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**2001 Evaluation of 4VWX Herring**

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**Évaluation des stocks de hareng dans  
4VWX en 2001**

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## Abstract

Fishery, sampling, acoustic surveys and research results were compiled and used to evaluate the status of herring in the NAFO Division 4VWX area. Spawning stock biomass (SSB) was estimated from acoustic surveys of spawning grounds to be about 463,000t, similar to the previous three years. Age composition has expanded in recent years but the population contains a small fraction of fish older than the 1992 year-class (age 8). Juvenile herring dominated the fishery in 2000 at age 2. The 1995 year-class (age 5) was also prevalent. Larger amounts of spawning fish were documented in Scots Bay but fewer herring were recorded on German Bank and on Trinity Ledge spawning areas than in recent years. Spawning was again absent on the Seal Island grounds.

The 2000 herring fishery on the Scotian Shelf banks landed 2,182t, the lowest in the recent five years of fishing. Catches were primarily in June and on 'The Patch'. The July bottom trawl survey, with the last 3 years the highest on record, continued to indicate a general high abundance and widespread distribution of herring on the banks west of Sable Island.

Changes to management and recent research efforts have improved the knowledge of the fishery in four coastal Nova Scotia spawning areas, but there remains a problem of a lack of biological and fishery information for much of this component. There is continued concern for the status of the Bras d'Or Lakes spawning herring.

## Résumé

On a compilé les résultats de la pêche, de l'échantillonnage, des relevés acoustiques et de la recherche pour évaluer l'état des stocks de hareng dans les divisions 4VWX de l'OPANO. La biomasse du stock reproducteur (BSR-SSB), estimée à partir de relevés acoustiques des frayères, est d'environ 463 000 t, un chiffre équivalant à celui des trois dernières années. La composition par groupes d'âge s'est améliorée au cours des dernières années, mais la population contient toujours une petite fraction de poissons d'une classe d'âge antérieure à celle de 1992 (âgés de 8 ans). Les juvéniles d'âge 2 ont dominé la pêche en 2000. La classe d'âge 1995 (âge 5) était également dominante. Des quantités plus importantes de poissons en train de frayer ont été signalées dans la Scots Bay, mais moins de poissons que les dernières années ont été décelés sur le banc German et dans les frayères de Trinity Ledge. Il n'y a toujours pas eu de fraye sur les aires de l'île Seal.

En 2000, les débarquements de hareng sur les bancs de la Plate-forme Scotian ont atteint 2 182 t, le niveau le plus bas des cinq dernières années. Les prises ont surtout été capturées en juin et à l'endroit appelé « The Patch ». Le relevé au chalut de fond en juillet, les trois dernières années ayant été les plus prolifiques jusqu'à maintenant, a continué d'indiquer une augmentation générale de l'abondance et une distribution étendue du hareng sur les bancs ouest de l'île de Sable.

Grâce aux changements apportés à la gestion et aux récents efforts de recherche, on a une meilleure connaissance de la pêche dans quatre frayères côtières de la Nouvelle-Écosse, mais on manque encore de données biologiques et halieutiques sur une grande partie de ce secteur. L'état des reproducteurs du lac Bras d'Or continue d'être préoccupant.

# 2001 Evaluation of 4VWX Herring

## 1) Background and Context

### 1.1 Objectives and Management

The fisheries for herring in NAFO Divisions 4VWX in 2000 were conducted under the 1999-2001 Scotia-Fundy Herring Integrated Fisheries Management Plan (DFO 1999a). The main principle stated in this plan is “*the conservation of the herring resource and the preservation of all of its spawning components*”.

Three conservation objectives were specified in the plan:

To maintain the reproductive capacity of herring in each management unit:

- persistence of all spawning components in the management unit;
- maintenance of biomass of each spawning component above a minimum threshold;
- maintenance of a broad age composition for each spawning component; and
- maintenance of a long spawning period for each spawning component.

To prevent growth overfishing:

- continue to strive for fishing mortality below  $F_{0.1}$ .

To maintain ecosystem integrity/ ecological relationships (“ecosystem balance”).

For the purposes of evaluation and management, the 4VWX herring fisheries are divided into four components (Fig. 1):

1. SW Nova Scotia/Bay of Fundy spawning component
2. Offshore Scotian Shelf Banks spawning component
3. Coastal (South Shore, Eastern Shore and Cape Breton) spawning component; and
4. SW New Brunswick migrant juveniles.

The Georges Bank spawning component (Fig. 1) is not included in this evaluation except to document Canadian herring landings from there (Table 1).

As each component has several spawning areas, there has been an attempt to spread the fishing effort appropriately among spawning areas. The “in-season” management process, first implemented in the southwest Nova Scotia fishery during 1995 (DFO 1997, Stephenson et al. 1996, 1999a) has continued to be used

within the 4VWX management area. The approach encourages surveying of components using the commercial fleet under scientific direction prior to fishing to ensure that effort is distributed appropriately among various components of the stock (particularly among spawning components) according to their relative size and current state.

Collaborative research efforts with the fishing industry were reduced compared with recent years (Paul 1998, 1999). The Pelagics Research Council was dissolved. A major portion of the herring industry (including the purse seine sector and major processors) formed the Herring Science Council, and some members of the fixed gear sector began forming a separate Joint Project Agreement. Unfortunately, there were no formal agreements in place during the 2000 fishery. The herring industry continued to provide sampling and the purse seine sector undertook key acoustic surveys – but initiatives such as tagging, summary of fleet activities, and analysis of acoustic records from fishing trips, were reduced or eliminated.

Progress in the Scotia-Fundy herring tagging program (Waters et al 2000) was restricted to two general locations. Approximately 34,000 tags were released in January 2000 and 2001 off Chebucto Head, near Halifax and 4,500 tags were applied in New Brunswick weirs in Sept. 2000. Returns have been limited so far to 173 tags returned (Appendix 1). Further analysis is planned after the fish have been at large for a longer period (i.e. the next assessment review).

Overwintering aggregations of herring off Chebucto Head were surveyed in January 2000 and again in January 2001. In January 2000, the maximum estimate of biomass was 103,000t and the fishery took approximately 1,000t (Melvin et al 2000) of predominantly ages 3 and 4 (1997 and 1996 year-classes). In 2001 the acoustic estimate was 158,000t, but only 700t of a 2,235t allocation were removed before the fish left the area (Melvin et al 2001).

## **1.2 Context for Stock Status Evaluation**

- A review of conservation objectives undertaken in 1997 (Sinclair 1997), led to the definition of three objectives and to further definition of criteria related to spawning areas (DFO 1999b).
- The location and timing of major spawning areas is known from historical fishing records and this has been used to define the times and locations of surveys which will give year-to-year records of biomass on each spawning ground (Melvin and Power 1999).
- Biomass estimates for major spawning grounds have been derived from industry surveys conducted by commercial vessels using quantitative sounder

recording systems under scientific direction (Melvin and Power 1999, Melvin et al 2001).

- Age composition has been related to the expected distribution under  $F_{0.1}$  fishing and constant average recruitment.
- Attributes relating to the 'normal' distribution and fishing patterns have been derived from fleet activity reports that summarize industry information (Paul 1998). Observations in some years have indicated anomalies in herring behavior, distribution and condition (fat content), apparently coincident with environmental (temperature) conditions (Harris and Stephenson 1999, Stephenson et al 1999b).

In recent years, negative and mixed signals have prompted caution in establishment of the TAC and in the management of the fishery. Effort has been made to compile relevant information from areas that have received less research effort and are less well documented, particularly the coastal Nova Scotia (Clark et al 1999) and Scotian Shelf (Harris and Stephenson 1999) spawning components.

## **2) SW Nova Scotia/Bay of Fundy Spawning Component (SWNS/BOF)**

### **2.1 The Fishery**

The common herring fishing areas and their definition by groupings of 10 mile squares (= 10 minute squares of latitude and longitude) are shown in Figures 2 to 4. The 2000 TAC for the SW Nova Scotia/Bay of Fundy spawning component was established at 100,000t, a decrease of 5,000t from the previous year (Fig. 5). Eighty percent of the TAC was allocated to the mobile gear sector and 20% to the fixed gear sector as has been done historically (DFO 1999a). In addition a small portion of the mobile gear sector quota was held back until the vessels contributed to surveying.

Total landings from the SWNS/BOF spawning component in 2000 (85,284t) were slightly higher than 1998 (77,027) and 1999 (77,552t) (Tables 1 and 2). Landings by the purse seine sector (83,760t) were approximately 13,000t greater than in 1999. Landings by both the gillnet sector (823t) and the Nova Scotia weirs (701t) were very small and considerably lower than in 1999. Failure to catch the quota can be attributed exclusively to the low catches by the fixed-gear sector.

The temporal and spatial distribution of the purse seine fishery was generally as expected, but there were some changes in the relative distribution of effort. The largest purse seine fisheries occurred on the German Bank and Scots Bay spawning grounds, and on summer feeding fish around Gannet/Dry Ledge, off Long Island, N.S. and around Grand Manan (Fig. 6; Tables 3 and 4). Catches in

Scots Bay and around Grand Manan were considerably higher than in the previous year; while catches in the Long Island area and around Trinity ledge were lower. In 2000 there was only a limited fishery for herring during the winter months in Chedabucto Bay, where during the 1970's and 1980's a larger fishery took place on over-wintering aggregations. There was a limited amount of fishing on the large aggregations of overwintering herring in January 2000 and 2001 off Halifax Harbour (Chebucto Head).

The gillnet fishery took place in the traditional areas, in June on the Spectacle Buoy area and in August/Sept. on Trinity Ledge (Fig. 7) but the decline in catch, noted in recent years, continued (Table 2). Reduced landings in the gillnet sector were related primarily to reduced effort caused by lack of market and/or price.

The reduced catch in the Nova Scotia weirs (Table 2; Fig. 8) was unexpected. Monthly catch figures (Table 5) show that almost no herring were taken in May and June when landings have traditionally been greatest. No herring were taken from weirs inside St. Mary's Bay – weirs that have traditionally fished well early in the season. The number of licensed weirs was lower than in past years, but was constant from 1999 to 2000. The market was good during May and June 2000 when the fishery traditionally had its highest landings from St. Mary's Bay and the Long Island. At the same time (and throughout the summer) the purse seine fleet was able to find herring off Long Island and southeast of Grand Manan.

## **2.2 Resource Status**

### Acoustic Surveys

Acoustic surveys were undertaken on the major spawning areas and in some of the major fishing areas using acoustic equipment mounted on commercial vessels, supplemented upon occasion by research vessels. Sonars and sounders of the purse seine fleet, and sounders of the gillnet fleet were used to document the number, location and approximate size of herring schools. Eight acoustic recording devices (five permanently aboard purse seiners, two on gillnet vessels and one mobile unit) allowed the logging of quantitative data for later analysis. Data were collected during "structured surveys" (following the survey plan proposed by Melvin and Power 1999) and from many fishing trips (Melvin et al 2001). Biomass estimates were made using a standard length to target strength relationship and the method used in recent assessments (Melvin et al 1998, 1999, 2000).

Adherence to the survey methodology was considered the best in the four years that this type of approach has been used with good coverage of most grounds and proper survey design, but there was incomplete coverage of Trinity Ledge. Acoustic surveys from the spawning grounds documented approximately 463,000t of spawning herring (Table 6; Melvin et al 2001).

## Sampling and Catch at Age

Comprehensive biological sampling continued with substantial involvement of the fishing industry in sample collection. The distribution of samples is presented in Table 7 and the sources of samples are shown in Table 8. Samples were widespread geographically (Fig. 9) as in the past but this is mostly due to research vessel survey coverage during the spring and summer.

Consistent with previous assessments, the catch at age was constructed using the MFD 'Catch at Age' application (version 6.23) which is a Marine Fish Division windows program for computing catch at age statistics as part of the stock assessment process. The catch at age statistics were calculated from length frequency and age length key samples. The various forms that make up Catch at Age were used to group or combine the Age Length Keys, group or combine the Length Frequencies and then apply Age Length Keys to Length Frequencies to produce Catch at Age statistics. Data files used by 'Catch at Age' were created with the 'CATCHFRM' application. CATCHFRM was used to select fish sample data from the Pelagic samples database. Data are selected from the specified databases with selection criteria provided via the CATCHFRM forms. These results include a 2% adjustment for the shrinkage due to freezing on the length measurements for frozen samples (Hunt et al. 1986).

The length-weight relationships which are also required as input to the 'Catch at Age' application were calculated using the FORTRAN program HERNLW as in the past.

Age composition was related to the expected distribution under  $F_{0.1}$  fishing and constant average recruitment (Fig. 10).

The 1995 year-class (age 5) was prevalent in the overall catch in the 2000 fishery as predicted (Table 9; Fig. 11,12) but unexpectedly the 1998 year-class was dominant at age 2. The 1998 year-class made up over 48% of the numbers and over 26% of the weight of herring landed. These young fish were taken primarily south of Grand Manan in areas 5Yb and 4Xs and mid-Bay of Fundy off the Nova Scotia Long Island shore in area 4Xr (Table 10; Fig. 13). This high fraction of juvenile fish in the catch has not been seen since 1978. It is more typical of the 1960's and early 1970's when there was a directed fish meal fishery (Table 11,12; Fig. 14). There remains very few fish older than the 1992 year-class (age 8).

The average weights at age (shown in Table 13 and Fig. 15) were within the range of data observed historically for ages 3+. Ages 1 and 2 were higher than normal and this is attributed to the fact that they are calculated as fishery weighted and would be biased by the high proportion of age 2 fish in the 4X fall/winter fishery (Fig. 12). In addition very few age 1 fish are actually sampled for weight and age (fewer than 50 fish for age 1 in 2000).



## **2.3 Outlook**

Acoustic surveys documented approximately 463,000t of herring on spawning grounds. This is considered to be a minimum estimate of spawning stock biomass. Although there were differences in survey coverage from year to year, progressively fewer fish have been documented each year since 1997 (Melvin et al 2001).

Surveys and fishing confirmed the presence of large aggregations of herring on German Bank and in Scots Bay. More herring were documented in 2000 in Scots Bay than in either of the two previous years, but less in other spawning areas. Almost no herring were documented on Trinity Ledge. While survey coverage of that area was poor, it remains obvious that the SSB observed at Trinity Ledge in recent years remains far below historic levels. German Bank was surveyed well in 2000, and the reduction in recorded biomass, compared with earlier years, is of concern. There remains concern over the lack of spawning in the traditional Seal Island area and the limited spawning at Spectacle Buoy.

Fishery information shows the presence of substantial amounts of herring in some areas other than spawning grounds. Herring were abundant on summer feeding areas off south-west Nova Scotia and Grand Manan. Substantial numbers were documented on an overwintering aggregation off Halifax in January. Fewer herring were available to the weir fisheries of Nova Scotia and New Brunswick – particularly early in the year in May and June.

Far more herring were taken at age two than was expected (Fig. 10,11). This is presumed to have been due to the shift in distribution of effort to the large summer feeding aggregation which occurred southeast of Grand Manan, the presence of markets that would accept small fish (for canned herring and for bait), and the lack of landings from weirs (on both sides of the Bay of Fundy).

In recent years it was argued that the spawning stock biomass had increased from the low in 1994 and had been above 500,000t, and that age composition had been improving. During the 1999 fishery assessment there was discussion that the increase in SSB implied by the acoustic surveys was not consistent with the development of catch at age in a VPA, and that the biomass might have been lower than 500,000t. The current estimate from acoustic surveys of SSB in 2000 is about 465,000t.

In recent assessments of the SWNS/BOF spawning component it has been suggested that fishing mortality should remain below  $F_{0.1}$  (about 20% exploitation rate) for a number of years in order to rebuild spawning stock biomass in all spawning areas and expand age composition. It has been stated several times that these improvements in stock status would take time. This evaluation suggests that there has been a recent deterioration rather than improvement in stock status. It is

suggested that the catches in 2001 should be reduced to below the catches in recent years (about 80,000t).

## **2.4 Management Considerations**

The in-season management approach, which spreads the effort in the fishery spatially and temporally among spawning components, is seen as beneficial in achieving the objectives related to maintaining spawning potential (Stephenson et al 1999a). The “survey, assess, then fish” protocol is effective in spreading the catch appropriately among spawning components in proportion to their relative size and should be strictly adhered to particularly on Trinity Ledge where the SSB was demonstrated to be low in both 1999 and 2000.

Acoustic surveys have become critical to stock status evaluation. Where surveys occurred in 2000 they conformed well to the proposed survey design. It is important that there be continued attention to survey coverage and design, in order to develop year-to-year consistency in these surveys as has been proposed (Melvin and Power 1999).

## **3) Offshore Scotian Shelf Banks Spawning Component**

### **3.1 The Fishery**

A foreign fishery during the period 1963-1973 is estimated to have removed as much as 60,000t per year from the offshore Scotian Shelf banks (Table 2) (Stephenson et al 1987). There had been little effort or herring catch after the extension of jurisdiction in 1977 until 1996 when a fishery was initiated by the 4WX purse seine fleet and 11,745t was taken.

The 2000 fishery on Scotian Shelf Banks was smaller than in previous years, with landings amounting to a little over 2,100t (Table 2). Fishing took place primarily in June, in the vicinity of The Patch (Table 1; Fig. 16). The maximum acoustic biomass assessed from fishing vessels working in the area was 1,500t on June 19 (Melvin et al 2001).

In 2000 there continued to be a by-catch in the domestic bottom trawl fishery on the Scotian Shelf edge and slope, but the amount (87t) was considerably less than in 1999 (Table 1).

The offshore purse seine catch was dominated by 1993 and 1994 year classes (ages 6 and 7) (Table 14, Fig. 17). The same year classes were dominant in 1999.

## **3.2 Research Vessel Surveys**

### July Bottom Trawl Survey

The summer bottom trawl survey showed few herring on the Scotian Shelf during the 1970's, increasing amounts during the 1980's and a relatively widespread distribution in recent years (Harris and Stephenson 1999, Stephenson et al 2000). Offshore herring catches during the 2000 July bottom trawl survey were the third highest in the 31-year time series with an average of 125 fish per standard tow (Table 15, Fig. 18) for strata 55 through 78 (Fig. 19). While the 2000 catches of herring in the survey were considerably lower than in 1999, survey results of the past three years have been the highest on record in the 18 years in which the same methods have been used (Fig. 18). Herring were again widely distributed on banks west of Sable Island (Fig. 20).

### October Herring Acoustic Research Survey (Alfred Needler)

A survey of the eastern portion of the Scotian Shelf Oct 20-28 (NED2000-58) documented approximately 2,200t of large herring (mean length 31.5cm) on southern Western Bank (Melvin et al 2001).

Large concentrations of fish were also observed in Chedabucto Bay just prior to the beginning of the fall purse seine fishery. Estimates of 4,200t and 79,200t were made for the two survey blocks in this area. These fish had a mean length of 29.8cm.

### Midwater Trawler Observations

A single vessel, equipped with a mid-water trawl made several trips to offshore areas from April through November and recorded sightings of herring (Fig. 21). Most of the information is of more relevance to Georges Bank than to the offshore Scotian Shelf banks. Herring were observed on The Patch, German Bank, Browns Bank as well as in transit to and from fishing grounds on Georges Bank.

## **3.3 Resource Status and Outlook**

Landings in the foreign fisheries of 13,000t to 60,000t between 1969 and 1973 did not appear to be sustainable. The results of recent annual summer bottom trawl surveys demonstrate that there is a considerable abundance of herring, widely spread over the offshore banks of the Scotian Shelf in July. Past information (Harris and Stephenson 1999) indicates the presence of at least some autumn spawning on Western Bank in recent years. There is very little new information to add and no reason to change the previous recommendations that:

- The initial catch level should not exceed the 12,000t reference value used in the recent fishing plans.
- There continues to be the need for industry surveys to estimate abundance.

### **3.4 Management Considerations**

There is insufficient documentation of stock size, distribution and spawning behaviour for this component. Industry, Science and Management are encouraged to continue to work together to improve the biological basis for management.

## **4) Coastal (South Shore, Eastern Shore and Cape Breton) Nova Scotia Spawning Component**

### **4.1 The Fishery**

There has been an increase in the number of active gillnet licenses in recent years. This was the fifth year for a fishery on spawning fish east of Halifax and the fourth year of gillnet roe fisheries off Little Hope and Glace Bay.

Recorded landings in the four major gillnet fisheries along the coast of Nova Scotia (4,283t) were lower than in 1999 and approximately the same as in 1998 (Table 16).

#### Little Hope

The fishery in the Little Hope area occurred in September and October. A total of 2,043t of herring was landed. A biomass estimate of 5,200t was made from an automated acoustic recorder during the fishery. No samples were taken for biological analysis and length samples were limited. The catch was composed of the 1992 and 1993 year classes (age 6 and 7) (Table 17, Fig. 22).

#### East of Halifax

The roe fishery in September and October had landings of 1,350t. Sampling was very limited, but indicated that the catch was composed primarily of 1993-1994 year-classes (ages 7-8) (Table 17, Fig. 23). Acoustic surveys undertaken by Eastern Shore Fishermen's Protective Association on four nights in October resulted in an SSB estimate of 10,865t (Melvin et al 2001).

## Glance Bay

The fishery off Glance Bay, Cape Breton took place in September and October with landings of 834t. Fish aged 7 (1993 year-class) and age 8 (1992 year-class) dominated the catch (Table 17, Fig. 24). There were no surveys.

In the July groundfish survey stratum 42 (Fig. 19) covers the area of 4Vn that includes the fall roe fishery off Glance Bay. In 1999, herring catches by number from this stratum were the highest in the past ten years (1,605 herring caught, average of 229 herring per set) and the catches by weight were the highest since 1994 (Table 18). Catches were also greater than the overall averages for the 1970s, 1980s and 1990s. It should be noted that there is a great deal of annual variability in the numbers and weights of herring caught in this survey. In 2000 overall catches of herring in this stratum were reduced and below the historical averages for the last 3 decades.

## Bras d'Or Lakes

The fishery was technically closed, but a limited number of fishers were allowed to set nets for samples and could retain their catches. Fishing began about the last week of March and ended the first week of May 2000. Effort was concentrated (by regulation) outside of spawning areas. A concerted and co-ordinated effort was made by local fishers and their families, the Eskasoni Fish and Wildlife Commission, and the Department of Fisheries and Oceans to sample in this area. In about six weeks more than 12,000 herring were measured in length frequency determinations and 581 fish were collected for determination of age, length, weight, sex and maturity.

The 1993 year-class (age 7) and 1994 year-class (age 8) dominated the catches (Table 17, Fig. 25). Sampling demonstrated that for most of the fishery, the catch was composed primarily (90%) of autumn spawners. Spring-spawning herring made up only a small fraction of herring caught in several areas that had in the past been known spawning areas (including Groves Point, Malagawash). There was evidence of substantial numbers of spring spawners in only two areas, Baddeck Bay and Eskasoni Harbour.

Spatial herring surveys were undertaken on April 15, 18 and 28 on Bras D'Or Lake, and Great Bras d'Or Lake surveys were undertaken on April 18 and 19 with a small seiner and a gillnet vessel. The estimate of spring spawning herring documented in the surveys was less than 70t (Melvin et al 2001). Two successful purse seine sets were made above the Seal Island bridge. Attempts to tag spawning fish were unsuccessful.

## 4.2 Outlook

Inshore fisheries in Glace Bay, East of Halifax and Little Hope, primarily for roe, have developed since 1996. As these fisheries progressed, participants have contributed to sampling and surveying and the fisheries have attempted to follow the 'survey, assess, fish' protocol. The results of the fisheries in 2000 demonstrate that there needs to be better coordination of surveys and sampling.

This management approach and recent research efforts have improved knowledge in these three areas, but there has been little advancement in knowledge in adjacent areas. The lack of knowledge on the specifics of stock structure, lack of documentation of the historical fishery, and limited survey information preclude evaluation of current fishing mortality for much of this component. Individual spawning groups within this component are considered vulnerable to fishing because of their relatively small size and proximity to shore. As in the past four years, it is recommended that:

- *“no coastal spawning area should have a large effort increase until much more information is available on the state of that spawning group. There should be no new fisheries developed when there is uncertainty regarding stock composition and degree of mixing”* (DFO 1999b, DFO 2000).

It has been noted since 1997 that the status of herring in the Bras d'Or Lakes is cause for concern. The information gathered in 2000 does not indicate improvement. Spawning is still absent from some traditional areas and the observed biomass of spring spawners is very low. For the fourth year it is therefore appropriate to advise that:

- *“Given continued deterioration in signals from the Bras d'Or Lakes fishery it is preferable, from a biological perspective, that no fishing take place on this spawning component”* (DFO 1999b, DFO 2000).

## 4.3 Management Considerations

In coastal Nova Scotia there is no overall quota, and the size and historical performance of various spawning groups are poorly documented. In addition to traditional fisheries for bait and personal use there are new directed roe fisheries on the spawning grounds. The “survey, assess, then fish (<10%)” protocol is considered useful for spawning components that have a history of biomass estimates and are considered to be healthy and of sufficient size, but is not practical for all coastal spawning groups.

## **5) SW New Brunswick Migrant Juveniles**

The southwest New Brunswick weir and shutoff fishery has relied, for over a century, on the aggregation of large numbers of juvenile herring (ages 1-3) near shore at the mouth of the Bay of Fundy. These have traditionally been considered to be juveniles of mixed origin, dominated by fish from Subarea 5 spawning components, and have therefore been excluded from the 4WX quota. Mature herring (ages 4+) taken in this fishery are historically considered to be of 4WX origin.

The number of active weirs has decreased over the past decade, due in part to the conversion of sites to aquaculture and poor catches in some local areas resulting in weirs not being rebuilt (Table 19). The distribution of weirs has also been reduced especially over the past decade in the Passamaquoddy Bay area and along the Bay of Fundy shore (Fig. 26). The 2000 catch of 16,829t for N.B. weir and shutoff gears was a little lower than in 1999 and below the long term average (Tables 1 and 2, Fig. 27). Landings were particularly low early in the season, with almost no weir landings in May and June (Table 5).

The spatial and temporal distribution of catches were similar to those of recent years (Table 20; Fig. 8 and 25).

Sampling of this fishery has been extensive (Table 7). The 2000 catch was dominated by the 1998 year-class (age 2) which made up over 75% of the catch by number and by weight (Table 20; Fig. 28).

The recent US management plan (NEFSC 1998) assumes that all of the juvenile herring from this fishery originate from the US "coastal complex" (5Y + 5Z) which is reported to be at record high levels of abundance.

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Table 1. 4VWX herring fishery landings (t) by month, gear sector and management unit for 2000 (calendar year).

	Area	Gear	Month												Total	
			1	2	3	4	5	6	7	8	9	10	11	12		
<b>Coastal Nova Scotia</b> (South Shore, Eastern Shore, Cape Breton)	4Vn	Trap					18	16								34
		Bras d'Or Gillnet				50	6									56
		Glace Bay Gillnet									602	232				834
		Other					1	0	0	0						2
	4W	Eastern Shore Gillnet									433	917				1,351
		Trap						36								36
	4X	Little Hope Gillnet										2	2,042			2,043
		Trap								23						23
	4VWX	Misc. Gillnet					0		0	0	9	32	5			46
		Misc.					0	0	0							0
<b>Coastal Nova Scotia Total</b>						50	25	52	0	24	1,046	3,223	5			4,425
<b>Offshore S.S.</b>	4WX	Offshore P. Seine				2	171	1,852	69	1						2,095
		Bottom Trawl	1	3	7	1	10	19	32	5	4	2	3	1		87
<b>Offshore S.S. Total</b>			1	3	7	3	181	1,871	101	6	4	2	3	1		2,182
<b>S.W. Nova Scotia</b>	4W	Fall/Winter P. Seine	1,002												10	1,012
	4X	Fall/Winter P. Seine	259									2,636	1,843			4,738
		Summer P. Seine				80	2,187	6,605	18,306	21,669	18,965	10,198				78,010
		Gillnet "Stock"						80	2	7	733					823
		N.S. Weirs						16	151	344	191					701
<b>S.W. Nova Scotia Total</b>			1,261			80	2,187	6,701	18,459	22,020	19,890	12,834	1,843	10		85,284
<b>Migrant Juveniles</b>	4X	N.B. Weirs					10	7	2,125	7,578	4,968	1,715	69			16,472
		N.B. Shutoff								33	155	113	57			357
<b>Migrant Juveniles Total</b>							10	7	2,125	7,611	5,122	1,828	126			16,829
<b>Georges Bank</b>	5ZE	5Z Purse Seine					1	1		257			6			265
		Midwater Trawl								10						10
<b>Georges Bank Total</b>							1	11		257			6			275
												<b>Total</b>	108,995			

Table 2. Historic series of nominal and adjusted annual landings (t) by major gear components and seasons of the 4WX herring fishery, 1963-2000 (the 1963-73 Offshore Scotian Shelf landings are from Stephenson et al. (1987)).

Year <sup>^</sup>	4W		4Xs	4Xqr	4X	4Xr	4WX	4WX	4WX	Non-Stock	Offshore	Total
	Winter Purse Seine	Fall&Winter Purse Seine	Summer Purse Seine	Summer Gillnet	Summer Weir	Stock Nominal Landings	Stock Adjusted Landings*	Stock TAC	Weir and Shutoff	Scotian Shelf Banks	4WX Adjusted Landings	
1963			6,871	15,093	2,955	5,345	30,264	30,264		29,366	3,000	62,630
1964			15991	24,894	4,053	12,458	57,396	57,396		29,432	2,000	88,828
1965			15,755	54,527	4,091	12,021	86,394	86,394		33,346	6,000	125,740
1966			25,645	112,457	4,413	7,711	150,226	150,226		35,805	2,000	188,031
1967			20,888	117,382	5,398	12,475	156,143	156,741		30,032	1,000	187,773
1968			42,223	133,267	5,884	12,571	193,945	196,362		33,145	18,000	247,507
1969	25,112	13,202	84,525	3,474	10,744	137,057	150,462			26,539	121,000	298,001
1970	27,107	14,749	74,849	5,019	11,706	133,430	190,382			15,840	87,000	293,222
1971	52,535	4,868	35,071	4,607	8,081	105,162	129,101			12,660	28,000	169,761
1972	25,656	32,174	61,158	3,789	6,766	129,543	153,449			32,699	21,000	207,148
1973	8,348	27,322	36,618	5,205	12,492	89,985	122,687			19,935	14,000	156,622
1974	27,044	10,563	76,859	4,285	6,436	125,187	149,670			20,602		170,272
1975	27,030	1,152	79,605	4,995	7,404	120,186	143,897			30,819		174,716
1976	37,196	746	58,395	8,322	5,959	110,618	115,178			29,206		144,384
1977	23,251	1,236	68,538	18,523	5,213	116,761	117,171	109,000		23,487		140,658
1978	17,274	6,519	57,973	6,059	8,057	95,882	114,000	110,000		38,842		152,842
1979	14,073	3,839	25,265	4,363	9,307	56,847	77,500	99,000		37,828		115,328
1980	8,958	1,443	44,986	19,804	2,383	77,574	107,000	65,000		13,525		120,525
1981	18,588	1,368	53,799	11,985	1,966	87,706	137,000	100,000		19,080		156,080
1982	12,275	103	64,344	6,799	1,212	84,733	105,800	80,200		25,963		131,763
1983	8,226	2,157	63,379	8,762	918	83,442	117,400	82,000		11,383		128,783
1984	6,336	5,683	58,354	4,490	2,684	77,547	135,900	80,000		8,698		144,598
1985	8,751	5,419	87,167	5,584	4,062	110,983	165,000	125,000		27,863		192,863
1986	8,414	3,365	56,139	3,533	1,958	73,409	100,000	97,600		27,883		127,883
1987	8,780	5,139	77,706	2,289	6,786	100,700	147,100	126,500		27,320		174,420
1988	8,503	7,876	98,371	695	7,518	124,653	199,600	151,200		33,421		233,021
1989	6,169	5,896	68,089	95	3,308	83,557	97,500	151,200		44,112		141,612
1990	8,316	10,705	77,945	243	4,049	102,627	172,900	151,200		38,778		211,678
1991	17,878	2,024	73,619	538	1,498	97,010	130,800	151,200		24,576		155,376
1992	14,310	1,298	80,807	395	2,227	100,227	136,000	125,000		31,967		167,967
1993	10,731	2,376	81,478	556	2,662	98,464	105,089	151,200		31,573		136,662
1994	9,872	3,174	64,509	339	2,045	80,099	80,099	151,200		22,241		102,340
1995	3,191	7,235	48,481	302	3,049	62,499	62,499	80,000		18,248		80,747
1996	2,049	3,305	42,708	6,340	3,476	58,068	58,068	57,000		15,913	11,745	85,726
1997	1,759	2,926	40,357	6,816	4,019	56,117	56,117	57,000		20,552	20,261	96,930
1998	1,405	1,494	67,433	2,231	4,464	77,027	77,027	90,000		20,091	5,591	102,709
1999	1,235	4,764	64,432	1,660	5,461	77,552	77,552	105,000		18,644	12,646	108,842
2000	1,012	4,738	78,010	823	701	85,284	85,284	100,000		16,829	2,182	104,295

<sup>^</sup>Annual landings by purse seiners are defined for the annual plan period from October 15 of the preceding year to October 14 of the current year.  
All landings by other gear types are for the calendar year.

Table 3. Summary of herring purse seine catches (t) from 1984 to 2000 by year and fishing grounds.

S.W. Nova Grounds	Year																	
	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Browns Bank			732						86		1,903	1,554	40	14	2,967	2,197	1,137	
Chedabucto Bay	490	3,887	4,607	910	4,097	3,369	8,620	10,641		1,325	1,407	2,049	1,759		1,583	1,151	20	
Gannet, Dry Ledge		5,675	2,187	1,474	14,901	2,010	4,213	6,294	18,527	2,935	2,588	2,693	1,963	4,590	4,489	10,296	12,674	
German Bank		15,522	13,346	16,547	18,392	8,087	11,744	23,193	3,235	4,045	9,662	19,549	15,898	13,576	20,698	24,660	25,596	
Grand Manan	372	4,989	5,823	4,298	4,440	4,300	5,442	4,225	2,722	783	6,846	5,297	6,005	5,312	15,682	7,912	22,222	
Long Island		974	3,365	7,499	10,722	21,719	18,484	9,470	3,213	2,814	7,666	7,906	4,385	3,557	12,476	18,286	11,602	
Lurcher		476	132		2,928	18	65	151	2,141	1,560	530	382	243	599	57		754	
N.B. Coastal	384	188	621	960	1,031	3,033	2,347	488	992	598	99	1,502	271	1,176	846	1,867	361	
S.W. Grounds		558	1,108	184	181	276	56	521	225	2,961	3,444	6,205	3,035	797	1,143	3,241	1,879	
Scots Bay			36	3,822	4,145	6,583	9,003	7,982	7,987	5,258	10,840	980	8,984	4,894	8,210	1,789	10,813	
Seal Island		13,818	8,894	11,560	19,019	23,420	25,344	12,740	10,455	3,874	2,820	465	1,567	492	543	567	240	
Trinity		35,805	13,433	18,715	18,539	266	1,113	3,039	4,499	1,348	2,366	370	3,448	5,308	2,758	1,220	103	
Yankee Bank				194	250	3,647	817	119	10	175	323	9	4	219		82	133	
Unknown	45	66	3,464	5,693	3,426	4,956	4,049	2,753	3,690	193		73			84	140		
<b>4WX Stock Total</b>	<b>1,291</b>	<b>81,958</b>	<b>57,745</b>	<b>71,661</b>	<b>102,015</b>	<b>78,287</b>	<b>94,127</b>	<b>82,314</b>	<b>57,888</b>	<b>27,703</b>	<b>50,345</b>	<b>49,348</b>	<b>47,606</b>	<b>40,319</b>	<b>71,671</b>	<b>73,350</b>	<b>87,675</b>	
<b>Misc Nonstock Areas</b>																		
Georges Bank							91	64			266		2,491	79			271	
Liverpool								13		4,067	4,177							
Shelburne				59				64		526	161		56					
Halifax										652	1,945		585	455			1,002	472
Offshore Banks													11,800	18,770	4,339	8,669	1,609	
Western Hole			41	154				213	3,451	2,255	1,495	108	127	691	1,013	1,057	47	
Sydney Bight		3,511	4,250	1,751	2,100	1,330	3,591	3,606		396		3,951	4,267		52			
<b>Misc Nonstock Total</b>		<b>3,511</b>	<b>4,291</b>	<b>1,964</b>	<b>2,100</b>	<b>1,330</b>	<b>3,682</b>	<b>3,959</b>	<b>3,451</b>	<b>7,896</b>	<b>8,044</b>	<b>4,059</b>	<b>19,325</b>	<b>19,995</b>	<b>5,404</b>	<b>9,726</b>	<b>2,928</b>	<b>472</b>
<b>Overall Total</b>	<b>1,291</b>	<b>85,468</b>	<b>62,036</b>	<b>73,625</b>	<b>104,116</b>	<b>79,617</b>	<b>97,809</b>	<b>86,273</b>	<b>61,339</b>	<b>35,598</b>	<b>58,389</b>	<b>53,407</b>	<b>66,931</b>	<b>60,314</b>	<b>77,075</b>	<b>83,076</b>	<b>90,603</b>	<b>472</b>

Table 4. Summary of the percentage of herring purse seine catches from 1984 to 2000 by year and fishing grounds.

Summary of the percentage of purse seine catches from 1984 to 2001 by year and grounds

S.W. Nova Grounds	Year																2001	
	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999		2000
Browns Bank			1%						0%		3%	3%	0%	0%	4%	3%	1%	
Chedabucto Bay	38%	5%	7%	1%	4%	4%	9%	12%		4%	2%	4%	3%		2%	1%	0%	
Gannet, Dry Ledge		7%	4%	2%	14%	3%	4%	7%	30%	8%	4%	5%	3%		8%	6%	12%	14%
German Bank		18%	22%	22%	18%	10%	12%	27%	5%	11%	17%	37%	24%	23%	27%	30%	28%	
Grand Manan	29%	6%	9%	6%	4%	5%	6%	5%	4%	2%	12%	10%	9%	9%	20%	10%	25%	
Long Island		1%	5%	10%	10%	27%	19%	11%	5%	8%	13%	15%	7%	6%	16%	22%	13%	
Lurcher		1%	0%		3%	0%	0%	0%	3%	4%	1%	1%	0%	1%	0%		1%	
N.B. Coastal	30%	0%	1%	1%	1%	4%	2%	1%	2%	2%	0%	3%	0%	2%	1%	2%	0%	
S.W. Grounds		1%	2%	0%	0%	0%	0%	1%	0%	8%	6%	12%	5%	1%	1%	4%	2%	
Scots Bay			0%	5%	4%	8%	9%	9%	13%	15%	19%	2%	13%	8%	11%	2%	12%	
Seal Island		16%	14%	16%	18%	29%	26%	15%	17%	11%	5%	1%	2%	1%	1%	1%	0%	
Trinity		42%	22%	25%	18%	0%	1%	4%	7%	4%	4%	1%	5%	9%	4%	1%	0%	
Yankee Bank					0%	0%	4%	1%	0%	0%	0%	1%	0%	0%	0%	0%	0%	
Unknown	4%	0%	6%	8%	3%	6%	4%	3%	6%	1%		0%				0%	0%	
<b>4WX Stock Total</b>	<b>100%</b>	<b>96%</b>	<b>93%</b>	<b>97%</b>	<b>98%</b>	<b>98%</b>	<b>96%</b>	<b>95%</b>	<b>94%</b>	<b>78%</b>	<b>86%</b>	<b>92%</b>	<b>71%</b>	<b>67%</b>	<b>93%</b>	<b>88%</b>	<b>97%</b>	
<b>Misc Nonstock Areas</b>																		
Georges Bank							0%	0%			0%		4%	0%			0%	
Liverpool								0%		11%	7%							
Shelburne				0%				0%		1%	0%		0%					
Halifax										2%	3%		1%	1%			1%	100%
Offshore Banks													18%	31%	6%	10%	2%	
Western Hole			0%	0%				0%	6%	6%	3%	0%	0%	1%	1%	1%	0%	
Sydney Bight		4%	7%	2%	2%	2%	4%	4%		1%		7%	6%		0%			
<b>Misc Nonstock Total</b>		<b>4%</b>	<b>7%</b>	<b>3%</b>	<b>2%</b>	<b>2%</b>	<b>4%</b>	<b>5%</b>	<b>6%</b>	<b>22%</b>	<b>14%</b>	<b>8%</b>	<b>29%</b>	<b>33%</b>	<b>7%</b>	<b>12%</b>	<b>3%</b>	<b>100%</b>

Table 5. Monthly weir landings (t) for New Brunswick and Nova Scotia; 1978 to 2000.

Sum of Catch mt		Month												Grand Total
Province	Year	1	2	3	4	5	6	7	8	9	10	11	12	
N.B.	1978	3				512	802	5,499	10,275	10,877	4,972	528	132	33,599
	1979	535	96			25	1,120	7,321	9,846	4,939	5,985	2,638	74	32,579
	1980					36	119	1,755	5,572	2,352	1,016	216		11,066
	1981					70	199	4,431	3,911	2,044	2,435	1,686	192	14,968
	1982			17		132	30	2,871	7,311	7,681	3,204	849	87	22,181
	1983					65	29	299	2,474	5,382	3,945	375		12,568
	1984					6	3	230	2,344	2,581	3,045	145		8,353
	1985					22	89	4,217	8,450	6,910	4,814	2,078	138	26,718
	1986	43				17		2,480	10,114	5,997	6,233	2,564	67	27,516
	1987	39	21	6	12	10	168	2,575	10,893	6,711	5,362	703	122	26,621
	1988		12	1	90	657	287	5,993	11,975	8,375	8,457	2,343	43	38,235
	1989		24		95	37	385	8,315	15,093	10,156	7,258	2,158		43,520
	1990					93	20	4,915	14,664	12,207	7,741	168		39,808
	1991					57	180	4,649	10,319	6,392	2,028	93		23,717
	1992				15	50	774	5,477	10,989	9,597	4,395	684		31,981
	1993					14	168	5,561	14,085	8,614	2,406	470	10	31,328
	1994				18		55	4,529	10,592	3,805	1,589	30		20,618
	1995					15	244	4,517	8,590	3,956	896	10		18,228
	1996					19	676	4,819	7,767	1,917	518	65		15,781
	1997				8	153	1,017	6,506	7,396	5,316				20,396
1998					560	713	3,832	8,295	5,604	525			19,529	
1999					690	805	5,155	9,895	2,469	48			19,063	
2000					10	11	2,105	7,520	4,934	1,713	69		16,362	
N.B. Total		619	169	7	238	3,251	7,894	98,052	208,371	138,815	78,584	17,871	866	554,736
N.S.	1978				1	490	3,704	2,990	239	46	111	198	79	7,858
	1979					811	3,458	1,418	420	39	136	57		6,339
	1980					69	647	1,271	395					2,383
	1981					50	437	983	276	37		41		1,824
	1982					16	267	468	195	172	12			1,130
	1983				2	286	141	188	208	53		18		896
	1984					113	1,032	736	602	220				2,702
	1985					378	1,799	1,378	489			11		4,055
	1986					385	403	71	704	390	5			1,957
	1987					1,503	2,526	1,215	1,166	367				6,776
	1988					1,217	2,976	1,696	1,204	386				7,480
	1989					340	1,018	870	843	226				3,296
	1990					208	973	1,482	879	538	52			4,132
	1991				3	23	149	719	342	262				1,498
	1992					35	659	405	754	371				2,224
	1993					226	908	608	867	53				2,662
	1994					111	736	499	519	180				2,045
	1995					236	1,255	1,059	470	29				3,049
	1996					430	1,267	1,232	358	188				3,476
	1997					70	1,874	1,739	271	65				4,019
1998					1,304	1,677	390	359	317				4,048	
1999					1,958	1,513	547	488	31				4,537	
2000						11	151	326	191				678	
N.S. Total					7	10,258	29,429	22,115	12,375	4,161	315	326	79	79,065
Grand Total		619	169	7	245	13,510	37,323	120,166	220,746	142,976	78,899	18,197	945	633,801

Table 6. Acoustic and mapping biomass estimates for spawning components surveyed in the 4WX herring stock complex, 1997 to 2000 (from Melvin et al. 2000).

<b>Location</b>	<b>1997 Observed</b>	<b>1998 Observed</b>	<b>1999 Observed</b>	<b>2000 Observed</b>
Scots Bay	160,100	72,500	41,000	106,300
Trinity Ledge	23,000	6,800	3,900	600
German Bank	370,400	440,700	460,800	356,400
Spectacle Buoy	15,000	1,300	<b>no survey</b>	<b>no survey</b>
<b>Total</b>	<b>568,500</b>	<b>521,300</b>	<b>505,700</b>	<b>463,300</b>

Table 7. Summary of biological samples (by fishery and month) taken in the 2000 4VWX herring fisheries.

Gear	Data	Month											Grand Total	
		1	2	3	4	5	6	7	8	9	10	11		
4Vn Purse Seine	Sum of NO_LF				2									2
	Sum of NO_MEAS				487									487
	Sum of Aged				120									120
4W Purse Seine	Sum of NO_LF	1					11							12
	Sum of NO_MEAS	217					993							1210
	Sum of Aged	45					0							45
Gillnet	Sum of NO_LF			4	94	3				2	10	3		116
	Sum of NO_MEAS			372	11234	439				368	659	250		13322
	Sum of Aged			0	464	0				0	18	0		482
N.B. Purse Seine	Sum of NO_LF	12					1	17	25	51	17	1		124
	Sum of NO_MEAS	1323					101	1906	2747	7208	1774			15059
	Sum of Aged	99					0	0	4	59	17	0		179
N.B. Shut-off	Sum of NO_LF								4	1				5
	Sum of NO_MEAS								404	116				520
	Sum of Aged								0	0				0
N.B. Weirs	Sum of NO_LF						1	83	180	114	46	1		425
	Sum of NO_MEAS						103	8911	19570	13044	4833	119		46580
	Sum of Aged						0	12	64	85	116	0		277
N.S. Purse Seine	Sum of NO_LF	15				6	75	152	154	95	39	3		539
	Sum of NO_MEAS	2530				1085	9182	18744	21337	13608	4608	313		71407
	Sum of Aged	255				29	92	368	407	80	74	18		1323
N.S. Weirs	Sum of NO_LF							4	9	3				16
	Sum of NO_MEAS							449	1056	340				1845
	Sum of Aged							84	131	28				243
Resrch. Otter Trawl	Sum of NO_LF		53	29				86				8		176
	Sum of NO_MEAS			64								475		539
	Sum of Aged		749	407				906				172		2234
Resrch. MW Trawl	Sum of NO_LF										3			3
	Sum of NO_MEAS										426			426
	Sum of Aged										28			28
5Y CAN P.Seine	Sum of NO_LF					2	34			11	31	5		83
	Sum of NO_MEAS					325	3891			1628	3163	606		9613
	Sum of Aged					44	26			22	21	38		151
5Y USA P.Seine/MW	Sum of NO_LF				20	17	10	1			2	1		51
	Sum of NO_MEAS				2261	1903	1086	108			201	100		5659
	Sum of Aged				0	14	0	0			0	0		14
5Z USA P.Seine/MW	Sum of NO_LF	65	56	14				1		1		11		148
	Sum of NO_MEAS	7226	6297	1670				100		111		1168		16572
	Sum of Aged	0	0	0				0		0		82		82
5Z CAN MW Trawl	Sum of NO_LF					4	1							5
	Sum of NO_MEAS					935	154							1089
	Sum of Aged					32	16							48
5Z CAN P.Seine	Sum of NO_LF						1							1
	Sum of NO_MEAS													
	Sum of Aged						20							20
Total Sum of NO_LF		93	109	47	96	35	141	353	373	278	156	25		1706
Total Sum of NO_MEAS		11296	6297	2106	11721	5045	16327	31196	45222	36423	16139	2556		184328
Total Sum of Aged		399	749	407	584	105	168	1370	606	274	446	138		5246



Table 8. Number of herring samples collected by DFO personnel from commercial fisheries (Commercial), by members of the fishing industry (Industry), observer program (Observer), independent observers on foreign vessels (OSS) and DFO research surveys (Research).

Year	Sample Source					Total
	Commercial	Industry	Observer	OSS	Research	
1990	422			185		607
1991	448			167	1	616
1992	330			205	1	536
1993	183			421		604
1994	223			228	14	465
1995	138			244	108	490
1996	127	868	49		69	1,113
1997	78	1,443			114	1,635
1998	225	1,376			98	1,699
1999	49	1,388	89		198	1,724
2000	34	1,387	108		177	1,706
<b>Total</b>	<b>2,257</b>	<b>6,462</b>	<b>246</b>	<b>1,450</b>	<b>780</b>	<b>11,195</b>

Table 9. Herring catch at age for the 2000 purse seine, weir and gillnet fisheries conducted on the southwest Nova Scotia spawning component (4WX stock).

SW Nova Scotia Spawning Stock Component - 2000 overall catch at age (number and weight).

	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11+	Total
Catch Numbers (000's)	841	364,078	75,330	108,560	124,083	60,754	25,829	4,454	251	33	23	764,236
% number	0%	48%	10%	14%	16%	8%	3%	1%	0%	0%	0%	100%
Catch Weight (t)	22	22,159	7,150	14,929	21,163	12,487	6,079	1,196	79	12	9	85,285
% catch wt.	0%	26%	8%	18%	25%	15%	7%	1%	0%	0%	0%	100%
Avg. length (cm)	15.7	20.5	23.6	26.4	28.3	30.1	31.5	32.8	34.7	36.0	36.3	24.1 Overall Avg. len.
Avg. weight (g)	26.4	60.9	94.9	137.5	170.6	205.5	235.4	268.5	316.0	359.7	393.5	111.6 Overall Avg. wt.

Catch at age for 2000 southwest Nova Scotia stock component by gear type.

Catch Numbers (000's)	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11+	Total
4W Purse Seine	0	413	3,329	2,693	1,490	824	195	5	34	0	0	8,984
4X Summer Purse Seine	351	285,949	67,776	104,181	120,484	57,810	23,432	4,004	202	33	23	664,245
4X Fall/Winter Purse Seine	376	76,469	3,917	404	516	165	46	7	0	0	0	81,900
4X N.S. Weir	114	1,248	308	1,253	1,320	623	230	33	0	0	0	5,129
4X Gillnet	0	0	0	29	273	1,332	1,926	406	14	0	0	3,978
<b>Total Numbers by Age</b>	841	364,078	75,330	108,560	124,083	60,754	25,829	4,454	251	33	23	764,236

Percent Numbers	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11+	Total
4W Purse Seine	0%	5%	37%	30%	17%	9%	2%	0%	0%	0%	0%	100%
4X Summer Purse Seine	0%	43%	10%	16%	18%	9%	4%	1%	0%	0%	0%	100%
4X Fall/Winter Purse Seine	0%	93%	5%	0%	1%	0%	0%	0%	0%	0%	0%	100%
4X N.S. Weir	2%	24%	6%	24%	26%	12%	4%	1%	0%	0%	0%	100%
4X Gillnet	0%	0%	0%	1%	7%	33%	48%	10%	0%	0%	0%	100%
<b>Percent Numbers by Age</b>	0%	48%	10%	14%	16%	8%	3%	1%	0%	0%	0%	100%

Catch Weight (t)	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11+	Total
4W Purse Seine	0	26	312	283	200	142	38	1	10	0	0	1,012
4X Summer Purse Seine	11	17,850	6,466	14,415	20,609	11,924	5,563	1,087	65	12	9	78,010
4X Fall/Winter Purse Seine	8	4,227	337	48	78	28	10	2	0	0	0	4,738
4X N.S. Weir	3	57	34	179	231	132	57	9	0	0	0	702
4X Gillnet	0	0	0	4	44	261	412	97	4	0	0	823
<b>Total Weight (t) by Age</b>	22	22,159	7,150	14,929	21,163	12,487	6,079	1,196	79	12	9	85,285

Percent Weight	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11+	Total
4W Purse Seine	0%	3%	31%	28%	20%	14%	4%	0%	1%	0%	0%	100%
4X Summer Purse Seine	0%	23%	8%	18%	26%	15%	7%	1%	0%	0%	0%	100%
4X Fall/Winter Purse Seine	0%	89%	7%	1%	2%	1%	0%	0%	0%	0%	0%	100%
4X N.S. Weir	0%	8%	5%	25%	33%	19%	8%	1%	0%	0%	0%	100%
4X Gillnet	0%	0%	0%	1%	5%	32%	50%	12%	1%	0%	0%	100%
<b>Percent Weight by Age</b>	0%	26%	8%	18%	25%	15%	7%	1%	0%	0%	0%	100%

Table 10. Herring catch at age by NAFO unit area for the 2000 summer purse seine fishery conducted on the southwest Nova Scotia spawning component (4WX stock).

**Summer Purse - overall**

	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11+	Total
Numbers (000's)	351	285,949	67,776	104,181	120,484	57,810	23,432	4,004	202	33	23	664,245
% numbers	0%	43%	10%	16%	18%	9%	4%	1%	0%	0%	0%	100%
Catch wt. (t)	11	17,850	6,466	14,415	20,609	11,924	5,563	1,087	65	12	9	78,010
% catch wt.	0%	23%	8%	18%	26%	15%	7%	1%	0%	0%	0%	100%
Avg. len (cm)	16.3	20.6	23.6	26.4	28.3	30.1	31.5	32.8	34.5	36.0	36.3	24.5 Avg. Len
Avg. wt. (g)	30.1	62.4	95.4	138.4	171.1	206.3	237.4	271.4	321.9	359.9	393.5	117.4 Avg. wt

<b>5Yb Purse</b>	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11+	Total
Numbers (000's)	157	37,286	5,775	3,375	2,639	712	100	6	-	-	-	50,049
% numbers	0%	74%	12%	7%	5%	1%	0%	0%	0%	0%	0%	100%
Catch wt. (t)	5	2,378	527	426	424	133	21	1	-	-	-	3,915
% catch wt.	0%	61%	13%	11%	11%	3%	1%	0%	0%	0%	0%	100%
Avg. len (cm)	16.2	20.8	23.5	26.0	28.2	29.6	30.9	32.4	-	-	-	22.0 Avg. Len
Avg. wt. (g)	29.9	63.8	91.2	126.1	160.9	186.9	212.4	243.5	-	-	-	78.2 Avg. wt

<b>4Xs Purse</b>	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11+	Total
Numbers (000's)	7	96,342	10,445	2,594	2,666	840	322	38	3	-	-	113,257
% numbers	0%	85%	9%	2%	2%	1%	0%	0%	0%	0%	0%	100%
Catch wt. (t)	0	6,063	859	346	442	171	78	10	1	-	-	7,971
% catch wt.	0%	76%	11%	4%	6%	2%	1%	0%	0%	0%	0%	100%
Avg. len (cm)	17.0	20.7	22.6	26.1	28.1	29.8	31.3	32.7	34.0	-	-	21.3 Avg. Len
Avg. wt. (g)	32.7	62.9	82.2	133.4	165.8	204.0	242.3	278.3	314.5	-	-	70.4 Avg. wt

<b>4Xr Purse</b>	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11+	Total
Numbers (000's)	159	98,446	18,348	33,537	32,146	18,223	8,163	1,517	54	3	3	210,598
% numbers	0%	47%	9%	16%	15%	9%	4%	1%	0%	0%	0%	100%
Catch wt. (t)	5	5,761	1,742	4,704	5,571	3,883	2,000	423	17	1	1	24,108
% catch wt.	0%	24%	7%	20%	23%	16%	8%	2%	0%	0%	0%	100%
Avg. len (cm)	16.4	20.2	23.5	26.4	28.2	30.0	31.4	32.7	34.0	35.8	36.0	24.1 Avg. Len
Avg. wt. (g)	30.6	58.5	95.0	140.3	173.3	213.1	245.0	279.1	312.5	373.2	387.9	114.5 Avg. wt

<b>4Xq Purse</b>	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11+	Total
Numbers (000's)	28	53,256	31,492	60,032	75,932	35,728	14,395	2,408	145	29	21	273,466
% numbers	0%	19%	12%	22%	28%	13%	5%	1%	0%	0%	0%	100%
Catch wt. (t)	1	3,603	3,154	8,297	12,958	7,275	3,359	642	47	11	8	39,354
% catch wt.	0%	9%	8%	21%	33%	18%	9%	2%	0%	0%	0%	100%
Avg. len (cm)	16.1	21.2	23.9	26.5	28.4	30.1	31.6	32.9	34.7	36.1	36.4	26.5 Avg. Len
Avg. wt. (g)	27.4	67.7	100.1	138.2	170.6	203.6	233.4	266.6	325.5	358.5	394.1	143.9 Avg. wt

<b>4Xp Purse</b>	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11+	Total
Numbers (000's)	-	619	1,716	4,643	7,102	2,308	452	35	-	-	-	16,874
% numbers	0%	4%	10%	28%	42%	14%	3%	0%	0%	0%	0%	100%
Catch wt. (t)	-	45	185	642	1,214	461	105	9	-	-	-	2,662
% catch wt.	0%	2%	7%	24%	46%	17%	4%	0%	0%	0%	0%	100%
Avg. len (cm)	-	21.5	24.4	26.4	28.3	29.7	31.1	32.4	-	-	-	27.4 Avg. Len
Avg. wt. (g)	-	72.7	107.7	138.4	171.0	200.0	231.5	263.8	-	-	-	157.8 Avg. wt

Table 11. Catch at age (millions) for the Southwest Nova Scotia / Bay of Fundy herring spawning component, 1965-2000.

Historical Catch at age in millions

Year	Year											Total
	1	2	3	4	5	6	7	8	9	10	11+	
1965	270	1,085	35	234	50	11	2	1	0	0	0	1,687
1966	154	914	449	73	322	46	14	8	2	0	0	1,982
1967	722	614	154	266	110	159	58	4	0	0	0	2,089
1968	165	2,389	225	83	290	73	91	32	15	6	1	3,370
1969	109	290	532	132	162	113	63	23	6	3	1	1,433
1970	700	577	77	286	201	120	112	41	21	7	3	2,145
1971	88	404	184	107	114	76	94	50	37	8	6	1,165
1972		649	72	149	77	75	49	49	26	14	12	1,172
1973	1	167	781	131	40	30	22	20	24	12	13	1,242
1974	18	766	94	804	68	19	10	7	13	7	9	1,815
1975	3	318	240	125	515	66	12	4	5	4	6	1,298
1976	0	56	207	154	69	269	21	6	4	2	3	790
1977	1	154	32	218	119	51	177	14	3	1	4	775
1978	35	384	41	13	122	68	31	109	11	2	2	819
1979	0	184	250	55	5	23	18	12	41	5	2	596
1980	2	13	81	474	28	4	5	7	3	11	3	629
1981		103	51	103	451	33	2	3	2	1	2	751
1982	4	102	151	23	98	211	15	2	1	1	1	609
1983	5	192	150	244	24	61	90	10	2	1	1	781
1984		88	244	224	146	23	22	28	10	2	9	796
1985	9	217	338	303	148	42	14	18	8	1	0	1,098
1986	0	125	276	293	57	32	11	4	3	1	0	802
1987	2	83	126	527	243	46	19	7	3	3	1	1,062
1988	0	148	113	195	434	236	43	21	4	4	3	1,202
1989	0	102	114	62	79	169	77	18	8	4	3	636
1990		179	130	172	90	101	202	117	31	11	7	1,039
1991		97	179	184	88	41	50	81	46	18	14	798
1992	0	169	133	287	127	75	34	35	59	35	21	974
1993	0	76	44	194	131	68	34	21	22	21	11	622
1994	0	104	142	54	118	73	36	15	9	10	16	576
1995	2	113	220	112	37	36	22	6	4	3	4	560
1996		37	38	256	55	17	9	3	2	1	2	420
1997	0	57	87	78	131	19	5	4	1	1	1	384
1998	0	265	62	139	97	97	21	4	2	1	0	689
1999	3	113	223	148	131	57	10	1	0	0	0	686
2000	1	364	75	109	124	61	26	4	0	0	0	764

Table 12. Catch at age (%) for the Southwest Nova Scotia / Bay of Fundy herring spawning component, 1965-2000.

Historical catch at age in percentages

Year	Year											Total
	1	2	3	4	5	6	7	8	9	10	11+	
1965	16	64	2	14	3	1	0	0	0	0	0	100
1966	8	46	23	4	16	2	1	0	0	0	0	100
1967	35	29	7	13	5	8	3	0	0	0	0	100
1968	5	71	7	2	9	2	3	1	0	0	0	100
1969	8	20	37	9	11	8	4	2	0	0	0	100
1970	33	27	4	13	9	6	5	2	1	0	0	100
1971	8	35	16	9	10	6	8	4	3	1	0	100
1972	-	55	6	13	7	6	4	4	2	1	1	100
1973	0	13	63	11	3	2	2	2	2	1	1	100
1974	1	42	5	44	4	1	1	0	1	0	0	100
1975	0	24	18	10	40	5	1	0	0	0	0	100
1976	0	7	26	19	9	34	3	1	0	0	0	100
1977	0	20	4	28	15	7	23	2	0	0	1	100
1978	4	47	5	2	15	8	4	13	1	0	0	100
1979	0	31	42	9	1	4	3	2	7	1	0	100
1980	0	2	13	75	4	1	1	1	0	2	0	100
1981	-	14	7	14	60	4	0	0	0	0	0	100
1982	1	17	25	4	16	35	2	0	0	0	0	100
1983	1	25	19	31	3	8	12	1	0	0	0	100
1984	-	11	31	28	18	3	3	4	1	0	1	100
1985	1	20	31	28	13	4	1	2	1	0	0	100
1986	0	16	34	36	7	4	1	1	0	0	0	100
1987	0	8	12	50	23	4	2	1	0	0	0	100
1988	0	12	9	16	36	20	4	2	0	0	0	100
1989	0	16	18	10	12	27	12	3	1	1	0	100
1990	-	17	13	17	9	10	19	11	3	1	1	100
1991	-	12	22	23	11	5	6	10	6	2	2	100
1992	0	17	14	29	13	8	4	4	6	4	2	100
1993	0	12	7	31	21	11	5	3	4	3	2	100
1994	0	18	25	9	20	13	6	3	2	2	3	100
1995	0	20	39	20	7	7	4	1	1	1	1	100
1996	-	9	9	61	13	4	2	1	0	0	0	100
1997	0	15	23	20	34	5	1	1	0	0	0	100
1998	0	38	9	20	14	14	3	1	0	0	0	100
1999	0	16	33	22	19	8	1	0	0	0	0	100
2000	0	48	10	14	16	8	3	1	0	0	0	100

Table 13. Average weights at age (g) for the SW Nova Scotia component of the 4WX herring fishery (weighted by fishery) for 1965-2000.

Year	Year									
	1	2	3	4	5	6	7	8	9	10
1965	10	41	112	172	218	254	286	323	354	389
1966	10	41	112	172	218	254	286	323	354	389
1967	10	41	112	172	218	254	286	323	354	389
1968	10	33	112	148	185	244	276	399	338	410
1969	10	37	105	162	207	242	282	306	334	390
1970	10	32	119	169	211	257	292	332	369	389
1971	10	66	143	199	230	254	293	329	362	388
1972	10	44	138	192	223	262	292	322	345	380
1973	10	29	106	143	225	252	279	331	360	389
1974	10	48	110	175	206	240	277	322	342	352
1975	10	21	94	179	216	240	268	333	358	379
1976	10	33	114	159	233	249	277	317	382	404
1977	10	65	113	174	214	274	293	325	328	416
1978	10	28	112	181	229	259	302	330	351	397
1979	10	41	112	172	218	254	286	323	354	389
1980	10	41	112	172	218	254	286	323	354	389
1981	10	41	112	172	218	254	286	323	354	389
1982	10	41	112	172	218	254	286	323	354	389
1983	10	41	112	172	218	254	286	323	354	389
1984	10	38	132	191	229	259	280	296	309	364
1985	10	53	118	204	249	278	315	334	344	440
1986	10	55	124	182	239	271	306	329	360	400
1987	12	50	98	153	199	245	274	290	318	350
1988	13	21	88	154	196	242	281	304	327	341
1989	7	33	79	162	207	238	274	303	324	353
1990	10	31	92	161	200	234	255	287	319	336
1991	10	48	100	147	186	217	251	270	303	322
1992	9	25	100	148	181	216	252	275	295	313
1993	18	29	108	153	188	215	251	279	302	324
1994	12	37	79	131	175	203	223	253	289	304
1995	15	42	76	136	187	223	247	293	300	326
1996	10	33	98	137	168	228	266	308	332	355
1997	19	34	80	161	190	238	284	314	358	376
1998	10	38	76	131	177	210	251	296	308	337
1999	20	42	75	120	172	220	263	304	344	378
2000	26	61	95	138	171	206	235	269	316	360

Table 14. 2000 4W offshore herring purse seine and by-catch fisheries catch at age.

Catch at age (numbers and weight)

	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11+	Total
Numbers (x1,000)	-	1,141	830	1,463	2,599	3,068	2,677	420	36	11	-	12,244
% numbers		9%	7%	12%	21%	25%	22%	3%	0%	0%		100%
Catch wt. (t)	-	67	81	193	428	604	601	106	10	4	-	2,094
% catch wt.		3%	4%	9%	20%	29%	29%	5%	0%	0%		100%
Avg. len (cm)	-	20.1	23.8	26.4	28.5	30.2	31.5	32.7	34.1	35.9		28.4 Avg. Len
Avg. wt. (g)	-	59.0	97.9	131.8	164.6	197.0	224.6	251.5	282.5	329.9		171.0 Avg. wt

Table 15. Herring abundance indices: larval abundance index (average number of larvae per m<sup>2</sup> from 79 index stations) and herring by-catch (stratified numbers per tow) from the July groundfish survey.

Larval Herring Bongo Survey No. per m2 to bottom					Summer groundfish by-catch (mean nos per tow for herring)									
Year	Cruise	Mean	SE	N	4WX area combined strata 453/495				4W Only strata 453/466		4X Only strata 470/495		Offshore Banks strata 455/478	
					Cruise	Mean#	SE	N	Mean#	SE	Mean#	SE	Mean#	SE
70					A175/176	4.1	1.5	95	4.9	2.4	1.6	0.6		
71					A188/189	4.0	1.9	86	2.6	1.2	3.6	2.6		
72	P109	9.4	1.8	79	A200/201	1.4	0.6	105	1.7	1.0	0.5	0.1		
73	P127	6.6	1.3	79	A212/213	0.9	0.3	96	0.4	0.3	1.0	0.4		
74	P147	49.5	10.9	79	A225/226	0.7	0.3	102	0.2	0.0	1.0	0.4		
75	P160	11.7	1.5	58	A236/237	0.9	0.4	104	0.8	0.4	0.7	0.4		
76	P175	13.5	2.9	79	A250/251	0.4	0.2	103	0.1	0.1	0.5	0.3		
77	P190	6.3	1.0	79	A265/266	0.5	0.3	106	0.0	0.0	0.8	0.5		
78	P207	4.5	0.5	77	A279/280	0.3	0.3	103	0.5	0.5	0.1	0.0		
79	P232	7.1	2.1	79	A292/293	0.6	0.5	106	0.0	0.0	1.0	0.7		
80	P246	26.2	6.7	79	A306/307	0.5	0.5	105	0.0	0.0	0.8	0.8		
81	P263	2.7	0.3	78	A321/322	1.5	1.4	104	0.0	0.0	2.3	2.1		
82	P280	10.6	1.2	77	H080/081	1.5	0.9	108	0.5	0.3	1.9	1.4		
83	P298	13.9	1.6	74	N012/013	2.4	0.8	106	2.6	1.2	2.2	1.0	2.1	1.0
84	P315	12.7	1.4	78	N031/032	7.0	3.5	102	3.3	1.2	10.5	6.8	8.5	5.4
85	P329	40.8	4.6	79	N048/049	3.4	1.8	111	6.6	3.8	0.3	0.1	5.0	2.9
86	P344	18.9	2.1	78	N065/066	23.2	14.9	118	30.8	26.7	16.0	14.3	23.4	20.3
87	P361	27.9	3.2	78	N85/86/87	10.4	5.6	135	17.0	11.3	4.0	1.8	12.9	8.6
88	P377	100.7	11.5	76	N105/106	2.1	0.6	127	2.7	1.2	1.5	0.5	2.0	0.9
89	P391	54.5	6.1	79	N123/124	8.4	1.8	124	11.8	3.4	4.5	1.2	9.8	2.7
90	P408	27.2	3.1	79	N139/140	5.6	1.9	156	7.4	3.6	3.4	1.0	6.5	2.9
91	P422	48.2	5.5	78	N154/H231	10.6	5.8	137	13.0	8.8	5.0	1.8	14.3	9.0
92	P437	57.0	6.4	79	N173/174	16.5	4.9	136	16.2	6.6	40.8	15.7	23.6	7.4
93	P451	55.0	6.2	78	N189/190	18.7	4.5	137	6.3	2.5	30.4	8.5	15.0	4.7
94	N211	5.4	0.7	77	N221/222	76.4	30.2	140	108.4	58.9	45.9	18.4	91.1	45.1
95	N232	20.3	4.6	78	N226/227	63.5	24.2	140	100.5	47.9	28.4	12.8	92.7	37.6
96	N252	9.5	1.6	77	N246/247	40.2	14.2	135	53.2	24.5	27.1	14.1	46.5	19.5
97	N765	23.3	2.7	77	N726/734	31.8	15.3	137	34.6	10.1	51.3	39.3	29.3	7.7
98	N865	33.6	3.8	77	N827/832	99.52	20.65	131	147.6	39.92	54.76	14.5	130.3	30.3
99	no survey				N925/929	229.8	83.8	133	264.2	101.0	199.4	130.2	226.2	74.4
2000	no survey				N426/431	90.6	20.0	146	146.3	40.6	38.7	7.4	124.7	30.5



Table 16. Recorded landings (t) of herring from major gillnet fisheries on the Coastal Nova Scotia Spawning component.

**Landings (t)**

	<b>1996</b>	<b>1997</b>	<b>1998</b>	<b>1999</b>	<b>2000</b>
<b>East of Halifax</b>	1,280	1,520	1,100	1,628	1,350
<b>Little Hope</b>	-	490	1,170	2,919	2,043
<b>Glace Bay</b>	-	170	1,730	1,040	834
<b>Bras d'Or Lakes</b>	170	160	120	31	56
<b>Total</b>	<b>1,450</b>	<b>2,340</b>	<b>4,120</b>	<b>5,618</b>	<b>4,283</b>

Table 17. Catch at age for herring from Coastal Nova Scotia fisheries in 2000.

Sept. to Oct., 2000 4X Little Hope Gillnet

Catch at age (number and weight)

	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11+	Total
Numbers (000's)	-	-	-	71	677	3,306	4,780	1,007	35	-	-	9,876
% numbers	0%	0%	0%	1%	7%	33%	48%	10%	0%	0%	0%	100%
Catch wt. (t)	-	-	-	10	110	648	1,022	242	11	-	-	2,043
% catch wt.	0%	0%	0%	1%	5%	32%	50%	12%	1%	0%	0%	100%
Avg. len (cm)	-	-	-	27.8	28.8	30.6	31.5	32.8	35.5	-	-	31.1 Avg. Len
Avg. wt. (g)	-	-	-	146.8	162.9	196.0	213.8	240.2	303.8	-	-	206.9 Avg. wt

2000 4W Eastern Shore herring gillnet

Catch at age (number and weight)

	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11+	Total
Numbers (000's)	-	-	-	-	8	725	2,358	2,304	227	15	45	5,683
% numbers	0%	0%	0%	0%	0%	13%	41%	40%	4%	0%	1%	99%
Catch wt. (t)	-	-	-	-	1	150	533	577	68	5	16	1,351
% catch wt.	0%	0%	0%	0%	0%	11%	39%	42%	5%	0%	1%	99%
Avg. len (cm)	-	-	-	-	29.0	31.1	32.1	33.2	35.2	36.5	37.5	32.6 Avg. Len
Avg. wt. (g)	-	-	-	-	167.0	207.1	226.2	250.3	299.5	332.8	361.0	237.7 Avg. wt

2000 Glace Bay herring gillnet

Catch at age (numbers and weight)

	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11+	Total
Numbers (000's)	-	6	2	-	38	423	1,293	1,402	238	11	52	3,463
% numbers	0%	0%	0%	0%	1%	12%	37%	40%	7%	0%	1%	99%
Catch wt. (t)	-	1	0	-	6	86	293	353	72	4	19	834
% catch wt.	0%	0%	0%	0%	1%	10%	34%	41%	8%	0%	2%	98%
Avg. len (cm)	-	23.5	23.5	-	28.5	31.0	32.1	33.3	35.3	36.5	37.7	32.7 Avg. Len
Avg. wt. (g)	-	88.9	88.9	-	158.3	204.5	227.0	252.1	300.9	332.8	365.4	240.8 Avg. wt

2000 Bras d'Or Lakes herring gillnet

Catch at age (number and weight)

	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11+	Total
Numbers (000's)	-	-	0	1	10	38	91	48	18	9	7	222
% numbers	0%	0%	0%	0%	4%	17%	39%	21%	8%	4%	3%	97%
Catch wt. (t)	-	-	0	0	2	8	22	13	6	3	3	56
% catch wt.	0%	0%	0%	0%	3%	14%	37%	22%	9%	5%	4%	96%
Avg. len (cm)	-	-	26.1	26.8	28.9	31.6	32.9	34.2	35.5	36.2	37.4	33.2 Avg. Len
Avg. wt. (g)	-	-	112.8	122.3	158.6	215.4	242.0	272.8	306.2	324.3	357.5	252.1 Avg. wt

Table 18. Summary of herring catches in Stratum 42 during the July groundfish survey, 1990 to 2000 in numbers and weight (kg).

Year	Total Number	Average No. Per Set	Total Weight	Average Wt. Per Set
1990	1	0	0	0
1991	11	2	4	1
1992	0	0	0	0
1993	13	3	4	1
1994	1,301	217	432	72
1995	359	60	80	13
1996	0	0	0	0
1997	2	0	1	0
1998	37	7	6	1
1999	1,605	229	431	62
2000	42	7	11	2
1970-79 Avg.	91	35	39	6
1980-89 Avg.	699	171	195	75
1990-99 Avg.	333	59	96	17

Note: strata 42 is entirely 4Vn inshore and was used in reference to the Glace Bay fishery

Table 19. Weir catches (t), number of active weirs and the catch per weir, 1978 to 2000.

Year	Catch (t)			No. Active Weirs			Catch per Weir		
	NB	NS	Total Catch	NB	NS	Total No.	NB	NS	Average
1978	33,599	7,858	41,458	208	31	239	162	253	173
1979	32,579	6,339	38,918	210	27	237	155	235	164
1980	11,066	2,383	13,449	120	29	149	92	82	90
1981	14,968	1,824	16,793	147	28	175	102	65	96
1982	22,181	1,130	23,311	159	19	178	140	59	131
1983	12,568	896	13,464	143	23	166	88	39	81
1984	8,353	2,702	11,056	116	13	129	72	208	86
1985	26,718	4,055	30,774	156	14	170	171	290	181
1986	27,516	1,957	29,473	105	18	123	262	109	240
1987	26,621	6,776	33,397	123	21	144	216	323	232
1988	38,235	7,480	45,715	191	21	212	200	356	216
1989	43,520	3,296	46,817	171	20	191	255	165	245
1990	39,808	4,132	43,940	154	22	176	258	188	250
1991	23,717	1,498	25,216	143	20	163	166	75	155
1992	31,981	2,224	34,206	151	12	163	212	185	210
1993	31,328	2,662	33,990	145	10	155	216	266	219
1994	20,618	2,045	22,662	129	11	140	160	186	162
1995	18,228	3,049	21,277	106	10	116	172	305	183
1996	15,781	3,476	19,257	101	12	113	156	290	170
1997	20,396	4,019	24,415	102	15	117	200	268	209
1998	18,164	3,852	22,016	104	14	118	175	275	187
1999	19,057	4,537	23,594	100	14	114	191	324	207
2000	16,362	678	17,040	77	2	79	212	339	216
Totals	553,365	78,869	632,234	3161	406	3567	175	194	177

Table 20. New Brunswick weir and shut-off catch at age for herring in 2000.

2000 NB Weir and Shutoff

Catch at age (numbers and weight)

	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11+	Total
Numbers (000's)	3,920	250,012	12,786	7,626	6,050	1,319	104	4	-	-	-	281,821
% numbers	1%	89%	5%	3%	2%	0%	0%	0%	0%	0%	0%	100%
Catch wt. (t)	97	13,265	1,075	1,051	1,043	274	24	1	-	-	-	16,830
% catch wt.	1%	79%	6%	6%	6%	2%	0%	0%	0%	0%	0%	100%
Avg. len (cm)	15.4	19.6	22.6	26.3	28.2	29.8	30.9	32.0	-	-	-	20.1 Avg. Len
Avg. wt. (g)	24.6	53.1	84.1	137.9	172.3	207.6	234.8	264.4	-	-	-	59.7 Avg. wt

NB Weirs

Catch at age (numbers and weight)

	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11+	Total
Numbers (000's)	3,868	244,059	12,475	7,609	6,049	1,319	104	4	-	-	-	275,486
% numbers	1%	89%	5%	3%	2%	0%	0%	0%	0%	0%	0%	100%
Catch wt. (t)	95	12,933	1,054	1,049	1,043	274	24	1	-	-	-	16,472
% catch wt.	1%	79%	6%	6%	6%	2%	0%	0%	0%	0%	0%	100%
Avg. len (cm)	15.4	19.5	22.7	26.3	28.2	29.8	30.9	32.0	-	-	-	20.1 Avg. Len
Avg. wt. (g)	24.5	53.0	84.5	137.9	172.3	207.6	234.8	264.4	-	-	-	59.8 Avg. wt

NB Shutoff

Catch at age (numbers and weight)

	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11+	Total
Numbers (000's)	53	5,953	311	17	0	-	-	-	-	-	-	6,334
% numbers	1%	94%	5%	0%	0%	0%	0%	0%	0%	0%	0%	100%
Catch wt. (t)	2	333	21	2	0	-	-	-	-	-	-	358
% catch wt.	0%	93%	6%	1%	0%	0%	0%	0%	0%	0%	0%	100%
Avg. len (cm)	17.2	20.1	21.4	26.0	26.0	-	-	-	-	-	-	20.1 Avg. Len
Avg. wt. (g)	32.7	55.9	68.0	129.8	134.5	-	-	-	-	-	-	56.5 Avg. wt

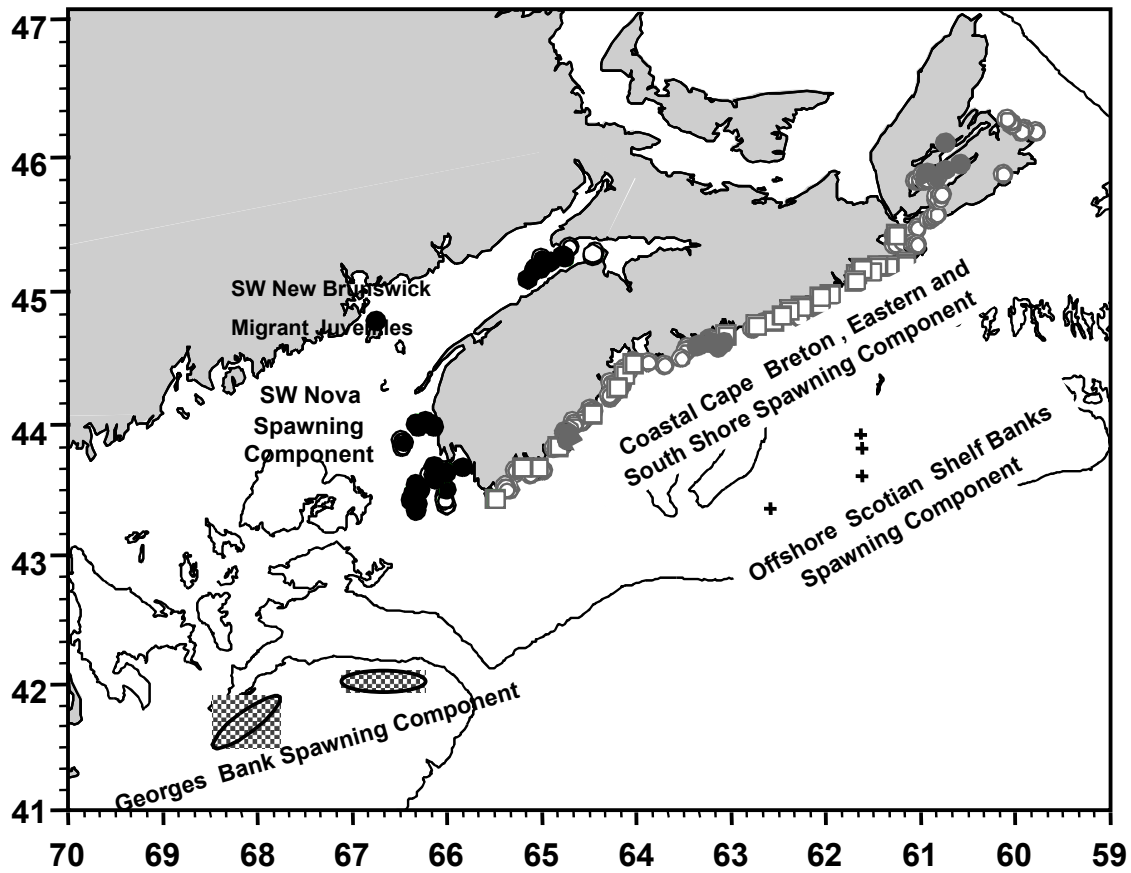


Figure 1. Management units for herring in areas 4VWX and 5 showing locations of known current (solid) and historical (open) spawning locations.

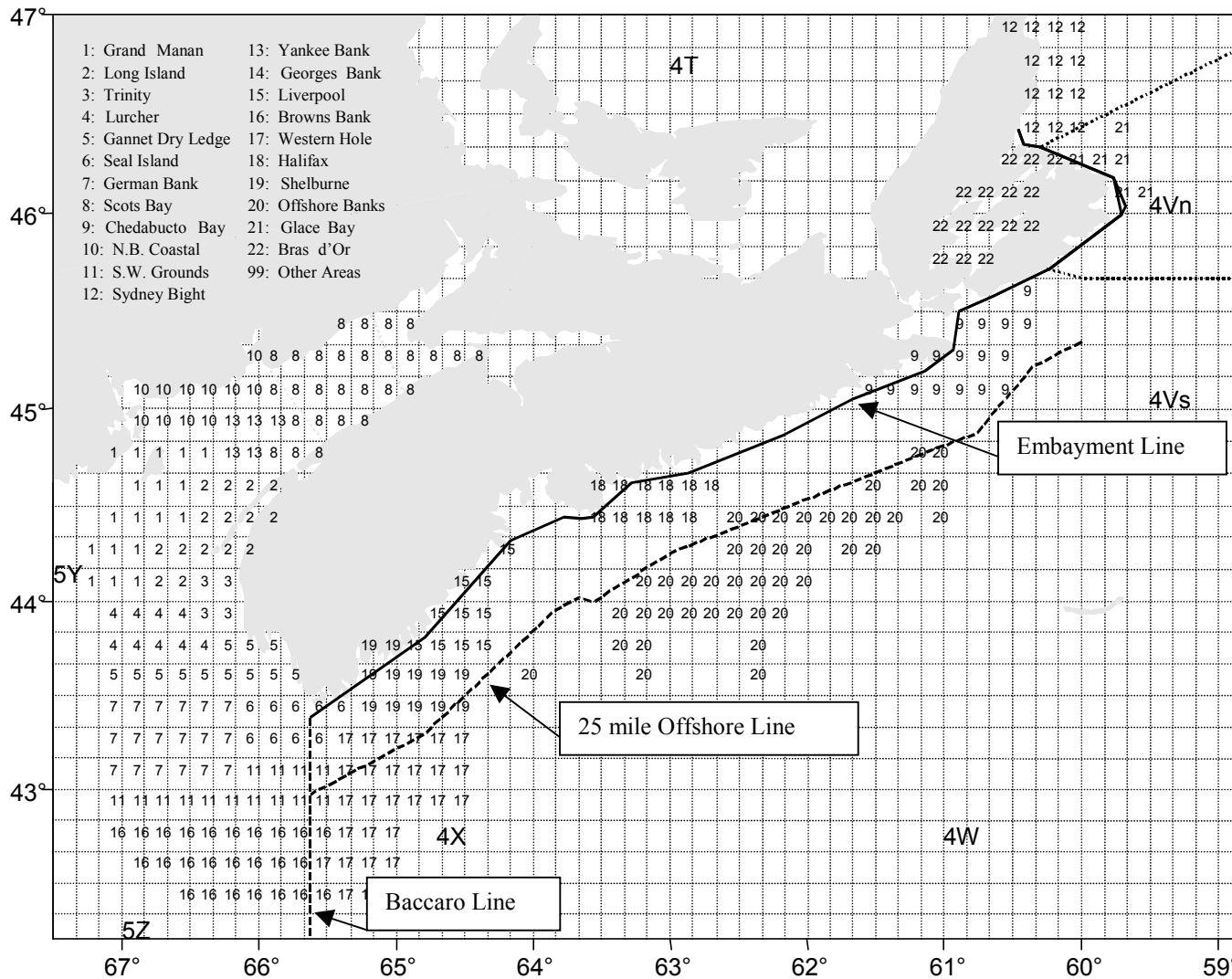


Figure 2. Herring fishing ground areas and management lines.

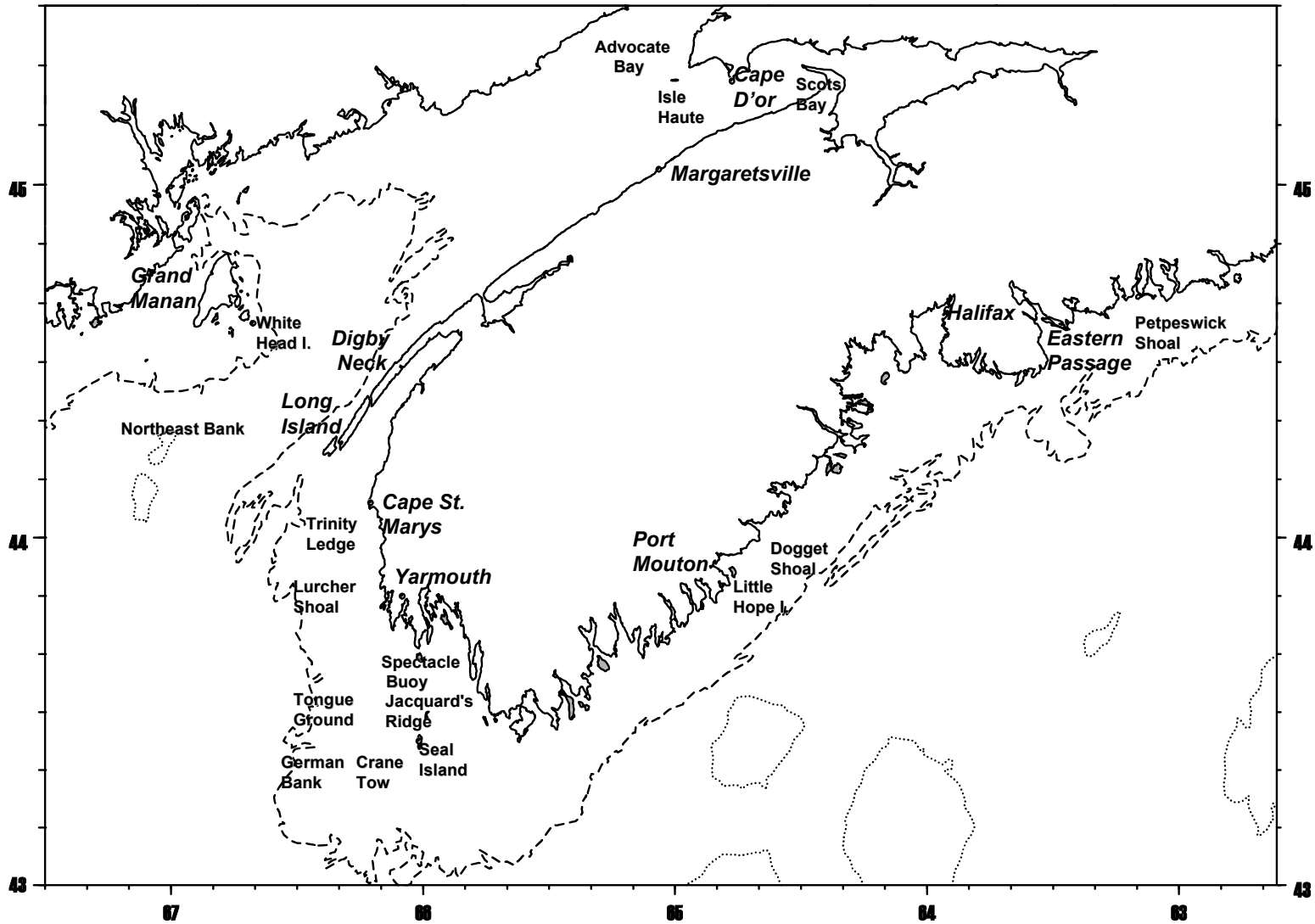


Figure 3. Fishing locations for herring in southwest and coastal Nova Scotia.



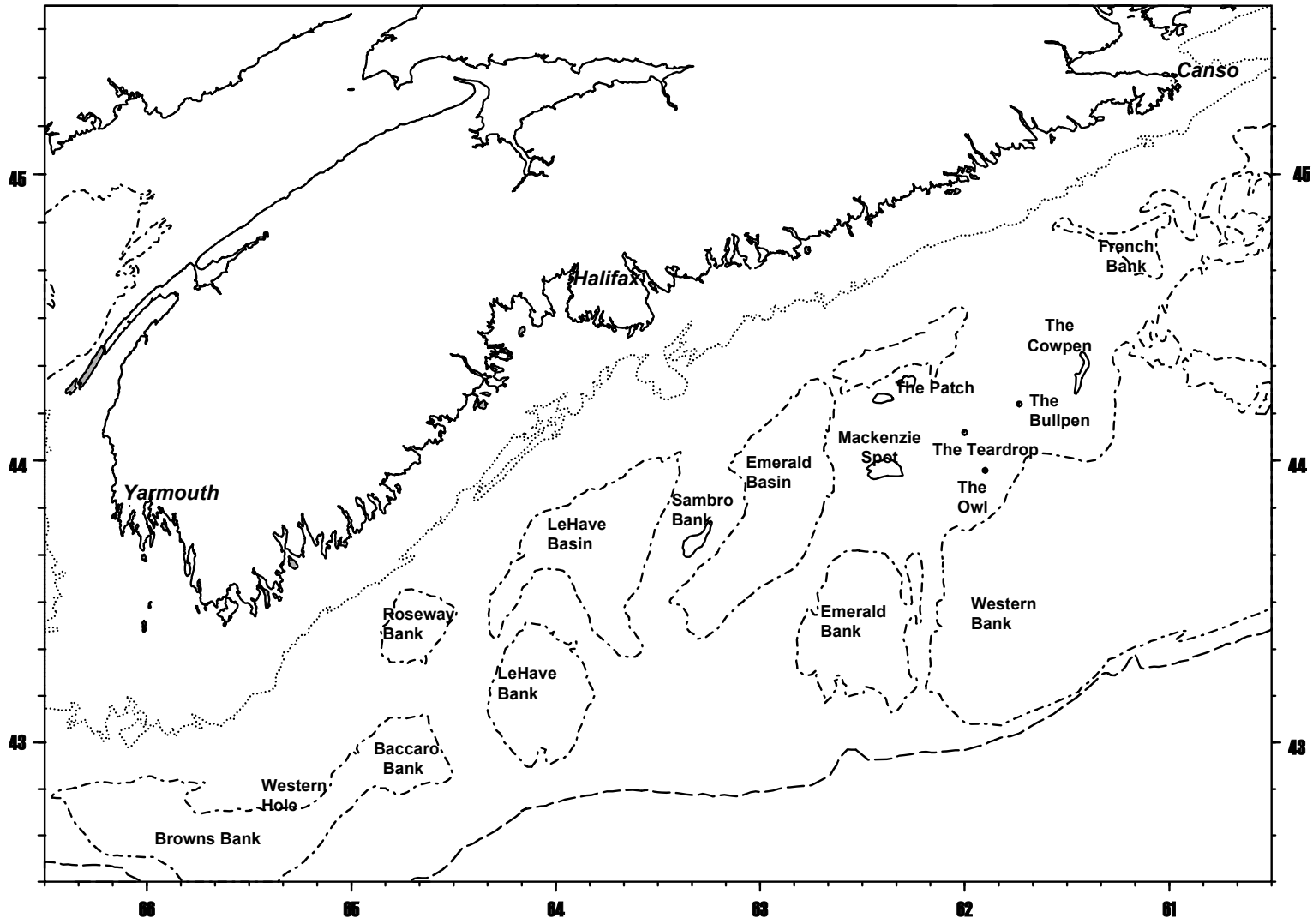


Figure 4. Fishing locations for herring on the offshore Scotian Shelf banks.

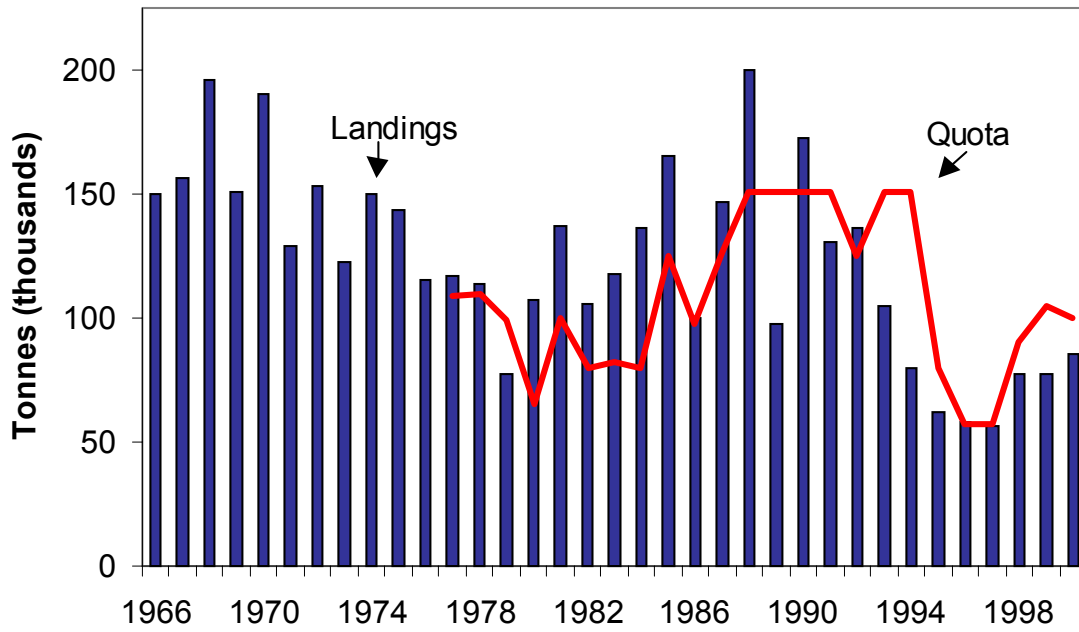


Figure 5. Annual herring landings and TAC (quota) for the southwest Nova Scotia spawning component (4WX stock).

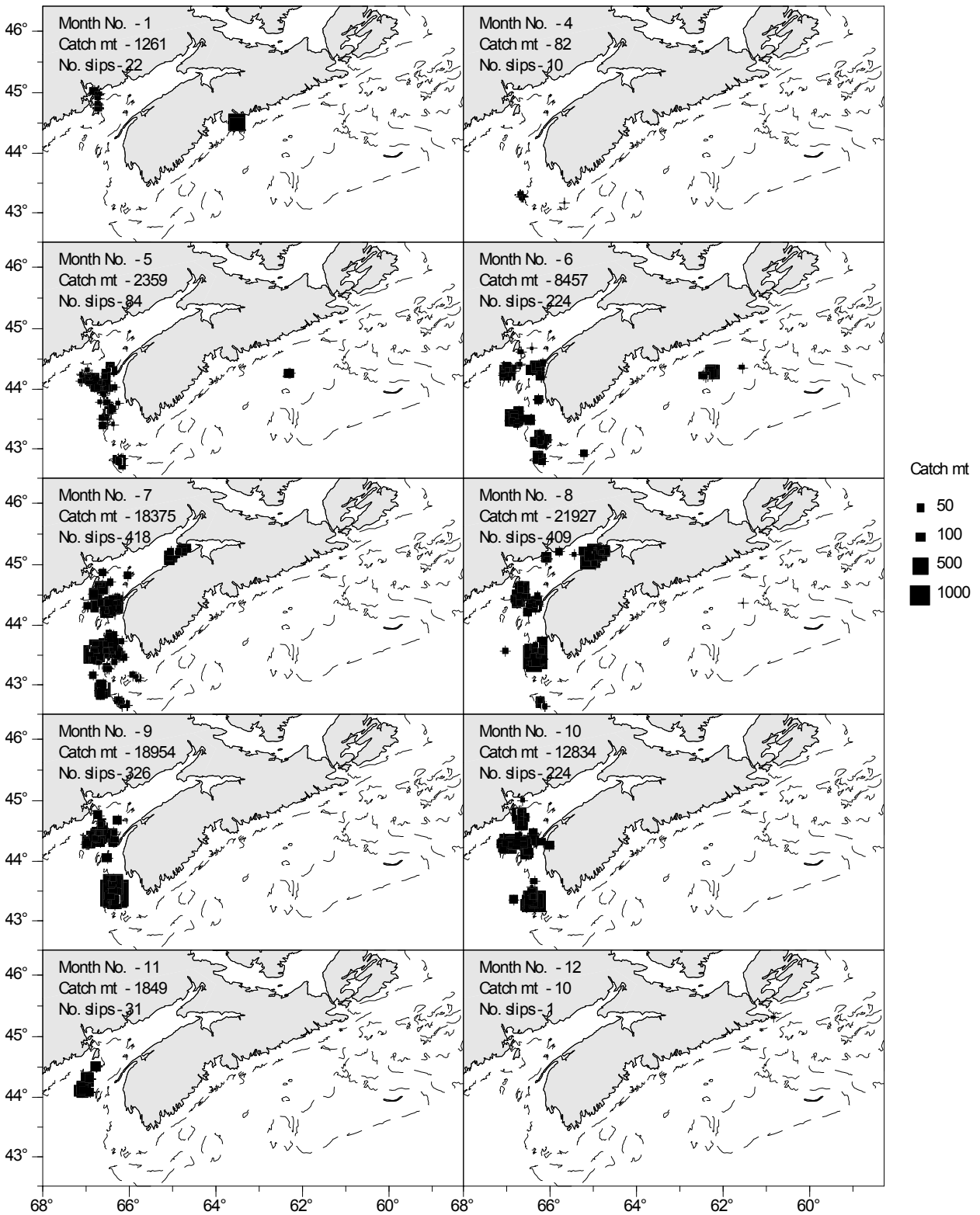


Figure 6. 2000 herring purse seine catches (t) for NAFO areas 4VWX by month (data from Statistics Division ZIF database).

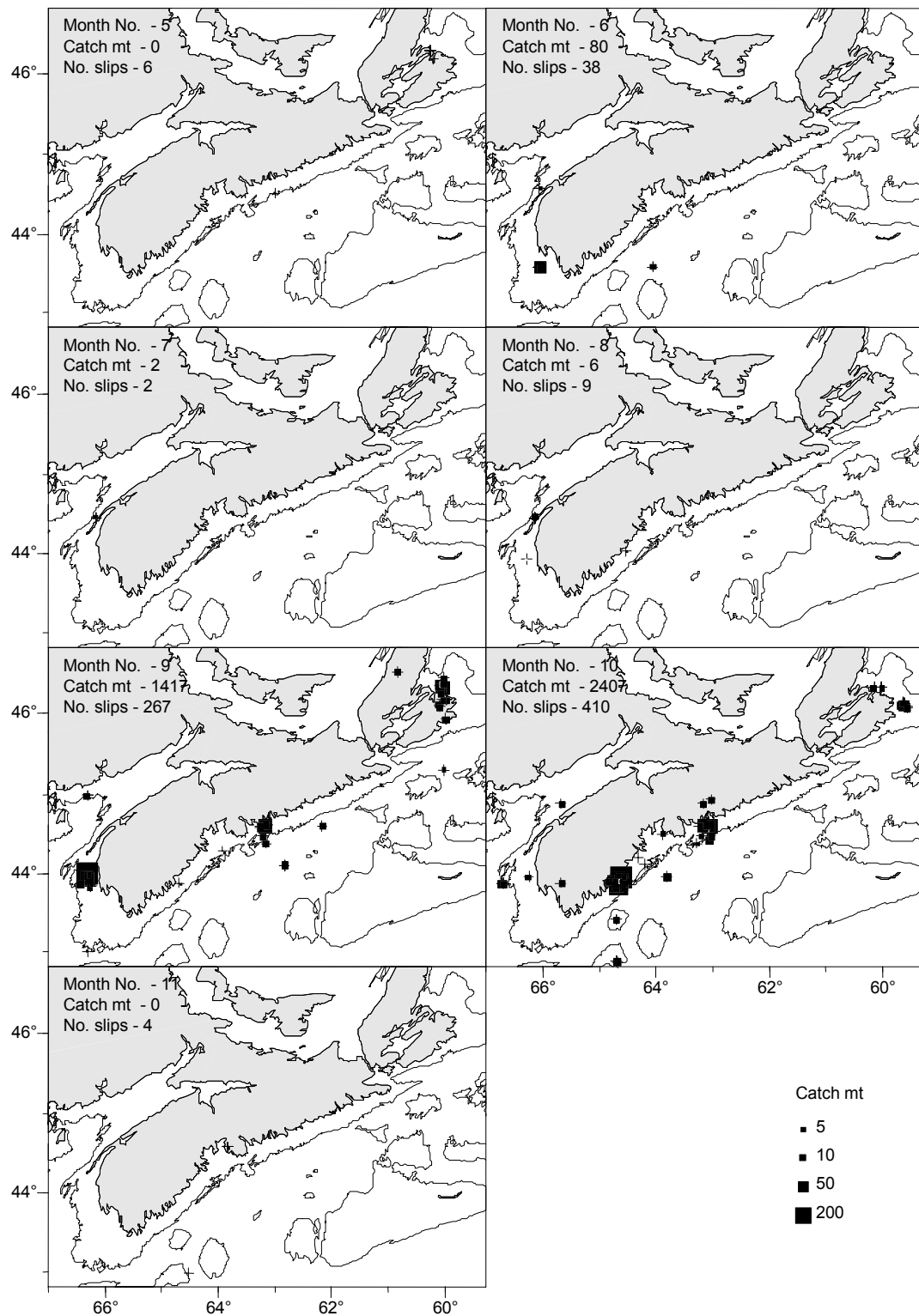


Figure 7. 2000 herring gillnet catches (t) for NAFO areas 4VWX by month (data from Statistics Division ZIF database).

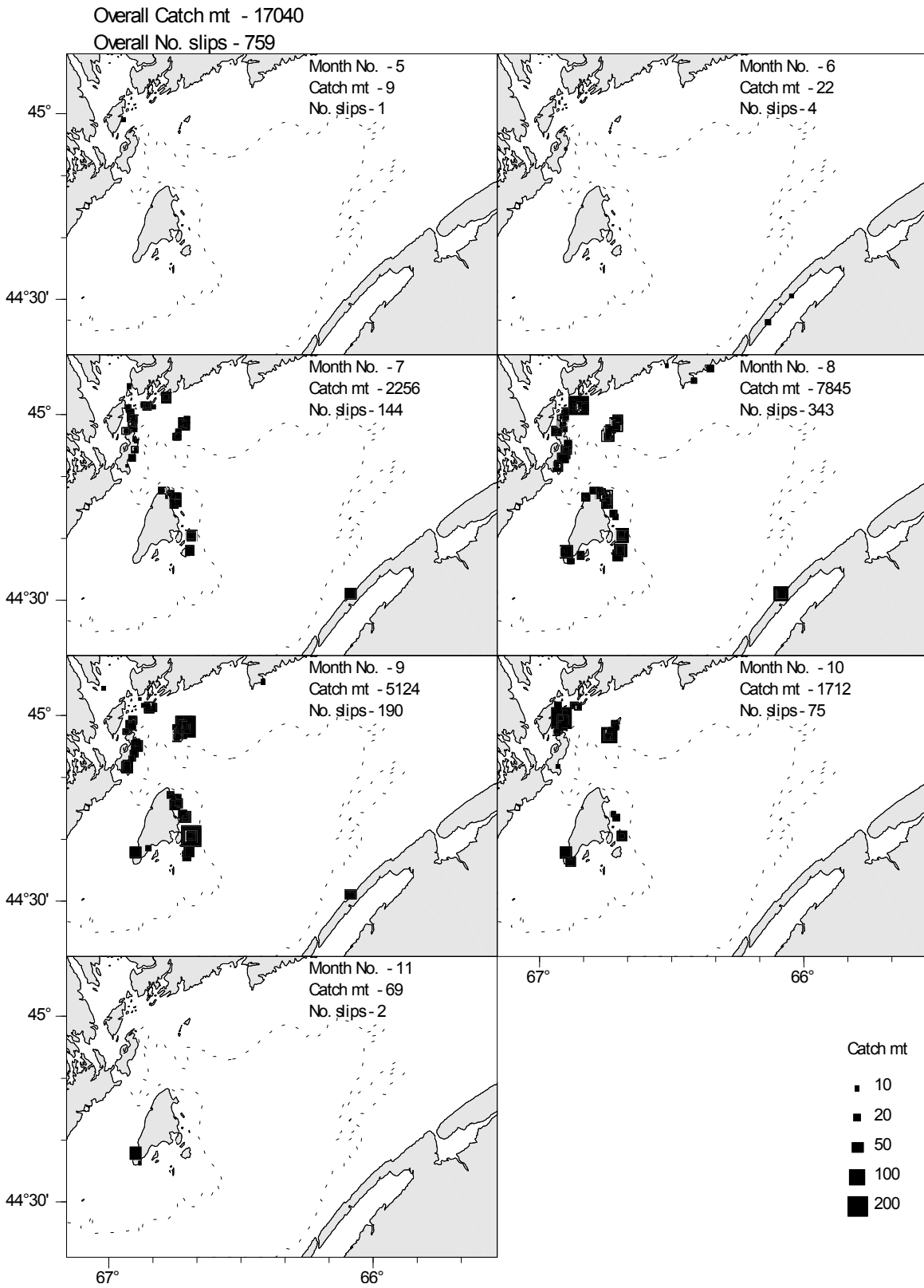


Figure 8. 2000 New Brunswick and Nova Scotia herring weir catches by month using exact weir locations.

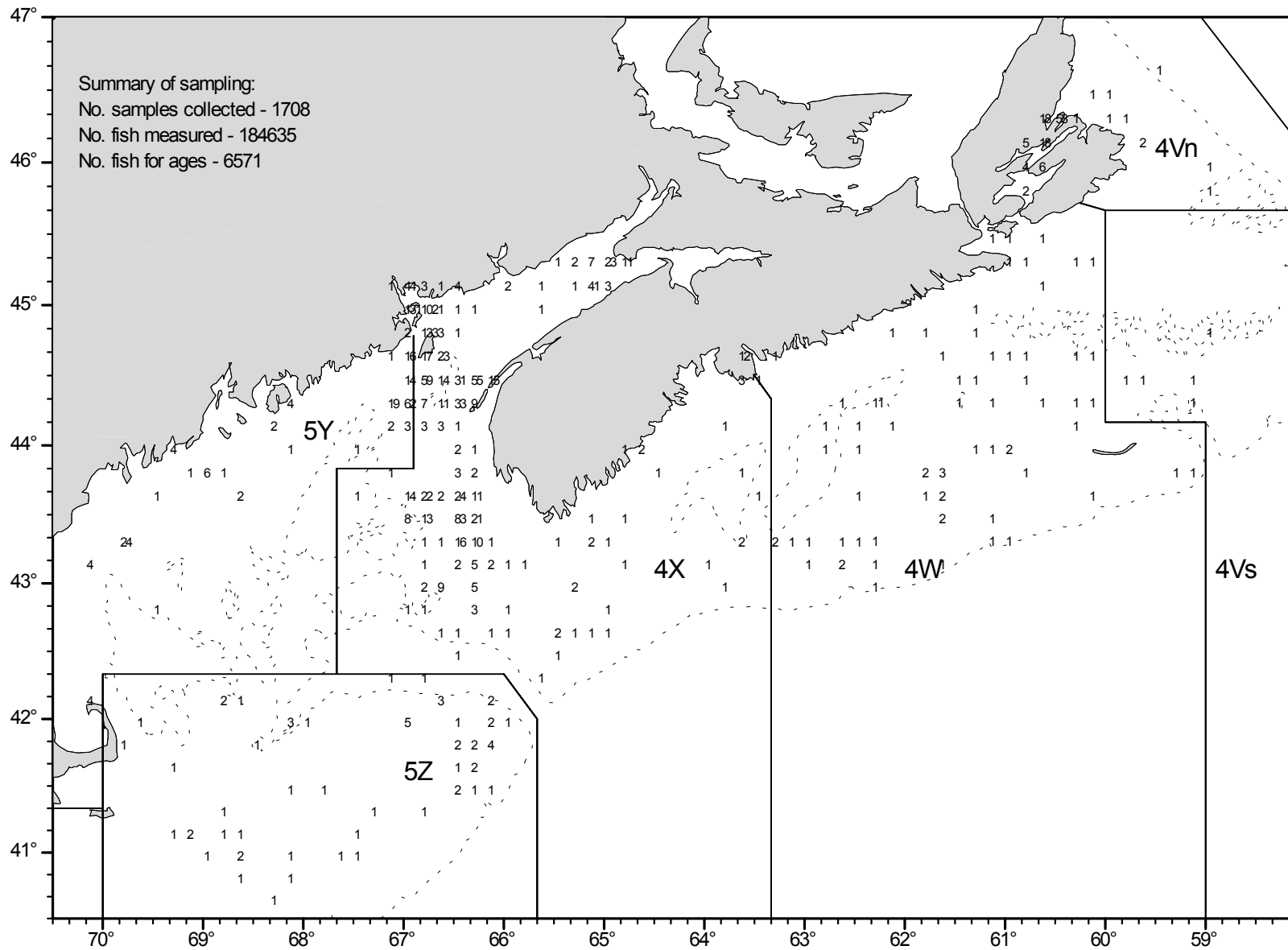


Figure 9. 2000 herring sampling coverage from all sources (number of length frequency samples by 10 mile square)

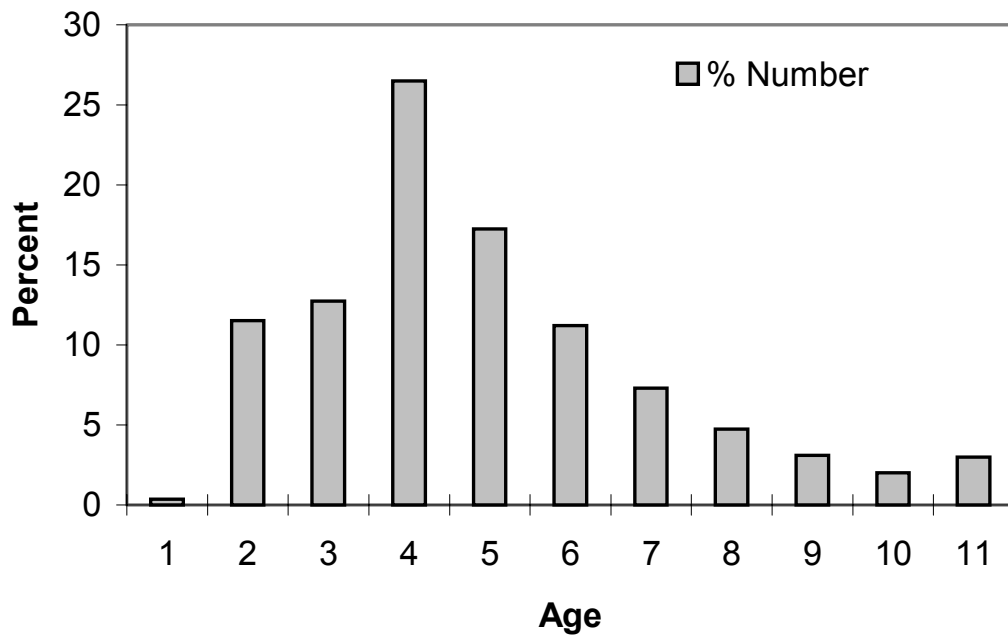


Figure 10. Expected age structure of SW Nova Scotia herring with fishing at  $F_{0.1}$  and constant average recruitment.

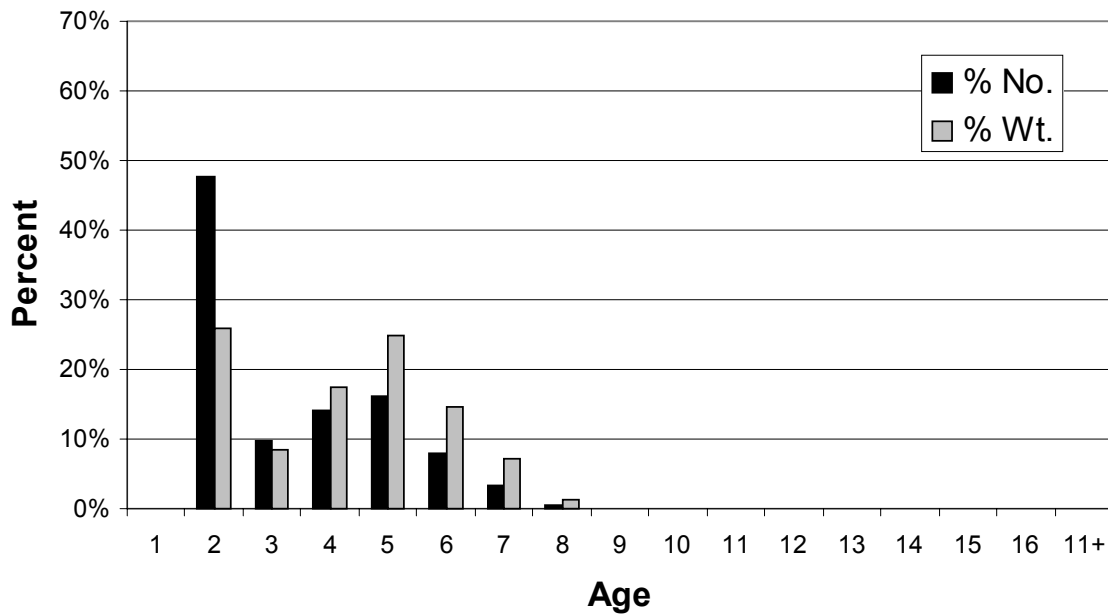


Figure 11. Catch at age for 2000 for the overall southwest Nova Scotia spawning component (% numbers and % weight).

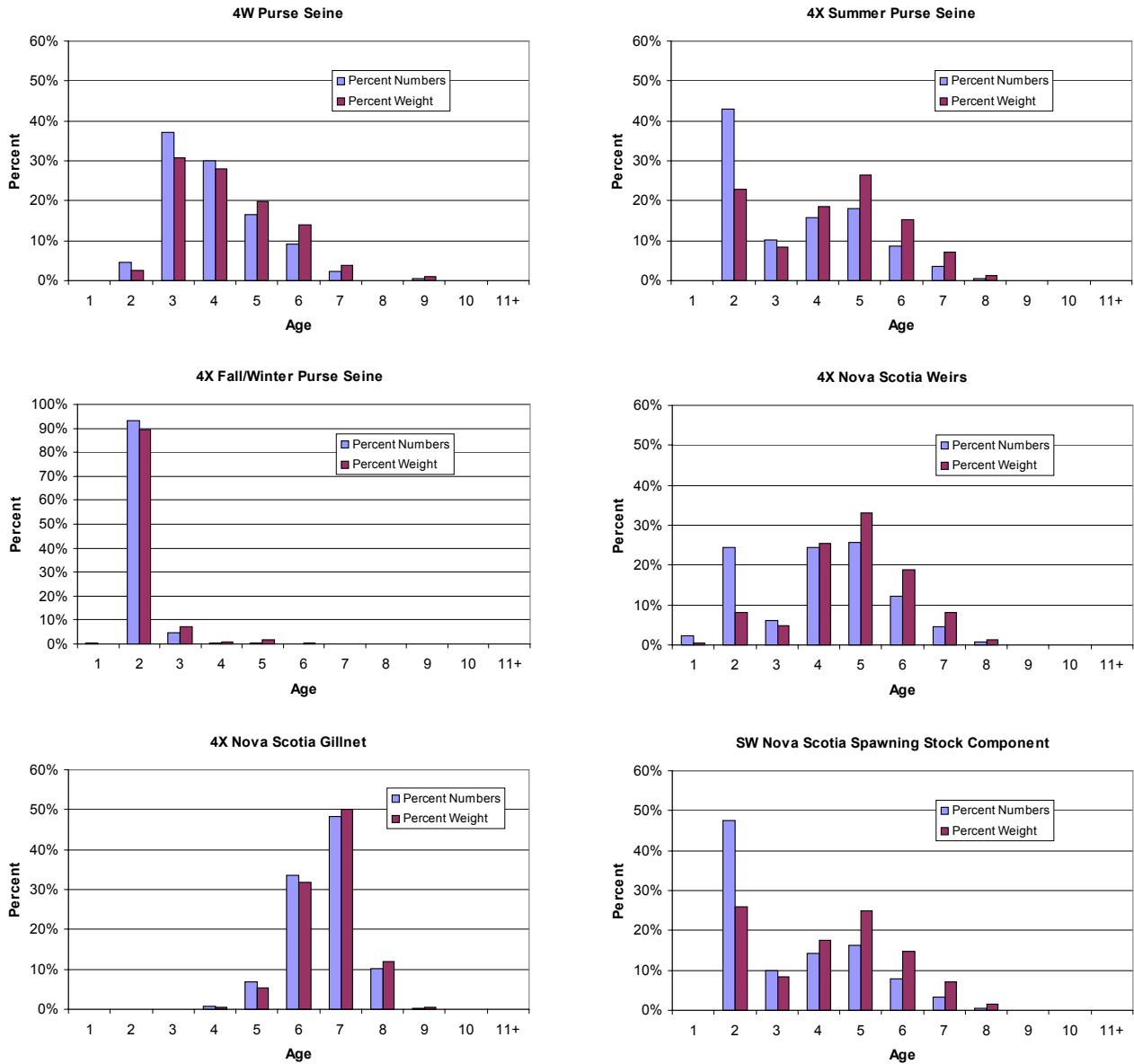


Figure 12. Catch at age for 2000 for the southwest Nova Scotia spawning component (% numbers and % weight) by gear type and for overall combined.



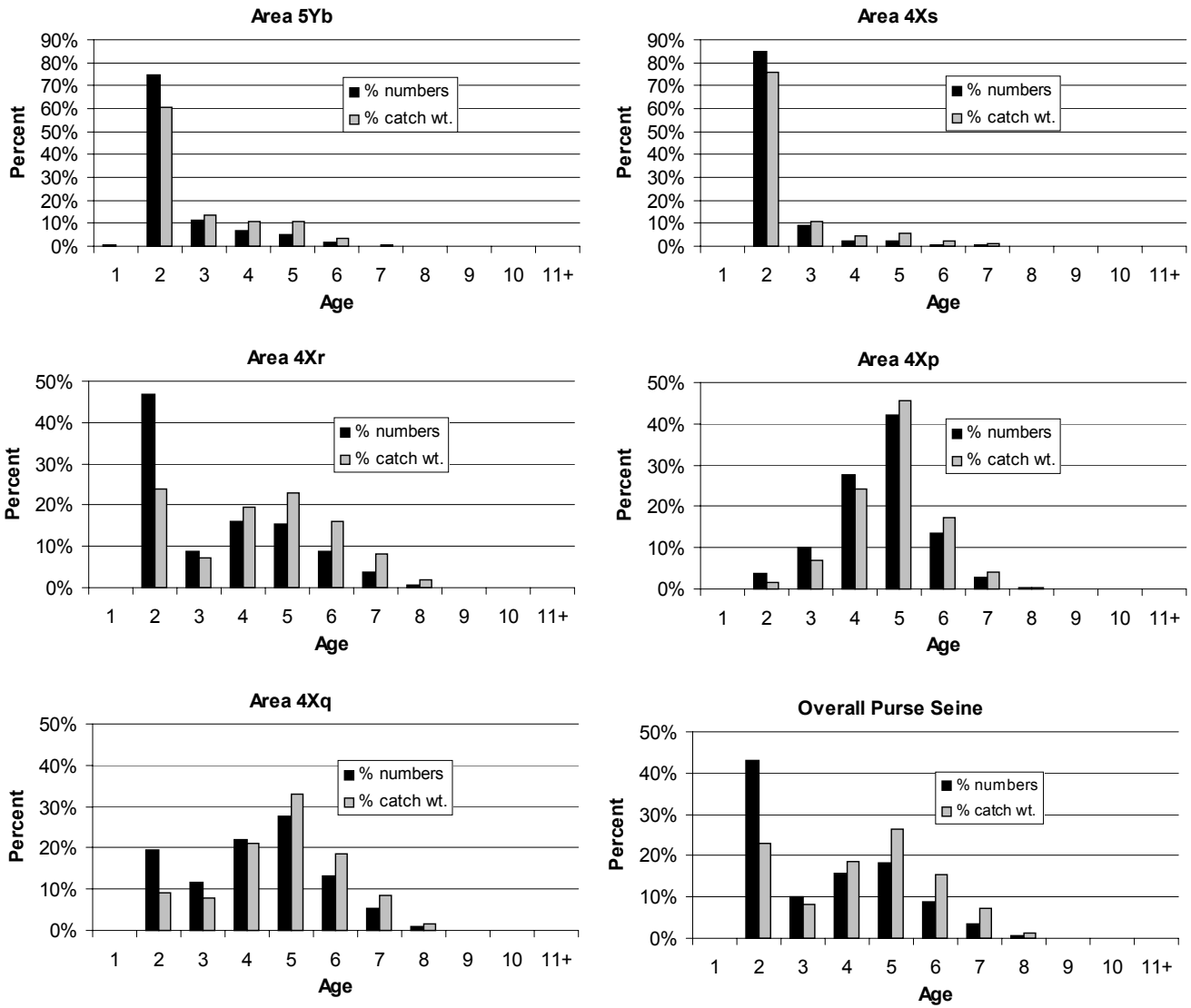


Figure 13. Herring catch at age by NAFO unit area for the 2000 summer purse seine fishery conducted on the southwest Nova Scotia spawning component (4WX stock).

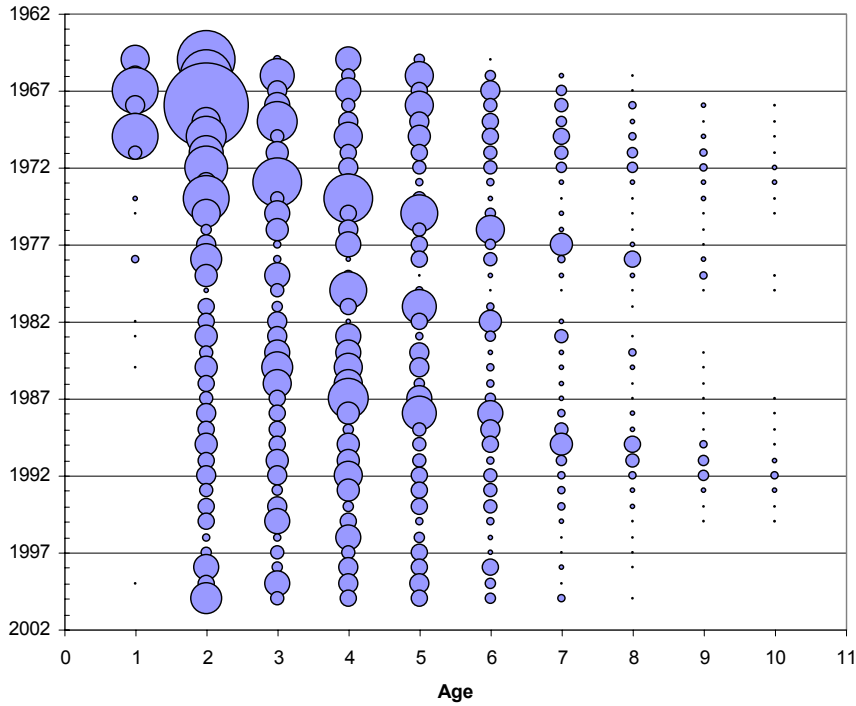


Figure 14. Historic catch at age (numbers) for the SW Nova Scotia spawning component.

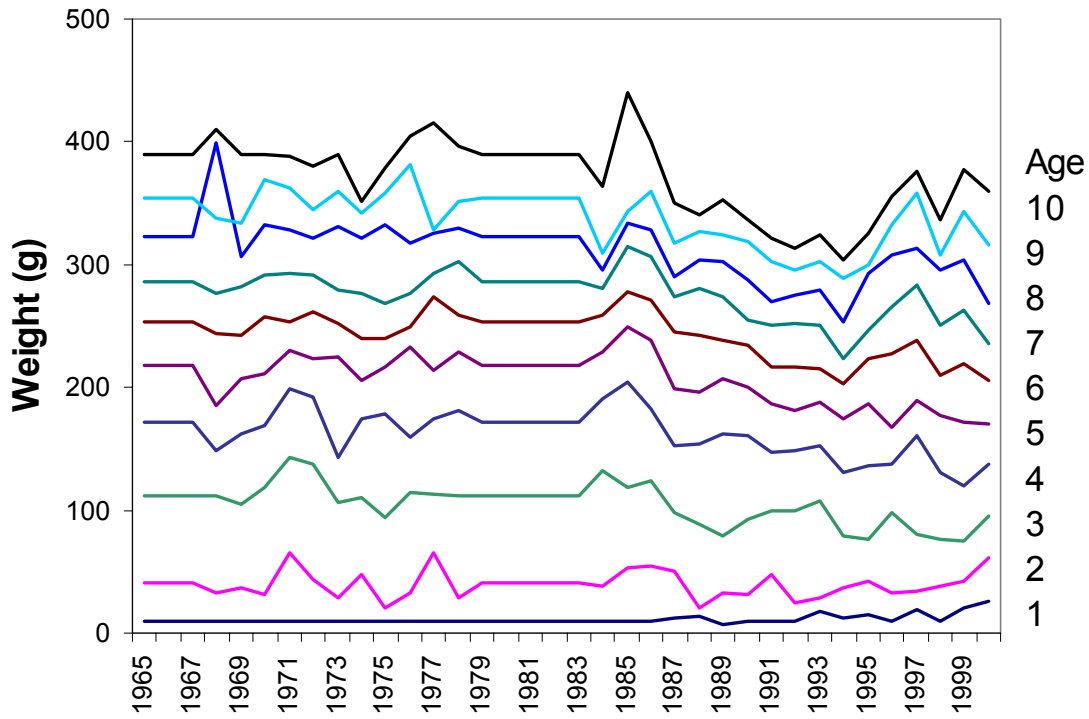


Figure 15. Average weights at age (g) for the SW Nova Scotia component of the 4WX herring fishery (weighted by fishery) for 1965-2000.

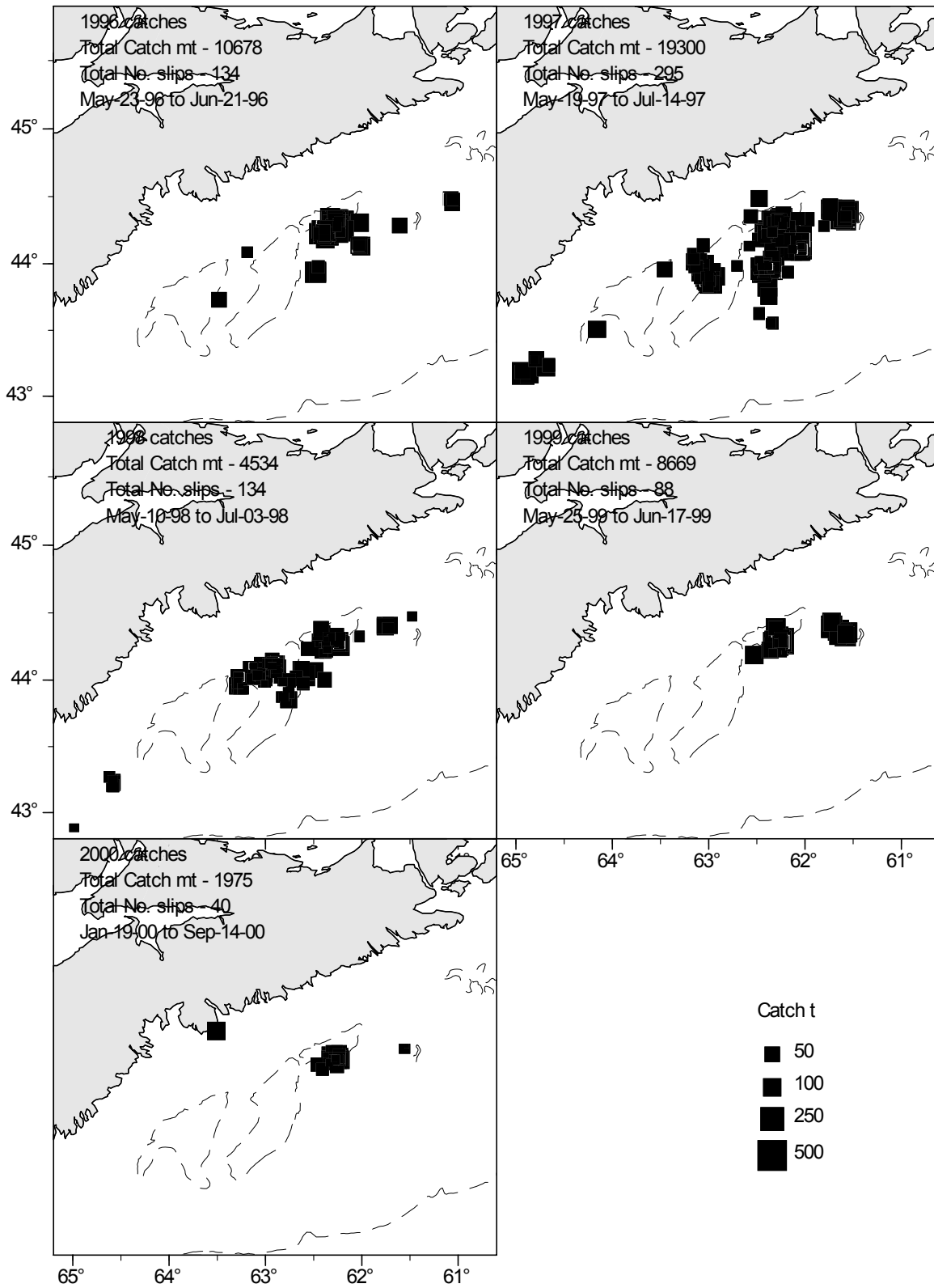


Figure 16. Herring purse seine catches (t) on offshore Scotian Shelf banks, 1996 to 2000.

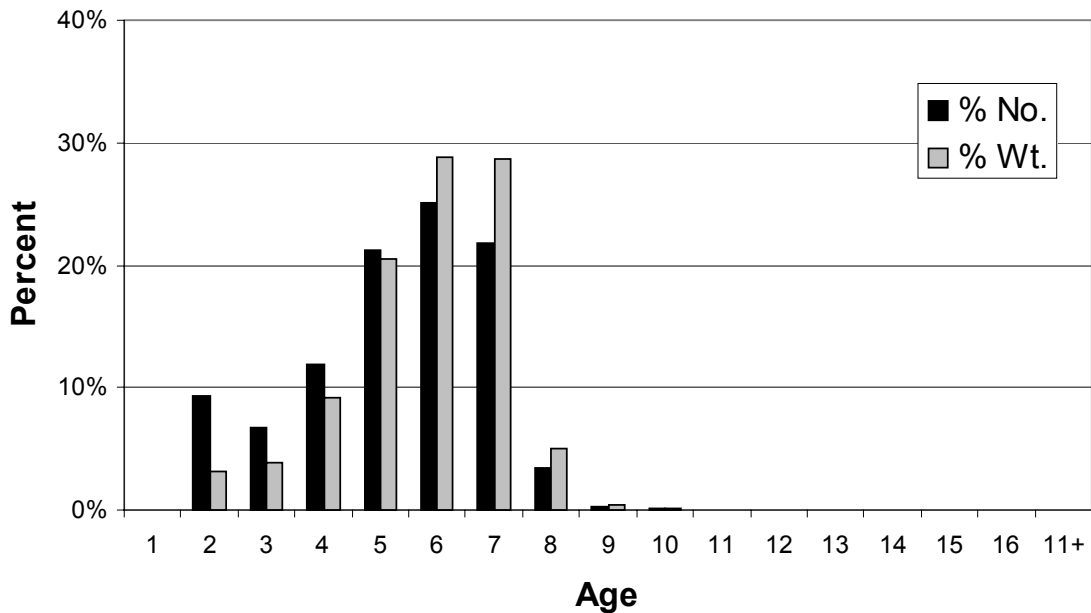


Figure 17. Catch at age for herring for the offshore Scotian Shelf Banks spawning component from the 2000 purse seine fishery.

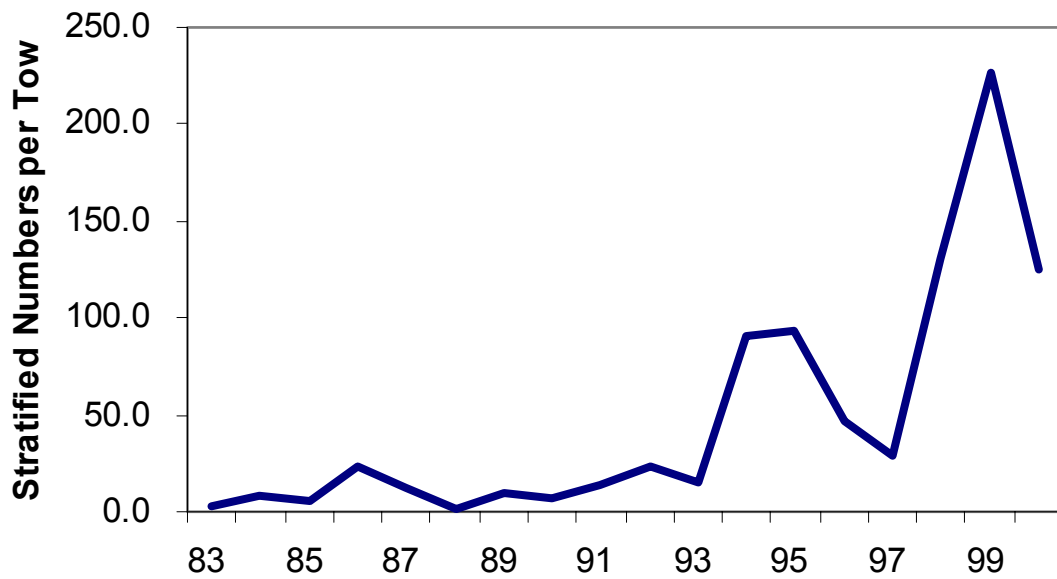


Figure 18. Number of herring caught per standard tow in the July bottom trawl survey of the offshore Scotian Shelf Banks, 1983 to 2000 (strata 55-78).

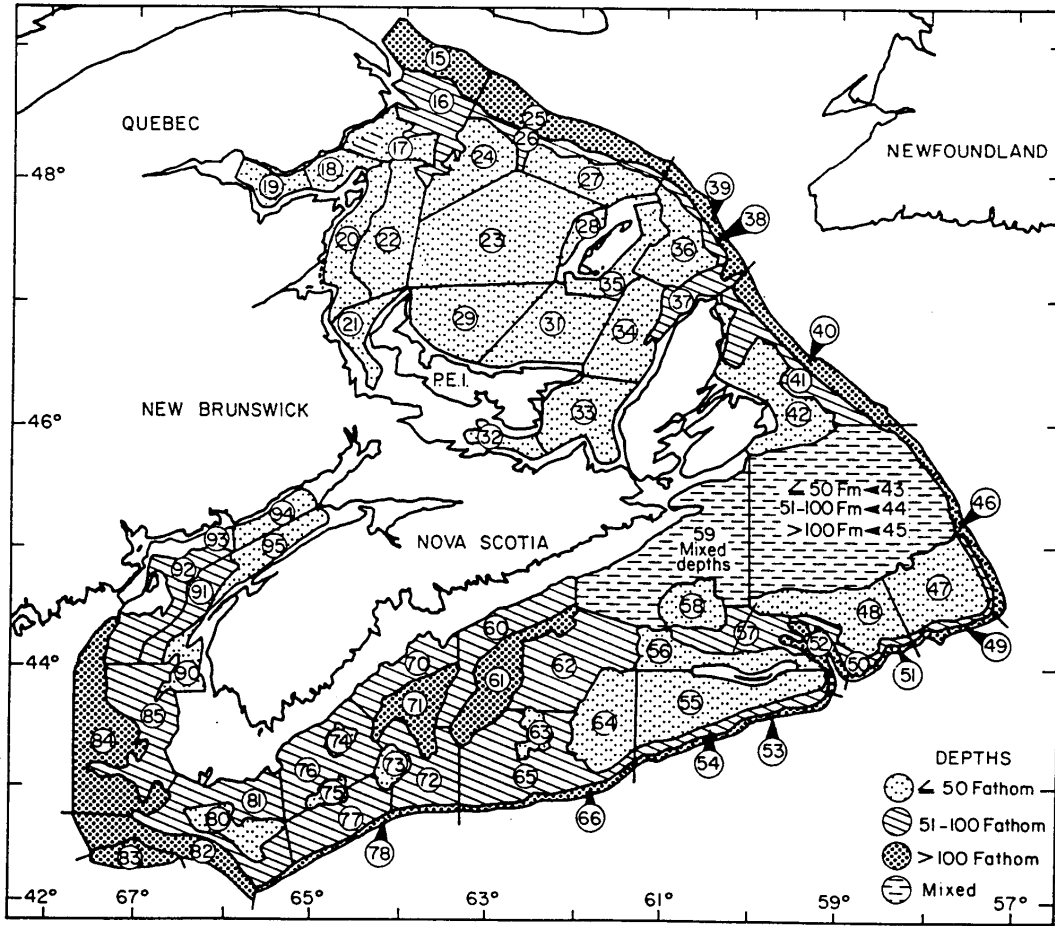


Figure 19. Groundfish survey strata in NAFO Divisions 4T, 4V, 4W and 4X (from Doubleday 1981).

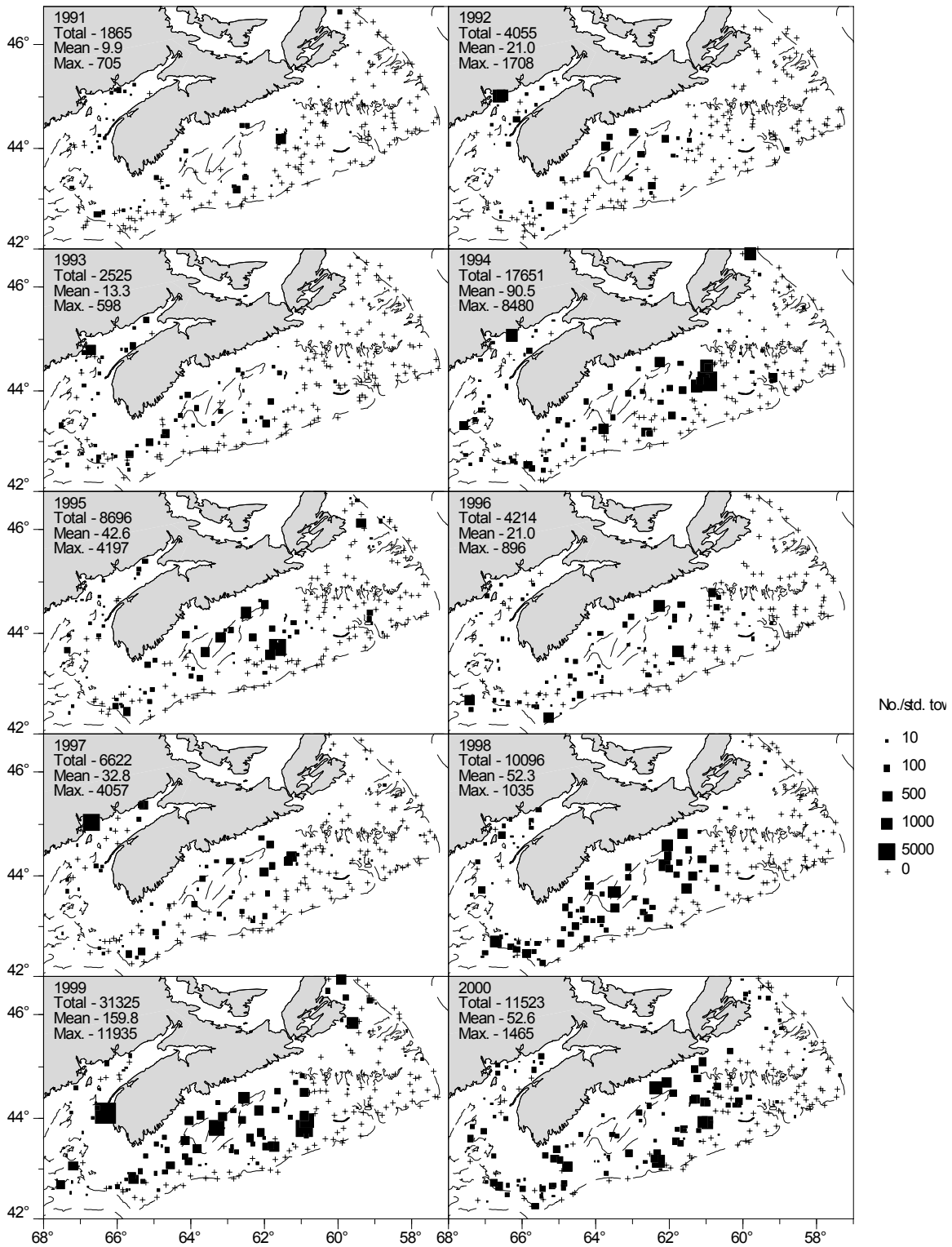


Figure 20. Herring catches (numbers per standard tow) from the July bottom trawl survey for 1991-2000.

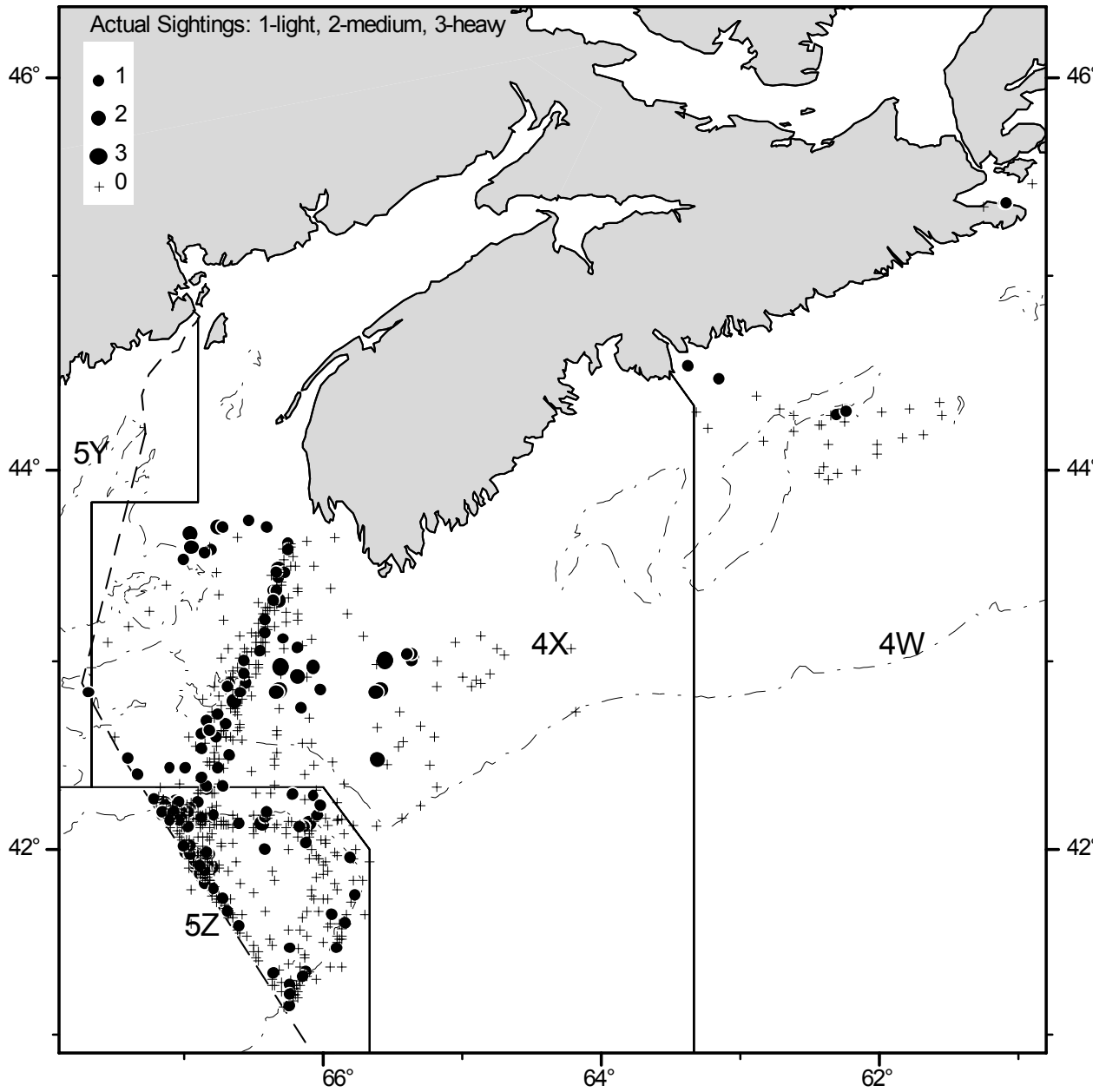


Figure 21 Herring midwater trawler (Morning Star) observations on southwest Nova Scotia, Georges Bank and the offshore Scotian Shelf banks for year 2000.

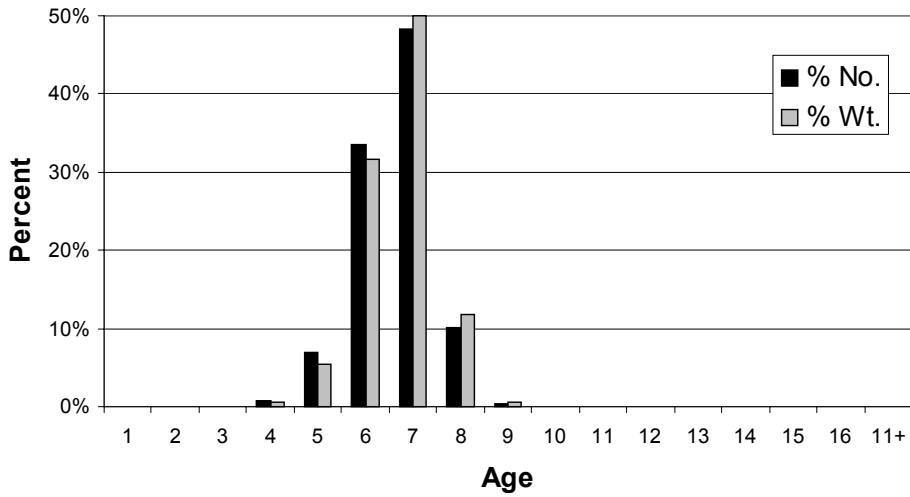


Figure 22. Catch at age (% numbers and % weight) of herring from the fall 2000 Port Mouton/Little Hope gillnet fishery.

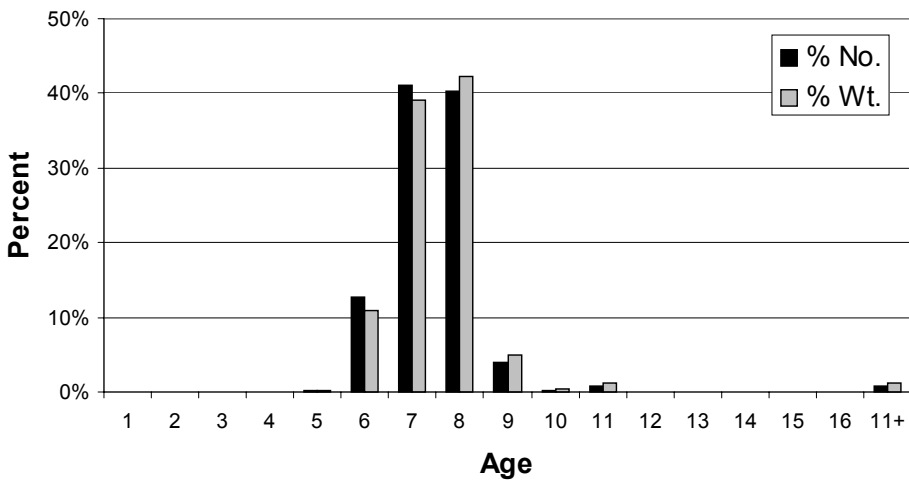


Figure 23. Herring catch at age (% numbers and % weight) for the fall 2000 gillnet fishery east of Halifax.



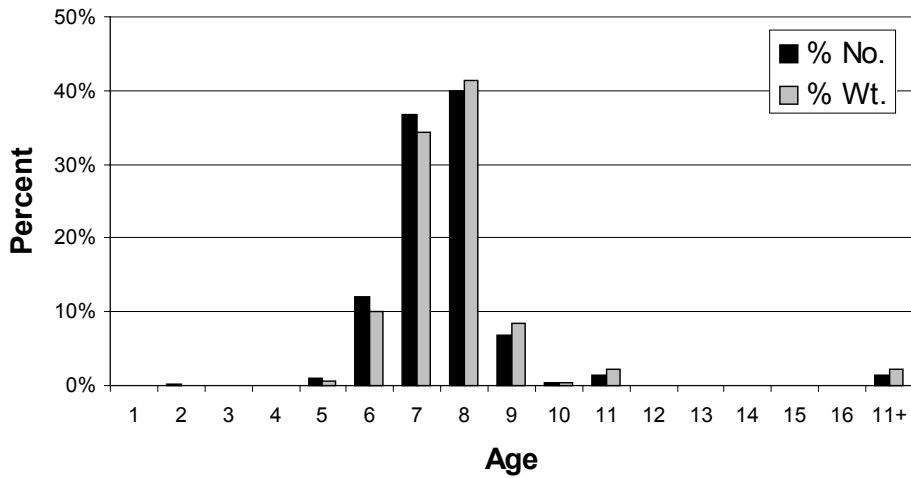


Figure 24. Catch at age (% numbers and % weight) of herring from the fall 2000 Glace Bay gillnet fishery.

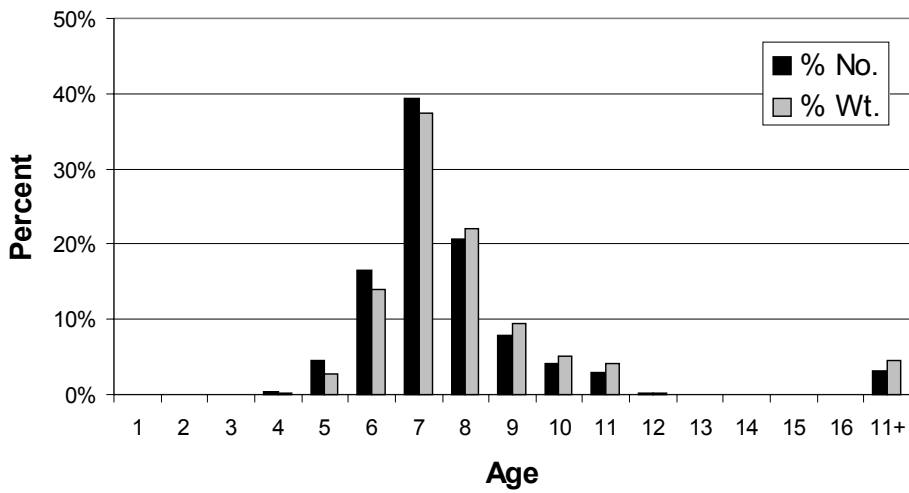


Figure 25. Catch at age (% numbers and % weight) of herring from the 2000 Bras D'Or Lakes gillnet fishery.

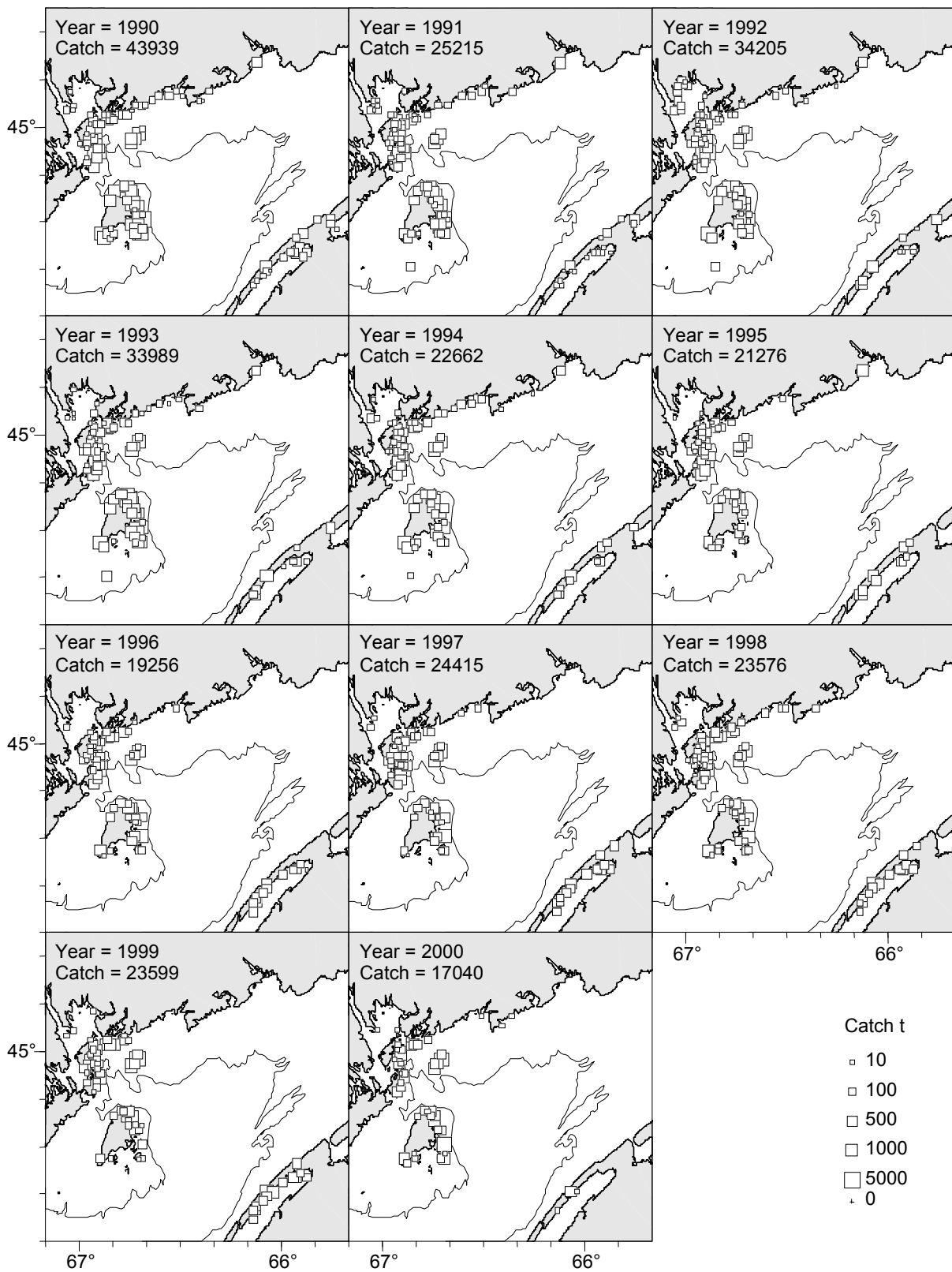


Figure 26. 1990-2000 New Brunswick and Nova Scotia herring weir catches (data summed by 1 mile square).

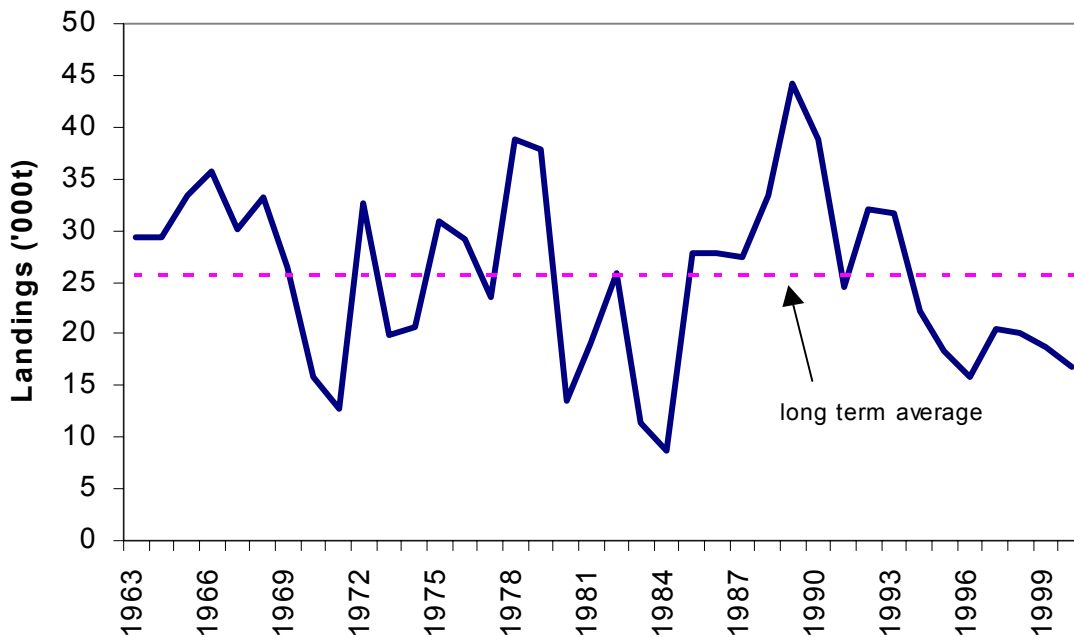


Figure 27. Herring landings from the southwest New Brunswick weir and shutoff fishery, 1963-2000.

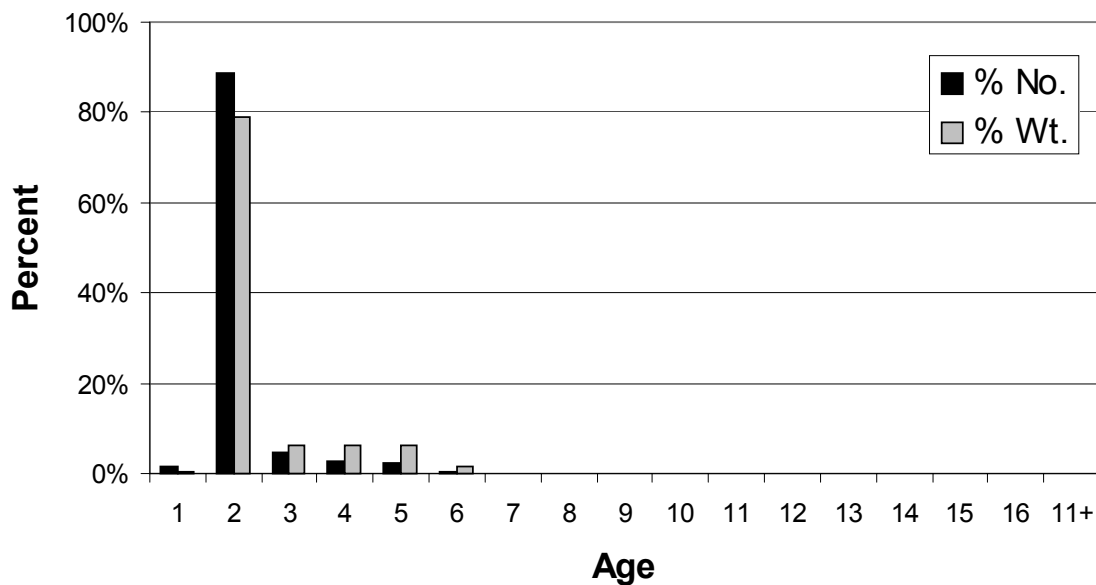


Figure 28. Catch at age (% numbers and % weight) of herring from the 2000 southwest New Brunswick weir and shutoff fisheries.

Appendix 1-1. Herring tags applied for 2000 and 2001 (as of April 2001).

Area	Date	# of Tags	Total for 2000	Total for 2001	Grand Total
Chebucto Head	1/8/00	6,995			
	1/9/00	15,987			
	1/4/01	4,126			
	1/5/01	6,660	22,982	10,786	33,768
Welcome Weir	9/19/00	1,000	1,000		1,000
Abnacki Weir	9/20/0	1,011	1,011		1,011
Burnt Boat Weir	9/21/00	1,200	1,200		1,200
Indian Island Shutoff	9/22/00	1,325	1,325		1,325
					Grand Total 38,304

Appendix 1-2. Herring tag return summary for 2000 to 2001 (as of April 2001).

Application Location (releases)	Number Returned	Location Returned
Chebucto Head (33168)	62	Chebucto Head
	6	Wedgeport, Nova Scotia
	56	Halifax
	1	Saint John
	1	Long Island Shore
	2	Scots Bay
	1	German Bank
	1	Tongue Ground
	1	Lower East Pubnico
	1	Cape Smokey Shore
	34	Unknown
Burnt Boat Weir (1200)	1	Outer Lighthouse Cove, Bliss Island
	1	Northeast Bank
Chedabucto Bay (3709)	1	Chebucto Head
	2	Halifax
	1	Teardrop Weir
Scots Bay (2433)	1	Browns Banks
Total 2000-2001 returns	173	