177	16	11	2	18	9	0	3	8	11	6	8	5	0	1	
10	41	2	5	13	32	1	2	0	0	0	0	0	4	3	4	9	9	2	41	2	5	13	32	1	2	0	0	0	0	4	3	4	9	9	2	2	
11	17	0	12	2	41	1	2	0	0	0	0	0	0	2	1	4	13	2	17	0	12	2	41	1	2	0	0	0	0	2	1	4	13	2	2	2	
12+	2	0	17	1	30	1	8	0	0	0	0	0	2	0	1	1	4	5	2	0	17	1	30	1	8	0	0	0	0	2	0	1	1	4	5	5	
Total	2807	5249	2486	4975	1676	1138	1188	201	259	450	587	178	270	328	67	218	264	395	2807	5249	2486	4975	1676	1138	1188	201	259	450	587	178	270	328	67	218	264	395	

Table 6. Weight at age (metric tons) of pollock in the commercial fishery in NAFO Divisions 4VWX and Subareas 5 and 6 by country, 1970 to 1987

		Canada																	USA																		
Age	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	Age	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
2	10	296	513	143	151	142	78	28	26	75	141	41	98	44	31	23	3	6	2	5	124	163	15	57	75	37	18	71	143	169	351	41	19	35	141	44	60
3	361	1476	2448	2110	6734	1236	1462	1571	974	3206	427	2267	4266	2233	1151	725	441	586	3	171	612	777	499	2598	523	1076	384	893	1631	1764	1011	782	602	1722	1066	995	
4	1790	2139	4369	11007	4607	7007	3321	4283	5464	8485	3595	1669	4185	14948	7840	4271	5793	4395	4	826	890	1389	2529	1640	2147	1745	974	3422	3578	1548	3309	3309	1253	5251	1646	955	
5	2094	2911	4280	9404	6318	5667	8744	4308	7695	8674	13930	5811	1934	3756	18169	11305	8868	12196	5	985	1210	1363	2249	2161	4571	1989	1992	3169	4403	5546	1033	1944	7553	4626	2511	7379	
6	1684	2956	2962	1929	3803	6343	3450	7332	4664	5489	10674	13123	7658	937	2335	19275	11762	10293	6	730	1228	942	451	1167	2073	1372	2982	2562	1985	3548	2964	3129	813	2051	6667	5900	2013
7	1754	1245	1743	946	1353	3980	4585	3155	5155	2117	4285	10269	9990	2429	471	3780	11881	8824	7	566	520	553	227	454	1125	1160	1516	4371	1295	2379	1782	1835	1802	569	1431	5316	2895
8	1532	680	437	421	861	846	1073	2126	1452	1357	1479	4127	5418	4069	1224	553	1252	6755	8	333	281	137	85	312	449	352	1561	1965	1639	1121	1442	1663	1002	882	521	1068	2226
9	783	7	390	428	417	329	239	583	903	304	1061	1394	2332	2406	1162	821	464	796	9	227	7	123	97	112	190	34	695	1733	775	1084	622	1109	845	766	664	406	607
10	480	38	122	432	361	423	93	138	125	107	290	1127	1284	1017	539	1302	688	221	10	95	19	38	108	130	220	7	434	896	356	559	867	654	844	701	883	1086	340
11	216	0	245	93	260	288	139	251	159	123	76	226	680	384	131	483	1008	275	11	28	0	82	28	64	178	22	145	622	196	279	259	722	626	313	383	694	784
12+	49	0	497	31	94	297	377	893	181	0	23	212	190	488	175	431	775	724	12+	0	0	153	10	45	180	80	1589	1635	931	667	1006	1613	1833	980	1077	1219	1453
Total	10753	11748	18006	26944	24959	26558	23561	24668	26798	29937	35981	40266	38035	32711	33228	42969	42935	45071	Total	3966	4891	5720	6298	8740	9310	10858	13058	17714	15542	18282	18170	14358	13969	17761	19368	24561	20398

Distant-Water Fleet

Age	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
2	320	773	170	423	7	7	25	0	0	0	33	42	8	6	0	10	1	1
3	281	2048	811	807	901	82	156	32	41	14	59	8	186	151	3	46	27	46
4	759	2051	1601	4220	492	781	412	30	81	369	244	12	2	184	25	25	74	122
5	1076	2197	2283	2327	654	662	1384	70	179	351	593	130	0	10	73	47	131	252
6	958	2116	984	484	586	830	542	207	233	236	152	105	0	26	8	149	152	138
7	957	936	577	231	237	195	439	110	111	148	88	51	50	14	20	21	138	74
8	834	487	143	136	130	419	83	130	71	6	51	54	44	70	45	13	69	105
9	491	7	2621	1220	110	82	13	125	72	0	19	59	97	30	47	27	0	5
10	299	19	38	106	245	7	17	0	0	0	0	0	30	21	24	48	55	11
11	156	0	82	16	367	8	19	0	0	0	0	0	0	15	7	24	79	10
12+	16	0	163	8	309	13	69	0	0	0	0	0	17	0	6	6	24	30
Total	6147	10634	9473	9978	4038	3086	3159	704	788	1124	1239	461	434	527	258	416	750	794

Table 7. Average weight (kg) at age for pollock in the commercial fishery in NAFO Divisions 4VWX and Subareas 5 and 6 by country, 1970 to 1987

Age	Canada												USA																							
	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
2	0.97	1.67	1.06	0.75	0.83	0.86	0.63	0.79	1.14	0.77	1.12	1.01	0.76	0.84	1.46	0.94	0.83	0.72	0.97	1.67	1.06	0.95	0.85	0.86	0.63	0.91	0.77	0.71	0.88	0.59	0.39	0.67	0.83	0.71	0.82	0.73
3	1.75	2.32	1.86	1.35	1.43	1.27	1.23	1.11	1.26	1.18	1.77	1.74	1.24	1.25	1.68	1.52	1.39	1.37	1.84	2.32	1.86	1.37	1.44	1.34	1.27	1.31	1.23	1.20	1.19	1.22	0.87	0.96	1.18	0.93	1.13	1.04
4	2.66	2.12	2.93	1.90	1.98	1.99	1.94	1.52	1.81	1.54	2.10	2.54	2.70	1.67	2.36	1.96	2.02	1.97	2.93	2.12	2.93	1.89	2.00	2.09	1.89	1.85	1.77	1.93	1.83	2.23	1.67	1.78	1.84	1.69	1.91	
5	3.61	3.15	4.44	2.64	3.02	3.10	2.80	2.48	2.59	2.63	2.80	2.91	3.51	3.13	2.67	2.74	2.52	2.51	4.44	3.15	4.44	2.63	3.04	3.08	2.67	2.92	3.07	3.05	2.83	2.99	2.95	2.55	2.80	2.85	2.71	
6	4.23	4.00	5.29	3.96	4.05	3.87	3.73	3.49	3.88	3.38	3.47	3.34	4.18	4.11	3.84	3.12	3.29	2.95	5.00	4.00	5.29	3.96	4.08	4.01	3.62	3.61	4.06	3.97	3.68	3.89	4.08	4.21	3.20	3.60	3.66	3.66
7	5.01	5.00	5.95	4.85	5.03	5.07	4.65	4.50	4.59	4.33	4.14	4.32	4.45	4.83	5.41	3.43	3.61	3.72	6.24	5.00	5.95	4.84	4.99	5.21	4.33	4.65	4.67	5.33	4.39	4.79	4.88	4.95	4.95	4.52	4.51	
8	5.87	6.24	6.52	6.19	6.06	6.51	5.62	5.45	6.00	5.54	5.56	5.93	5.19	5.08	5.97	4.39	4.20	4.04	7.25	6.24	6.52	6.19	6.06	6.51	5.62	5.45	6.84	6.61	6.51	6.90	6.12	5.84	5.90	6.13	5.66	4.55
9	7.18	7.25	6.84	6.69	6.62	7.47	7.04	6.55	6.84	6.61	6.51	6.90	6.12	5.84	6.34	5.89	6.09	6.32	9.62	7.25	6.84	6.69	6.62	7.47	7.04	6.55	7.37	7.14	9.07	7.77	7.64	6.48	6.34	5.89	6.09	6.32
10	7.06	9.62	7.60	7.32	7.22	7.69	7.71	7.25	7.37	7.14	9.07	7.77	7.64	6.48	6.34	5.89	6.09	6.32	--	9.62	7.60	7.32	7.22	7.69	7.71	7.25	7.37	7.14	9.07	7.77	7.64	6.48	6.34	5.89	6.09	6.32
11	9.01	--	6.81	9.33	8.12	8.47	8.67	10.02	8.38	8.79	8.40	7.54	8.00	8.00	7.69	6.19	6.11	6.26	--	--	6.81	9.33	8.12	8.47	8.67	10.02	8.38	8.79	8.40	7.54	8.00	8.00	7.69	6.19	6.11	6.26
12+	8.11	--	9.56	10.35	9.36	9.89	9.19	11.30	10.03	--	11.64	9.22	8.65	8.72	8.76	7.56	6.86	7.62	--	--	9.56	10.35	9.36	9.89	9.19	11.30	10.03	--	11.64	9.22	8.65	8.72	8.76	7.56	6.86	7.62
Age	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987

Age	Distant-Water Fleet																	
	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
2	0.58	0.61	1.06	0.44	0.59	0.84	0.49	--	--	--	0.77	0.66	0.62	0.43	0.48	0.37	0.32	0.32
3	0.97	1.34	1.86	1.05	1.10	1.13	1.01	0.74	0.83	1.23	1.25	1.52	0.84	1.15	1.29	0.62	0.87	0.79
4	1.29	2.13	2.32	2.11	1.65	1.71	1.74	1.65	1.66	1.81	1.86	1.74	2.15	1.28	2.50	1.39	1.68	1.40
5	2.07	3.17	3.93	2.70	2.83	2.78	2.89	2.80	2.88	2.49	2.19	2.96	--	2.52	2.82	2.35	2.48	1.92
6	2.86	4.00	5.29	3.97	4.37	3.40	3.61	3.90	4.32	3.93	2.72	3.63	--	4.38	3.77	2.92	3.24	2.65
7	4.02	4.98	5.95	4.91	5.38	4.88	4.99	4.99	4.45	4.48	3.14	4.28	4.97	4.62	4.97	3.04	3.20	2.94
8	5.52	6.24	6.52	6.46	6.86	6.55	5.90	5.90	6.45	5.98	6.32	5.41	6.30	4.35	5.60	4.29	3.85	3.61
9	6.73	7.25	9.36	6.89	6.90	7.48	6.70	6.92	8.01	--	6.37	7.36	8.82	5.03	5.87	5.40	--	4.78
10	7.29	9.62	7.60	8.14	7.66	7.00	8.26	--	--	--	--	--	7.43	7.08	5.96	5.35	6.14	5.74
11	9.17	--	6.81	8.14	8.95	8.43	9.46	--	--	--	--	--	--	7.61	7.25	5.94	6.04	4.84
12+	8.11	--	9.56	8.14	10.29	13.00	8.68	--	--	--	--	--	8.50	--	6.19	6.46	6.04	5.96

Table 8. Total catch at age in numbers and weight, and average weight in the commercial fishery in NAFO Divisions 4VWX and Subareas 5 and 6, 1970 to 1987

Age	Number (000s)																	
	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
2	567	1518	798	1168	261	260	234	56	115	299	361	699	247	94	64	248	60	93
3	589	2428	2170	2696	7332	1436	2190	1751	1548	4087	704	2754	4824	2732	1197	2403	1291	1443
4	1543	2392	2655	9131	3445	5297	3085	3779	3618	7487	3798	1309	2245	11166	2878	6019	3180	3180
5	1360	2001	1852	5279	3034	2566	5314	2443	3682	4478	6802	3896	847	1863	9793	5798	4453	7713
6	892	1575	924	723	1359	2400	1454	2980	1887	2184	4096	4720	2599	427	1251	8081	5234	4091
7	686	541	483	289	404	1041	1342	1049	2084	765	1605	2761	2631	870	206	1398	4510	3039
8	464	232	110	103	213	263	272	673	602	531	469	964	1349	994	374	211	494	2117
9	212	3	355	256	96	80	41	206	411	160	334	308	564	546	330	238	139	271
10	123	8	26	87	100	85	15	81	151	62	110	268	268	280	194	353	268	80
11	44	1	60	15	81	56	21	45	103	39	45	63	180	133	60	134	266	145
12+	8	1	85	5	45	49	57	274	229	112	78	148	220	262	136	176	251	262
Total	6488	10700	9518	19752	16370	13533	14025	13337	14430	20204	18402	17890	15974	19367	18796	21918	22985	22434

Age	Weight (mt)																	
	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
2	335	1184	846	584	214	224	140	46	97	218	343	433	148	69	66	174	48	67
3	813	4128	4036	3424	10265	1838	2694	1979	1904	4864	979	4048	5451	3169	1760	2499	1536	1631
4	3379	5071	7354	17805	6752	10541	5892	6046	6512	12279	7406	3246	5725	18536	11161	5555	11135	6169
5	4148	6323	7927	13989	9132	7878	14720	6376	9868	12180	18910	11493	2965	5719	25756	16002	11489	19822
6	3372	6300	4888	2863	5558	9240	5365	10519	7454	7710	14377	16190	10786	1776	4391	26102	17796	12437
7	3279	2700	2874	1405	2044	5299	6187	4783	9628	3557	6757	12093	11866	4246	1059	5229	17318	11791
8	2700	1448	717	642	1304	1715	1510	3816	3486	3000	2650	5620	7123	5139	2151	1087	2391	9082
9	1501	22	3135	1743	639	601	287	1403	2708	1080	2164	2076	3536	3281	1977	1514	870	1409
10	873	77	198	646	736	650	116	572	1022	463	849	1994	1402	1882	1265	2234	1830	573
11	400	9	409	138	690	474	179	396	781	319	354	485	1402	1025	451	890	1782	1069
12+	65	9	813	49	448	490	526	2482	1816	931	690	1218	1819	2321	1161	1515	2018	2206
Total	20865	27271	33197	43288	37782	38950	37616	38418	45276	46601	55479	58896	52788	47163	51198	62801	68213	66256

Age	Average Weight (kg)																	
	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
2	0.59	0.78	1.06	0.50	0.82	0.86	0.60	0.83	0.84	0.73	0.95	0.62	0.60	0.73	1.03	0.70	0.80	0.72
3	1.38	1.70	1.86	1.27	1.40	1.28	1.23	1.13	1.23	1.19	1.39	1.47	1.13	1.16	1.47	1.04	1.19	1.13
4	2.19	2.12	2.77	1.95	1.96	1.99	1.91	1.60	1.80	1.64	1.95	2.48	2.55	1.66	2.15	1.93	1.85	1.94
5	3.05	3.16	4.28	2.65	3.01	3.07	2.77	2.61	2.68	2.72	2.78	2.95	3.50	3.07	2.63	2.76	2.58	2.57
6	3.78	4.00	5.29	3.96	4.09	3.85	3.69	3.53	3.95	3.53	3.51	3.43	4.15	4.16	3.51	3.23	3.40	3.04
7	4.78	4.99	5.95	4.86	5.06	5.09	4.61	4.56	4.62	4.65	4.21	4.38	4.51	4.88	5.14	3.74	3.84	3.88
8	5.82	6.24	6.52	6.23	6.12	6.52	5.55	5.67	5.79	5.65	5.65	5.83	5.28	5.17	5.75	5.15	4.84	4.29
9	7.08	7.25	8.83	6.81	6.66	7.51	7.00	6.81	6.59	6.75	6.74	6.74	6.27	6.01	5.99	6.36	6.26	5.20
10	7.10	9.62	7.60	7.42	7.36	7.65	7.72	7.06	6.77	7.47	7.72	7.44	7.34	6.72	6.52	6.33	6.83	7.16
11	9.09	9.00	6.81	9.17	8.52	8.47	8.54	8.79	7.58	8.18	7.87	7.70	7.79	7.71	7.52	6.64	6.70	7.37
12+	8.11	9.00	9.56	9.77	9.95	9.99	9.23	9.06	7.93	8.31	8.84	8.23	8.27	8.86	8.54	8.61	8.04	8.42

Table 9. USA¹ and Canadian² commercial CPUE indices for pollock based on otter trawl trips in which pollock comprised 50% or more of the total catch, 1970 to 1987

Year	USA				Canada	
	Tonnage Class 3		Tonnage Class 4		Tonnage Class 5	
	Mar-Sep	All Months	Mar-Sep	All Months	Jun-Aug	Apr-Nov
1970	3.02	3.56	4.44	7.64	0.74	0.86
1971	2.88	4.13	5.03	7.80	0.78	0.64
1972	3.58	8.70	6.79	5.88	0.81	0.75
1973	4.35	7.52	6.50	6.65	1.07	0.75
1974	5.04	7.25	6.05	8.82	0.58	0.66
1975	4.43	5.47	8.17	7.45	0.61	0.70
1976	4.42	5.63	7.39	9.57	0.52	0.57
1977	7.19	7.89	8.89	9.14	0.69	0.78
1978	5.95	6.77	9.11	9.58	0.84	0.89
1979	5.23	6.18	7.04	6.16	1.16	1.09
1980	6.28	7.28	6.82	7.88	0.97	0.94
1981	4.58	7.30	6.02	8.03	0.89	1.01
1982	5.29	5.64	6.37	6.75	1.58	1.32
1983	6.06	5.86	7.00	8.26	0.87	1.05
1984	5.61	6.17	6.34	5.77	1.28	1.33
1985	4.13	5.32	3.79	4.17	0.70	0.96
1986	4.54	5.26	3.40	3.36	1.38	1.26
1987	2.34	3.12	3.10	3.28	0.84	0.94

¹ USA CPUE calculated as tons per 24-hour day fished.² Canadian CPUE calculated as tons per hour fished.

Table 10. USA catches of pollock in numbers and weight, and mean weights estimated from data collected in USA recreational fishery surveys, 1960 to 1987

Year	Number (000s)	Weight (metric tons)	Mean Weight (kg)
1960	4,335	9,834	2.27
1965	3,756	4,240	1.13
1970	2,451	2,533	1.03
1974	481	496	1.03
1979	3,648	1,021	0.28
	<i>2,349¹</i>	<i>658</i>	
1980	4,446	2,134	0.48
	<i>1,997</i>	<i>959</i>	
1981	2,724	1,226	0.45
	<i>1,602</i>	<i>721</i>	
1982	1,686	2,563	1.52
	<i>882</i>	<i>1,341</i>	
1983	1,314	2,799	2.13
	<i>590</i>	<i>1,257</i>	
1984	642	276	0.43
	<i>405</i>	<i>174</i>	
1985	2,147	862	0.40
	<i>1,860</i>	<i>747</i>	
1986	447	219	0.49
	<i>359</i>	<i>176</i>	
1987	741	296	0.40
	<i>278</i>	<i>111</i>	

¹Numbers in italics exclude data for pollock caught and released alive; weights calculated by multiplying numbers caught by mean weight of pollock available for identification in intercept (creel) survey work.

Table 11. Stratified mean catch per tow in numbers and weight (kg) for Scotian Shelf, Gulf of Maine, and Georges Bank pollock in NEFC offshore spring¹, summer², and autumn¹ bottom trawl surveys, 1963 to 1987

Year	Spring ³						Summer						Autumn					
	Weight		Numbers		Retrans-		Weight		Numbers		Retrans-		Weight		Numbers		Retrans-	
	Linear	Reformed	Linear	Reformed	Linear	Reformed	Linear	Reformed	Linear	Reformed	Linear	Reformed	Linear	Reformed	Linear	Reformed	Linear	Reformed
1963	.	.	.	.	10.28	3.45	2.31	1.07	5.79	4.63	1.46	1.27		
1964	.	.	.	.	5.27	2.32	2.06	0.96	4.40	2.15	1.64	0.96		
1965	.	.	.	.	2.56	1.05	1.72	0.63	2.74	1.85	0.83	0.72		
1966	.	.	.	.	.	.	.	.	2.35	1.43	0.97	0.55
1967	.	.	.	.	.	.	.	.	1.80	1.05	0.52	0.41
1968	4.47	2.45	1.09	0.84	.	.	.	.	3.17	2.09	0.69	0.59		
1969	2.66	2.22	1.12	0.94	1.75	1.19	0.70	0.47	6.58	2.67	1.31	0.79						
1970	4.91	3.04	1.67	1.35	.	.	.	.	2.59	1.80	0.64	0.59		
1971	4.39	2.97	1.18	0.99	.	.	.	.	3.96	1.69	1.09	0.65		
1972	5.67	3.78	4.43	2.52	.	.	.	.	4.37	2.83	1.41	1.11		
1973	4.82	3.33	4.00	1.47	.	.	.	.	4.71	3.59	1.64	1.17		
1974	4.10	4.13	1.39	1.20	.	.	.	.	3.17	1.35	0.90	0.51		
1975	5.90	4.52	1.67	1.19	.	.	.	.	2.04	1.38	0.70	0.48		
1976	6.84	6.51	1.59	1.43	.	.	.	.	16.66	6.69	3.69	1.64		
1977	3.44	2.80	1.63	1.18	9.98	8.35	2.07	1.67	8.78	4.81	2.14	1.19						
1978	6.56	3.29	2.48	0.98	4.05	3.80	1.29	0.92	5.83	3.31	0.98	0.65						
1979	4.75	3.68	1.06	0.93	17.57	4.14	2.96	1.19	5.81	4.29	1.28	0.86						
1980	4.40	3.40	1.52	1.09	9.83	6.61	12.21	2.25	4.63	2.99	0.83	0.64						
1981	6.30	4.87	2.00	1.34	.	.	.	.	7.75	1.37	5.24	0.57		
1982	6.62	3.18	3.98	1.76	.	.	.	.	3.14	1.44	1.40	0.71		
1983	1.83	1.09	0.92	0.65	.	.	.	.	3.03	1.28	0.98	0.56		
1984	2.87	1.89	1.00	0.79	.	.	.	.	0.99	0.57	0.45	0.34		
1985	8.36	4.75	2.81	1.82	.	.	.	.	2.43	1.79	1.12	0.72		
1986	7.69	3.56	1.84	1.14	.	.	.	.	1.83	1.09	0.88	0.54		
1987	13.17	2.15	6.94	0.98	.	.	.	.	2.04	1.10	0.60	0.47		

¹ Strata 13 to 40 (see Figure 3).² Strata 21 to 28 and 37-40 (see Figure 3).³ The 36 Yankee trawl was used from 1968 to 1972, and 1982 to 1987. The 41 Yankee trawl was used from 1973 to 1981. No gear conversion factors are available to adjust for differences in fishing power.

Table 12. Stratified mean catch per tow at age in numbers and weight for Scotian Shelf, Gulf of Maine, and Georges Bank pollock in Canadian summer¹ bottom trawl surveys, 1970 to 1988

Year	Age											Totals					
	1	2	3	4	5	6	7	8	9	10	11	12+	UK	1+	4+	5+	6+
1970 ²	0.007	1.815	0.445	0.270	0.197	0.178	0.120	0.066	0.025	0.000	0.035	0.007	0.000	0.000	0.898	0.628	0.431
1971	0.000	0.733	0.607	0.168	0.039	0.018	0.027	0.011	0.007	0.018	0.000	0.000	0.000	0.000	0.288	0.120	0.081
1972	0.000	0.019	0.013	0.146	0.321	0.140	0.037	0.068	0.049	0.024	0.012	0.026	0.004	0.859	0.827	0.681	0.360
1973	0.000	0.389	0.477	2.146	0.812	0.086	0.052	0.049	0.060	0.002	0.018	0.011	0.014	4.116	3.250	1.104	0.292
1974	0.007	0.039	0.798	0.199	0.259	0.121	0.129	0.073	0.055	0.036	0.074	0.031	0.000	1.821	0.977	0.778	0.519
1975	0.000	0.009	0.018	0.324	0.279	0.374	0.059	0.092	0.036	0.008	0.009	0.000	0.000	1.208	1.181	0.857	0.578
1976	0.000	0.029	0.219	0.667	1.239	0.310	0.534	0.197	0.043	0.044	0.015	0.048	0.011	3.356	3.108	2.441	1.202
1977	0.000	0.261	0.770	0.985	2.029	1.415	0.184	0.308	0.108	0.052	0.030	0.012	0.004	6.158	5.127	4.142	2.113
1978	0.000	0.007	0.147	0.607	0.944	0.351	0.328	0.102	0.048	0.022	0.000	0.023	0.017	2.596	2.442	1.835	0.891
1979	0.000	0.000	0.108	0.621	0.780	0.566	0.232	0.167	0.010	0.036	0.000	0.000	0.023	2.543	2.435	1.814	1.034
1980	0.012	1.142	1.250	3.305	5.195	1.314	0.715	0.206	0.077	0.041	0.000	0.000	0.029	13.286	10.882	7.577	2.382
1981	0.007	0.159	0.175	0.051	0.506	0.505	0.352	0.243	0.109	0.076	0.028	0.013	0.046	2.270	1.929	1.878	1.372
1982 ³	0.000	0.196	2.787	0.266	0.118	0.367	0.252	0.148	0.130	0.072	0.012	0.049	0.034	4.431	1.448	1.182	1.064
1983 ⁴	0.100	0.119	0.916	1.702	0.196	0.048	0.090	0.262	0.166	0.056	0.059	0.020	0.027	3.761	2.626	0.924	0.728
1984	0.035	0.469	0.228	0.699	2.007	0.306	0.210	0.456	0.689	0.427	0.071	0.156	0.044	5.797	5.065	4.366	2.359
1985	0.007	1.481	4.557	3.511	3.371	2.689	0.399	0.111	0.201	0.312	0.109	0.101	0.003	16.852	10.807	7.296	3.925
1986	0.044	0.606	0.653	0.959	1.002	1.370	0.999	0.070	0.011	0.101	0.135	0.086	0.007	6.043	4.740	3.781	2.779
1987	0.000	0.590	2.442	3.673	5.817	2.283	1.656	1.348	0.052	0.114	0.088	0.345	0.028	18.436	15.404	11.731	5.914
1988	0.020	0.029	0.557	1.090	2.142	1.908	1.794	0.993	0.576	0.040	0.042	0.159	0.000	9.350	8.744	7.654	5.512

Year	Mean Number Per Tow	Mean Weight Per Tow (kg)
1970 ²	0.000	0.000
1971	0.000	0.000
1972	0.000	0.000
1973	0.000	0.000
1974	0.001	0.000
1975	0.000	0.000
1976	0.000	0.000
1977	0.000	0.000
1978	0.000	0.000
1979	0.000	0.000
1980	0.000	0.000
1981	0.001	0.000
1982 ³	0.000	0.000
1983 ⁴	0.013	0.000
1984	0.012	0.000
1985	0.001	0.000
1986	0.009	0.000
1987	0.000	0.000
1988	0.004	0.000

¹ Strata 40-95, see Figure 5.
² 1970-1981 data from R/V A.T. Cameron.
³ 1982 data from R/V Lady Hammond.
⁴ 1983-1988 data from R/V Alfred Needler.

Table 13. Stratified mean catch per tow at age (numbers) for Scotian Shelf, Gulf of Maine, and Georges Bank pollock in NEFC offshore spring¹, summer², and autumn¹ bottom trawl surveys, 1970 to 1987

Year	Age												Totals				
	0	1	2	3	4	5	6	7	8	9	10	11	12+	1+	4+	5+	6+
Spring³																	
1970	0.01	0.52	0.05	0.17	0.20	0.05	0.07	0.09	0.12	0.08	0.04	0.04	0.23	1.66	0.92	0.72	0.67
1971	0.01	0.15	0.13	0.13	0.09	0.07	0.08	0.04	0.09	0.06	0.07	0.07	0.20	1.18	0.77	0.68	0.61
1972	-	1.20	1.49	0.90	0.20	0.05	0.05	0.07	0.12	0.04	0.07	0.04	0.17	4.40	0.81	0.61	0.56
1973	-	0.01	2.80	0.51	0.15	0.14	0.04	0.03	0.10	0.04	0.09	0.02	0.09	4.02	0.70	0.55	0.41
1974	-	0.01	0.10	0.53	0.14	0.08	0.16	0.07	0.03	0.00	0.01	0.10	0.16	1.39	0.75	0.61	0.53
1975	-	0.01	0.33	0.20	0.34	0.08	0.09	0.10	0.08	0.05	0.06	0.02	0.29	1.65	1.01	0.77	0.69
1976	-	0.08	0.11	0.14	0.15	0.24	0.13	0.15	0.17	0.11	0.03	0.04	0.24	1.59	1.26	1.11	0.87
1977	-	0.14	0.38	0.23	0.06	0.16	0.32	0.13	0.11	0.02	0.02	0.01	0.04	1.62	0.87	0.81	0.65
1978	-	0.00	0.22	0.42	0.65	0.63	0.15	0.11	0.08	0.07	0.05	0.04	0.07	2.49	1.85	1.20	0.51
1979	-	0.10	0.05	0.07	0.08	0.15	0.14	0.08	0.16	0.08	0.03	0.03	0.08	1.05	0.83	0.75	0.60
1980	-	0.15	0.15	0.09	0.28	0.25	0.20	0.23	0.08	0.04	0.02	0.00	0.05	1.54	1.15	0.87	0.62
1981	-	0.01	0.72	0.13	0.12	0.18	0.26	0.08	0.07	0.05	0.09	0.06	0.20	2.02	1.12	1.00	0.82
1982	-	0.13	1.63	0.84	0.55	0.11	0.33	0.11	0.14	0.05	0.01	0.02	0.07	3.99	1.39	0.84	0.73
1983	-	0.57	0.06	0.02	0.02	0.01	0.00	0.05	0.04	0.01	0.02	0.02	0.10	0.92	0.27	0.25	0.24
1984	-	0.15	0.15	0.09	0.10	0.14	0.07	0.04	0.04	0.05	0.03	0.04	0.07	1.00	0.61	0.51	0.37
1985	-	0.26	0.19	0.30	0.22	0.59	0.78	0.19	0.01	0.08	0.06	0.05	0.09	2.81	2.06	1.84	1.25
1986	-	0.11	0.14	0.07	0.17	0.17	0.38	0.37	0.09	0.05	0.04	0.08	0.17	1.84	1.52	1.35	1.18
1987	-	0.13	0.86	2.59	2.46	0.40	0.20	0.09	0.10	0.03	0.00	0.02	0.06	6.94	3.36	0.90	0.50
Summer																	
1977	-	0.05	0.23	0.09	0.26	0.29	0.32	0.15	0.23	0.07	0.08	0.07	0.23	2.07	1.70	1.44	1.15
1978	-	0.00	0.57	0.17	0.09	0.08	0.08	0.05	0.09	0.03	0.01	0.05	0.08	1.30	0.56	0.47	0.35
1979	-	0.05	0.00	0.38	0.26	0.36	0.55	0.36	0.49	0.06	0.21	0.00	0.23	2.95	2.52	2.26	1.90
1980	-	10.67	0.11	0.06	0.29	0.25	0.30	0.22	0.03	0.02	0.07	0.05	0.13	12.20	1.36	1.07	0.82
Autumn																	
1970	0.01	0.13	0.08	0.01	0.09	0.08	0.08	0.04	0.02	0.01	0.02	0.01	0.07	0.64	0.42	0.33	0.25
1971	0.02	0.11	0.38	0.16	0.02	0.06	0.09	0.04	0.08	0.03	0.01	0.01	0.09	1.08	0.43	0.41	0.35
1972	0.00	0.38	0.27	0.20	0.08	0.07	0.08	0.07	0.05	0.04	0.03	0.03	0.10	1.40	0.55	0.47	0.40
1973	0.00	0.03	0.71	0.12	0.17	0.11	0.11	0.09	0.07	0.00	0.12	0.02	0.10	1.65	0.79	0.62	0.51
1974	0.00	0.00	0.08	0.28	0.20	0.11	0.08	0.09	0.01	0.02	0.00	0.02	0.02	0.91	0.55	0.35	0.24
1975	0.01	0.22	0.06	0.03	0.11	0.07	0.04	0.09	0.01	0.01	0.01	0.01	0.03	0.68	0.37	0.26	0.19
1976	0.00	0.03	0.03	0.15	0.55	1.63	0.50	0.31	0.14	0.05	0.01	0.01	0.29	3.70	3.49	2.94	0.31
1977	0.00	0.06	0.17	0.24	0.29	0.42	0.38	0.22	0.11	0.09	0.02	0.00	0.14	2.14	1.67	1.38	0.96
1978	0.00	0.03	0.19	0.04	0.04	0.09	0.09	0.15	0.08	0.06	0.04	0.03	0.12	0.96	0.70	0.66	0.57
1979	0.00	0.01	0.02	0.26	0.33	0.19	0.13	0.08	0.09	0.05	0.04	0.01	0.06	1.27	0.98	0.65	0.46
1980	0.01	0.13	0.01	0.01	0.05	0.11	0.06	0.07	0.13	0.08	0.06	0.04	0.07	0.82	0.67	0.62	0.51
1981	0.00	0.07	3.59	0.98	0.14	0.20	0.13	0.04	0.00	0.00	0.01	0.00	0.08	5.24	0.60	0.46	0.26
1982	0.01	0.07	0.44	0.40	0.29	0.01	0.05	0.04	0.02	0.02	0.00	0.02	0.04	1.40	0.49	0.20	0.19
1983	0.00	0.49	0.03	0.05	0.04	0.07	0.01	0.06	0.08	0.03	0.02	0.02	0.06	0.98	0.41	0.37	0.30
1984	0.00	0.12	0.18	0.02	0.01	0.01	0.03	0.00	0.00	0.02	0.02	0.02	0.02	0.45	0.13	0.12	0.11
1985	0.00	0.62	0.05	0.08	0.07	0.12	0.07	0.01	0.00	0.00	0.03	0.01	0.04	1.10	0.35	0.28	0.16
1986	0.00	0.21	0.22	0.14	0.13	0.07	0.04	0.04	0.00	0.00	0.00	0.01	0.02	0.88	0.31	0.18	0.11
1987	0.00	0.05	0.21	0.06	0.00	0.05	0.02	0.08	0.06	0.04	0.00	0.01	0.02	0.60	0.28	0.28	0.23

¹ Strata 13-40 (see Figure 3).² Strata 21-28 and 37-40 (see Figure 3).³ The 36 *Yankee* trawl was used from 1970-1972 and 1982-1987; the 41 *Yankee* trawl was used from 1973-1981. No gear conversion factors are available to adjust for differences in fishing power.

Table 14. Stratified mean catch per tow in numbers and weight for pollock in Massachusetts spring inshore bottom trawl surveys¹, 1978 to 1987

Year	Stratified mean number per tow at age					Total	Stratified mean weight (kg) per tow
	0	1	2	3+			
1978	2.07	0.01	0.13	0.06		2.27	0.11
1979	4.34	0.04	0.01	0.06		4.45	0.07
1980	0.30	8.37	0.20	0.02		8.89	0.72
1981	1.52	1.42	1.40	0.00		4.34	0.54
1982	1.79	0.00	0.06	0.00		1.85	0.03
1983	0.03	6.45	0.27	0.04		6.79	0.68
1984	0.04	0.00	0.02	0.00		0.06	0.01
1985	0.88	0.02	0.03	0.00		0.93	0.04
1986	0.22	0.01	0.00	0.00		0.23	<0.01
1987	0.23	0.01	0.03	0.00		0.27	0.02

¹ Regions 1-5(strata 11-21 and 25-36) (See Figure 4 and Howe et al. 1979).

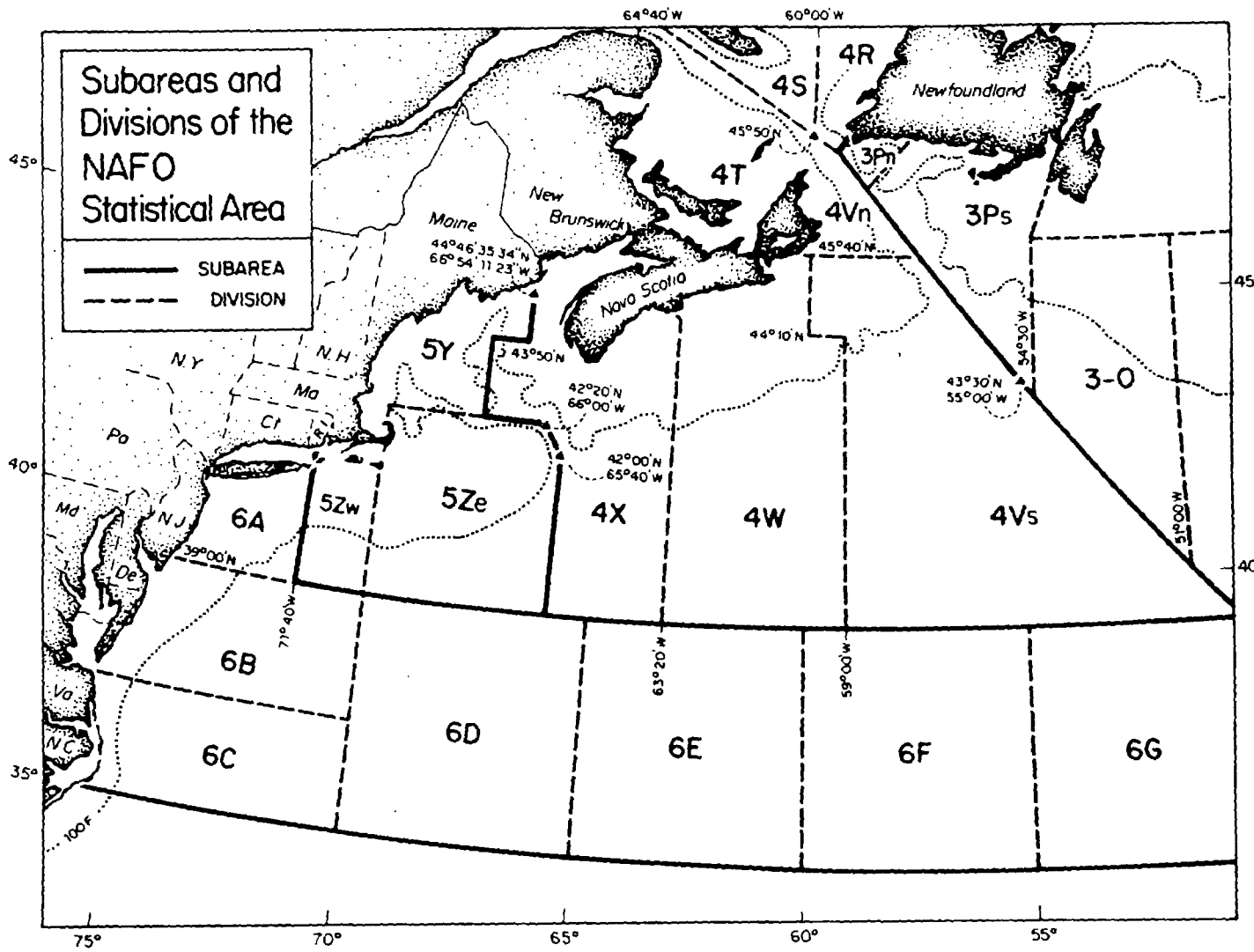


Figure 1. NAFO Subareas and Divisions referenced in this report.

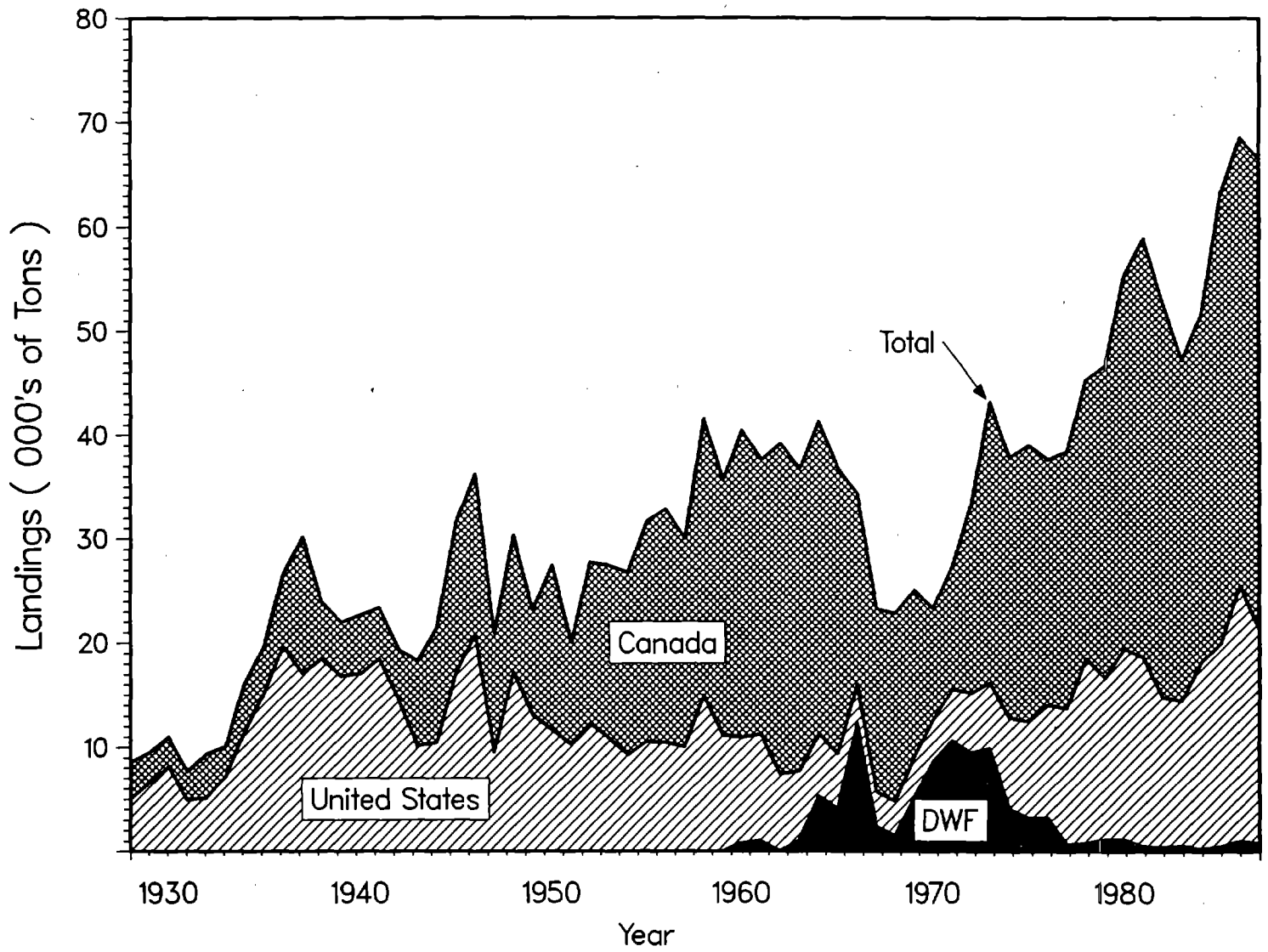


Figure 2. Commercial landings of pollock from NAFO Divisions 4VWX and Subareas 5 and 6 for Canada, USA, and distant-water fleets (DWF), 1928 to 1987.

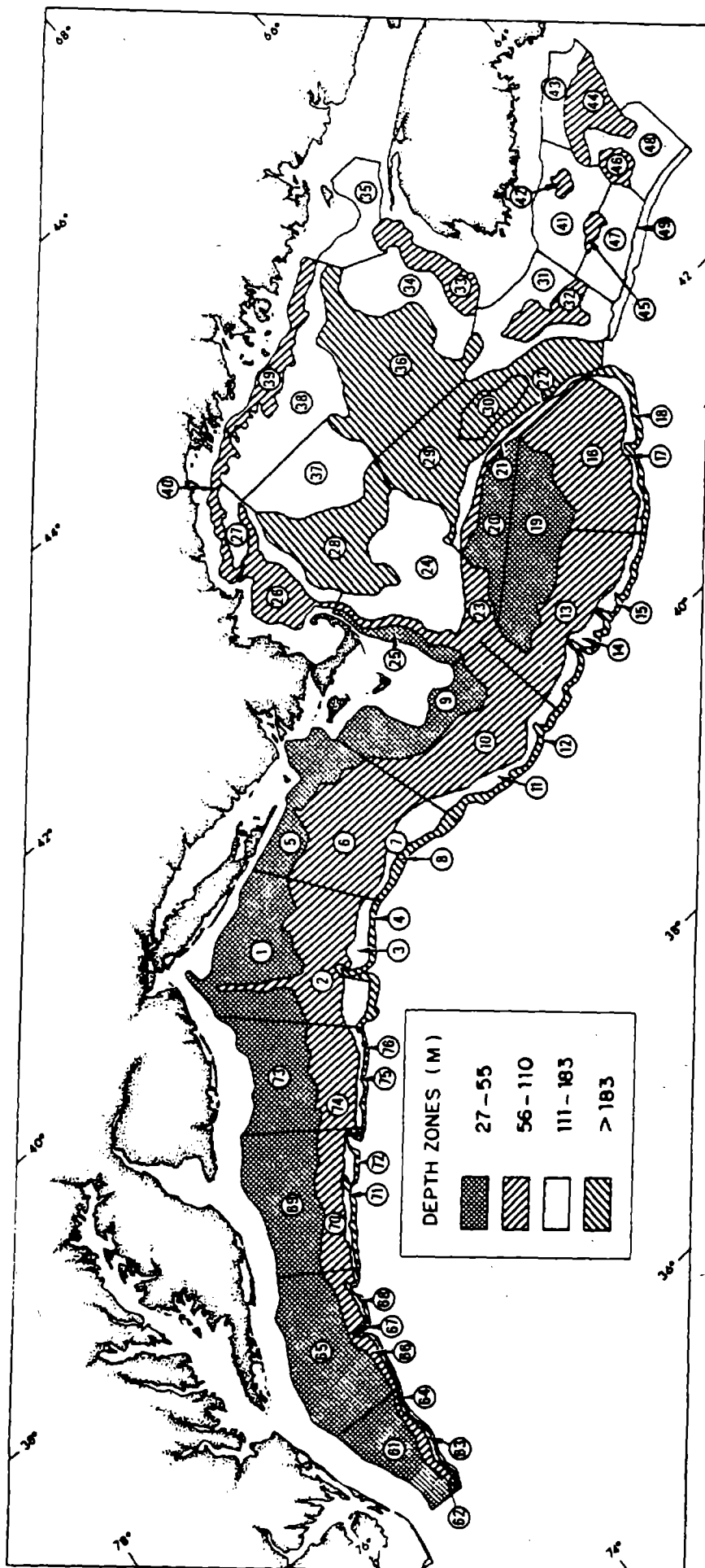


Figure 3. Sirata sampled during USA NEFC offshore spring, summer, and autumn bottom trawl surveys.

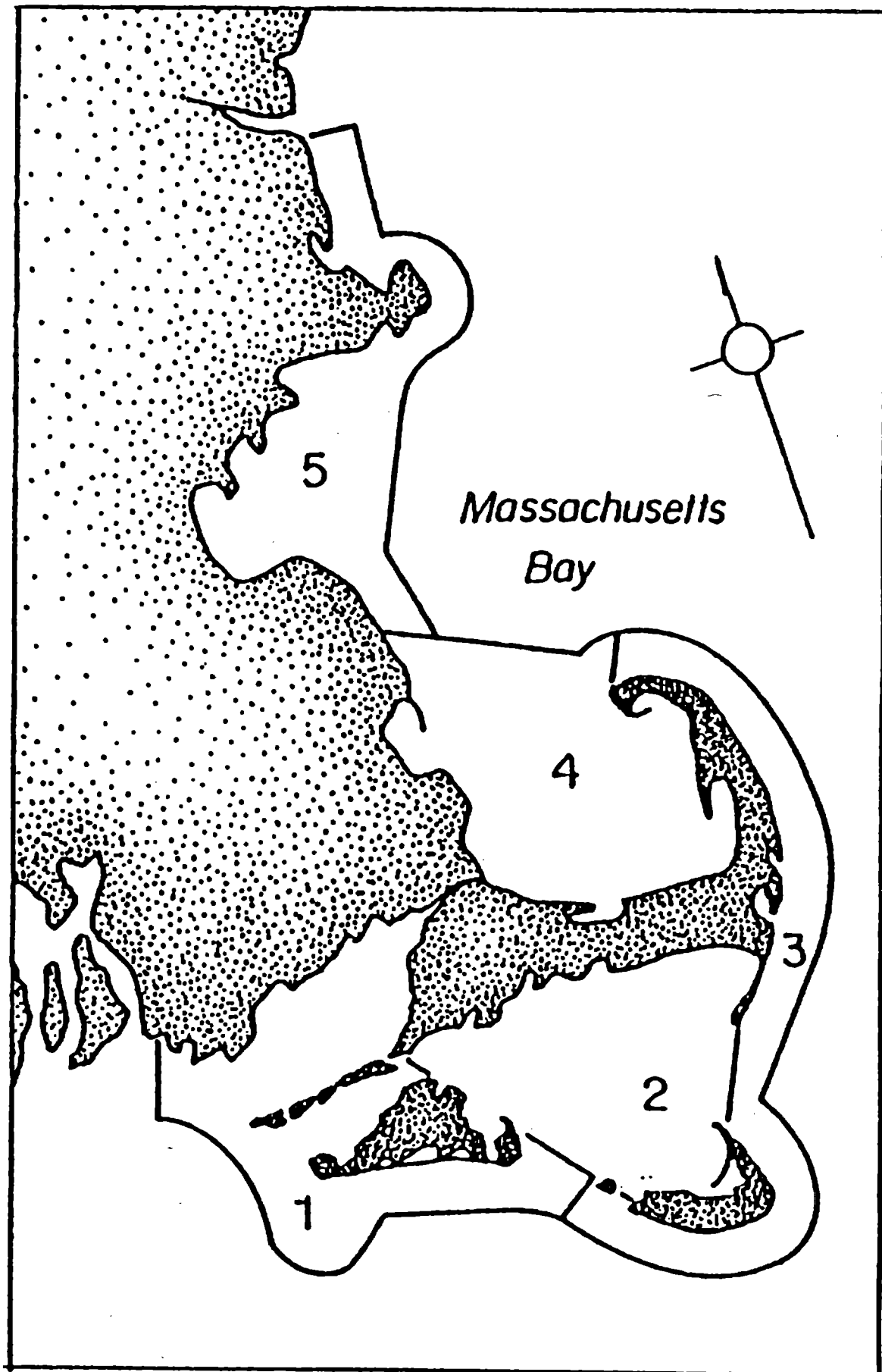


Figure 4. Areas sampled during Commonwealth of Massachusetts DMF spring inshore bottom trawl surveys.

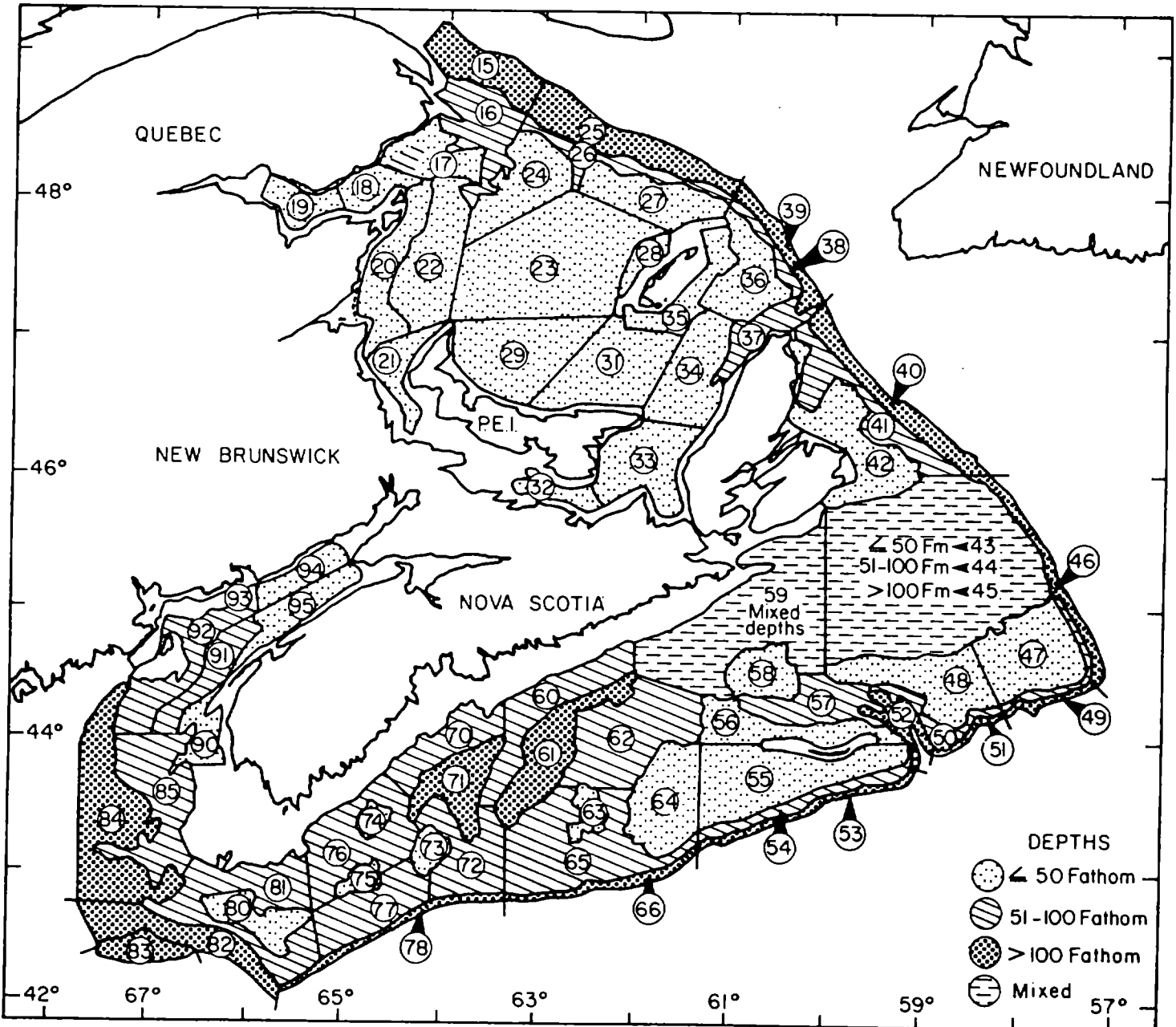
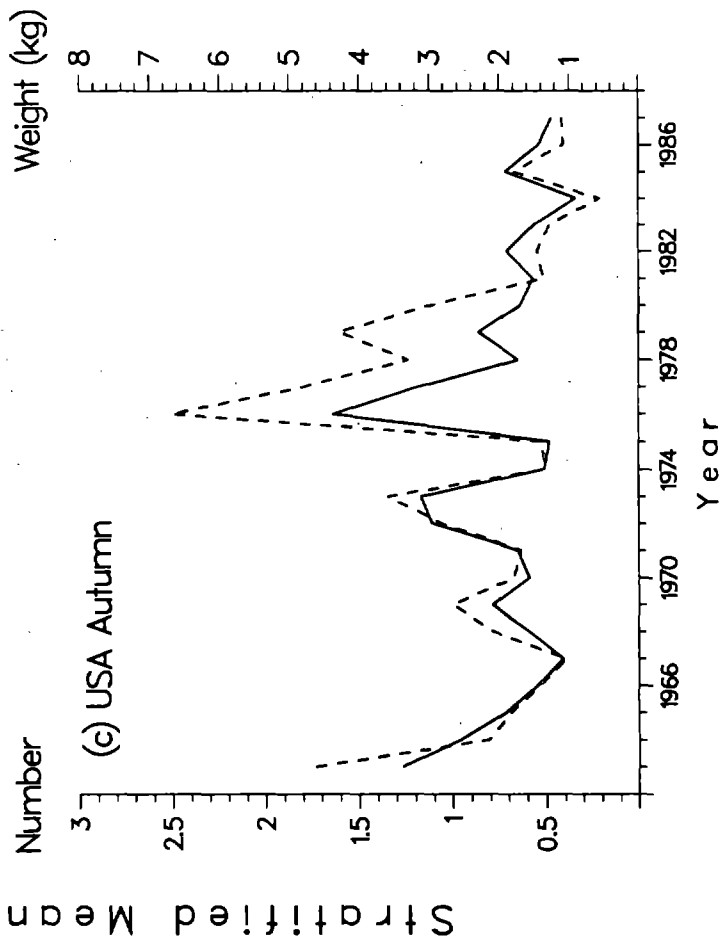
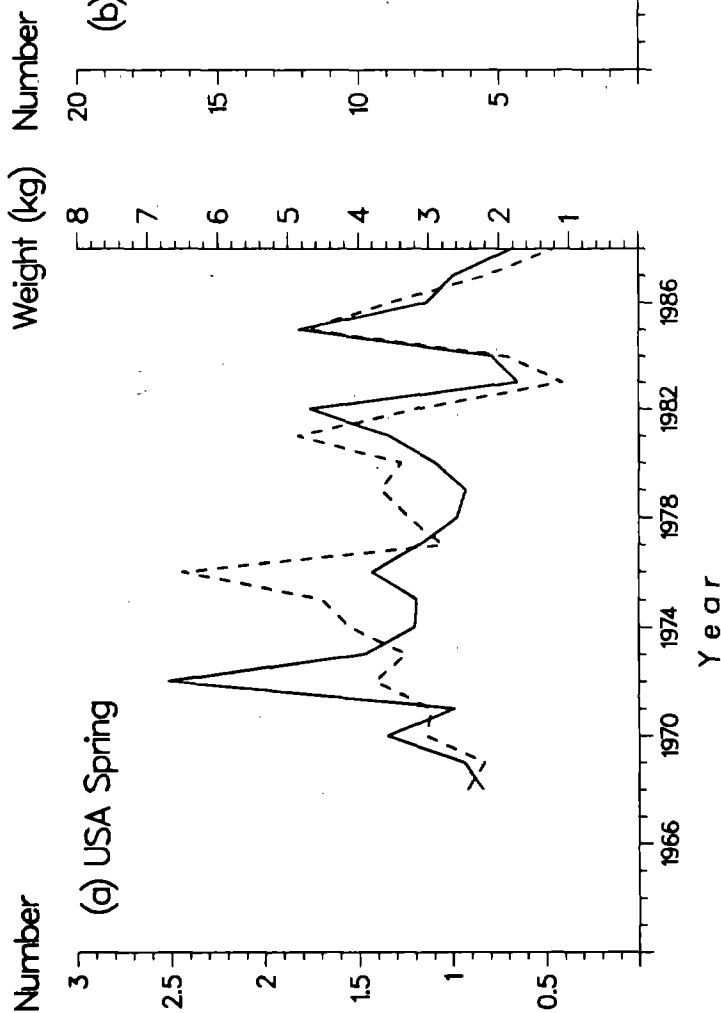
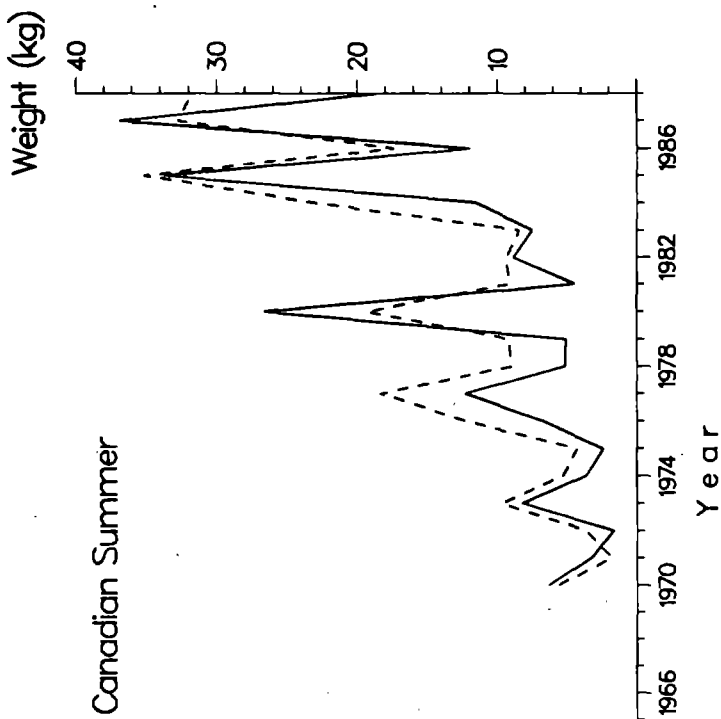


Figure 5. Strata sampled during Canadian DFO summer bottom trawl surveys.



Legend

— Mean Number per Tow

- - - Mean Weight (kg) per Tow

Figure 6. Trends in stratified mean catch per tow in numbers and weight for pollock derived from USA spring and autumn, and Canadian summer bottom trawl surveys conducted in NAFO Divisions 4VWX and Subareas 5 and 6, 1963 to 1988.