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**Évaluation des stocks de hareng de  
4VWX en 2011**

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**ABSTRACT**

Quota landings of Atlantic herring (*Clupea harengus*) in 2009-2010 were 45,534t against a Total Allowable Catch of 55,000t for the Southwest (SW) Nova Scotia/Bay of Fundy (SWNS/BoF) component. Acoustic biomass estimates decreased by 36% for the major spawning ground survey areas in Scots Bay and on German Bank. In 2010, the fishery catch at age composition by number was comprised of 60% fish at 2 years of age, 22% at age 3, and only 7% at ages older than age 5. There was a large reduction in fish condition and weights at age across all ages in the fishery, which is attributed to poor feeding conditions. This assessment indicates a decline in the resource with reduced spawning abundance, poor fish condition and a lack of older fish in the population. The high catches and targeting of juvenile fish, which was a major feature of the 2009 and 2010 fisheries, may impede future rebuilding of the stock.

There was an increase in landings from 9,088t to 11,862t from the offshore Scotian Shelf banks, mainly due to good fishing conditions and the availability of herring to the purse seine gear. There was no midwater trawl activity in the offshore area and only limited by-catch of herring from bottom trawl gear. Herring abundance in the summer bottom trawl research survey was again at a high level with large increases in all areas except the Bay of Fundy. This survey has not been considered indicative of overall abundance due to changes in catchability for herring and a lack of year-class tracking. There was a single acoustic survey completed for the offshore area in 2010, which documented 3,500t of biomass.

The recorded landings in the 2010 gillnet and trap net fisheries along the coast of Nova Scotia decreased from 9,873t to 5,575t. There were decreases in surveyed acoustic biomass in the Halifax/Eastern Shore and Little Hope areas from the previous year. Surveys were also completed near Glace Bay, but there were few spawning herring documented and very little catch reported. No herring surveys took place in the Bras d'Or Lakes.

Landings in the 2010 New Brunswick weir and shut-off fishery were 10,958t, up from the low of 4,031t in the previous year. It is notable that, as recently as 2007, landings were 30,944t, the highest in nearly 20 years. The age distribution of fish caught in the 2010 New Brunswick weir and shutoff fishery were primarily juveniles, with 95% by number at age 2. The success of this passive trap fishery has been historically unpredictable, and catches are inherently susceptible to many natural variables in addition to abundance.

## RÉSUMÉ

Les quotas de débarquements du hareng de l'Atlantique (*Clupea harengus*) en 2009-2010 se chiffraient à 45 534 t par rapport à un total autorisé des captures de 55 000 t pour la composante du sud-ouest de la Nouvelle-Écosse et de la baie de Fundy. Les estimations de la biomasse dans les relevés acoustiques ont diminué de 36 % pour les principales zones de relevé des frayères dans la baie Scots et du banc German. En 2010, la composition des captures (numériques) selon l'âge reflétaient 60 % de poissons d'âge 2, 22 % d'âge 3, et seulement 7 % de poissons d'âge supérieur à 5. On a observé une dégradation importante de la condition des poissons et une diminution importante de leur poids selon l'âge pour tous les âges dans la pêche, ce qui est attribuable à de mauvaises conditions alimentaires. Cette évaluation dénote un déclin des ressources avec une réduction de l'abondance des géniteurs, la piètre condition du poisson et un manque de poissons plus vieux dans la population. Le taux élevé de prises et le ciblage des juvéniles, qui étaient les principales caractéristiques des pêches de 2009 et de 2010, pourraient entraver le rétablissement futur du stock.

Il y a eu une augmentation des débarquements de 9 088 t à 11 862 t à partir des bancs du large du plateau néo-écossais, principalement en raison des bonnes conditions de pêche et de la disponibilité du hareng pour les engins utilisant une senne coulissante. Il n'y avait pas d'activité de pêche au chalut pélagique dans la zone extracôtière et seulement quelques prises accessoires de hareng provenant de la pêche au chalut de fond. L'abondance du hareng dans le relevé d'été au chalut de fond concernant le chalut de fond était encore une fois élevée avec d'importantes augmentations dans toutes les zones sauf dans la baie de Fundy. Ce relevé n'a pas été considéré indicateur de l'abondance globale en raison des variations de la capturabilité du hareng et du manque de suivi de la classe d'âge. Un seul relevé acoustique a été effectué pour la zone extracôtière en 2010 qui a indiqué une biomasse de 3 500 t.

Les débarquements enregistrés en 2010 pour la pêche au filet-trappe et filet maillant le long de la côte de la Nouvelle-Écosse ont diminué pour passer de 9 873 t à 5 575 t. Le relevé acoustique a fait état d'une diminution de la biomasse dans les régions de Halifax/côte est et de Little Hope depuis l'année précédente. Des relevés ont aussi été effectués près de Glace Bay, mais peu de harengs en frai y ont été observés et peu de captures signalées. Il n'y a pas eu de relevé sur le hareng dans les lacs Bras d'Or.

Les débarquements des parcs à hareng et des sennes de plage au Nouveau-Brunswick se sont chiffrés à 10 958 t en 2010, une augmentation par rapport aux débarquements de l'année précédente qui se chiffraient à 4 031 t. Il faut également noter qu'en 2007, les débarquements se chiffraient à 30 944 t, soit le niveau le plus élevé depuis presque 20 ans. Il ressort de la répartition des âges dans les captures de hareng provenant des parcs à hareng et des sennes de plage au Nouveau-Brunswick que ces captures étaient constituées essentiellement de juvéniles, dont 95 % d'âge 2. Le succès de cette pêche passive au casier est historiquement imprévisible et les prises ont une tendance inhérente à fluctuer en fonction de nombreuses variables naturelles, en plus de l'abondance.

## INTRODUCTION

Atlantic herring (*Clupea harengus*) is a pelagic species found on both sides of the North Atlantic. Herring spawn in discrete locations, to which they are presumed to home. Herring first mature and spawn at three or four years of age (23 to 28cm or 9 to 11in), then begin a predictable annual pattern of spawning, over wintering, and summer feeding, which often involves considerable migration and mixing with members of other spawning groups. Most fishing takes place on dense summer feeding, over wintering, and spawning aggregations and has been dominated by purse seine, weir and gillnet gear types, with relatively minor landings by shutoff, trap and midwater trawl.

The 4VWX Atlantic herring management unit contains a number of spawning areas, separated to various degrees in space and time. Spawning areas in close proximity with similar spawning times, and which share a larval distribution area, are considered part of the same component. These undoubtedly have much closer affinity than spawning areas that are widely separated in space or time, and do not share a common larval distribution. Some spawning areas are large and offshore, whereas others are small and more localized, sometimes very near shore or in small embayments. The situation is complicated further as herring migrate long distances and mix outside of the spawning period, both with members considered part of the same component and with members of other components. For the purposes of evaluation and management, the 4VWX herring fisheries are divided into four components (Figure 1):

- 1) Southwest Nova Scotia/Bay of Fundy (SWNS/BoF) spawning component (also '4WX' in management plan);
- 2) Offshore Scotian Shelf banks spawning component;
- 3) Coastal (South Shore, Eastern Shore and Cape Breton) Nova Scotia spawning component; and
- 4) Southwest New Brunswick (SWNB) migrant juveniles.

Each component has several spawning areas, and there is mixing of fish among spawning components. Industry and management have explored means of managing the complexity within each component (such as distributing fishing effort among spawning areas according to their relative size) and of taking appropriate account of interaction among components (such as fishing restrictions on some areas of mixing).

The Georges Bank spawning component is not included in this evaluation except to document Canadian fishing activity. There were no herring landings in 2010 from the Canadian portion of Georges Bank, with the last recorded landings in 2004. This fishery is included in the Gulf of Maine stock complex and was last evaluated in 2006 (DFO 2003a; TRAC 2006).

## OBJECTIVES AND MANAGEMENT

The 2003-2006 Scotia-Fundy Herring Integrated Fisheries Management Plan (DFO 2003b) sets out principles, conditions, and management measures for the 4VWX herring fisheries. The main principle stated in the plan is, "the conservation of the herring resource and the preservation of all of its spawning components". The background for the conservation objectives was first developed and reviewed by Sinclair (1997).

Three conservation objectives appear in the plan:

1. To maintain the reproductive capacity of herring in each management unit through:
  - 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.
2. To prevent growth over fishing:
  - continue to strive for fishing mortality at or below  $F_{0.1}$ .
3. To maintain ecosystem integrity/ecological relationships (“ecosystem balance”):
  - maintain spatial and temporal diversity of spawning; and
  - maintain herring biomass at moderate to high levels.

There is evidence that several of these objectives are not being met, and little improvement has been seen from the low level of the resource noted in recent assessments despite efforts that have been made recently including five years of a reduced Total Allowable Catch (TAC; Power et al. 2006, 2007, 2008, 2010a). There is also a need to better define these objectives in terms of minimum thresholds and to explicitly list the spawning components in terms of spatial and temporal expectations.

An “in-season” management process, first implemented in the SWNS fishery during 1995, continues to be used widely within the 4VWX management area (DFO 1997; Stephenson et al. 1996, 1999). The approach encourages surveying using the commercial fleet under scientific direction prior to fishing (“survey, assess, then fish” protocol) to ensure that effort is distributed appropriately among various components of the stock (particularly among spawning components) according to the relative size and current state of each component. The use of this approach in recent years has improved data collection and enabled modifications to management decisions to be made with the involvement of participants and on the basis of up-to-date information.

Collaborative research efforts with the fishing industry have been important in recent years. A major portion of the herring industry, including the purse seine sector and major processors which form the Herring Science Council (HSC), and some members of the fixed gear sector have undertaken a separate Joint Project Agreement with Department of Fisheries and Oceans (DFO) to undertake collaborative scientific projects. The herring industry has continued to undertake biological sampling and to collect samples, while the purse seine and gillnet sectors undertook key acoustic surveys. In 2010, field activities were covered by the HSC manager with assistance from St. Andrews Biological Station (SABS) / DFO staff, individual survey vessel captains and plant managers. In addition, downloading and data editing services were contracted by the HSC through A. Clay from FEMTO Electronics.

## **SOUTHWEST NOVA SCOTIA/BAY OF FUNDY SPAWNING COMPONENT**

### **THE FISHERY**

Fisheries in the 4VWX area in recent years have been dominated by purse seine, weir and gillnet, with relatively minor landings by shutoff and trap. A variety of herring fishing locations, NAFO areas and fishing ground areas are used to describe fishing activities and group the data for analysis of catch and sampling (figures 2-4).

Quota landings for the SWNS/BoF stock component, the only component under TAC control were 45,534t against a TAC of 55,000t for 2009-2010 quota year (Table 1). The quota year begins on October 15 and ends on October 15 of the following year. Landings in the fall 2010 and winter 2011 purse seine fisheries for the 2010/2011 quota year were 1,584t as of March 2, 2011 (Table 2). There were additional landings of 28,395t from the non-stock components including Coastal Nova Scotia, the Offshore Banks and SWNB. There was an increase in the proportion of landings from the New Brunswick weirs and shutoffs in 2010 over the 2009 landings, a decrease in landings from the Coastal Nova Scotia and an increase from the Scotian Shelf Banks components (tables 1, 3).

In 2009-2010, landings for the SWNS/BoF stock component were below the TAC. As a result of an industry decision late in the season 9,466t of quota was left in the water. This was in order to avoid catching and adding more fish of a size of less than 23cm to the 2010 landings. Landings for this component have recently tracked the TAC, with most of the quota being taken each year since 2002 (Figure 5). As a result of the reduced quota since 2005, total landings from this component remain near the lowest on record since 1963 (Table 3). Table 4 (a, b) show the purse seine catches (in t and in percentages) by fishing grounds from 1985-2010 for the 4VWX stock component. Most of the catch over the history of this fishery has been caught by purse seine gear with the 4X summer purse seine fishery being the most important (Table 3; figures 6, 7). In 2010, landings by the purse seine sector accounted for 97% of the component catch, with minimal landings by the gillnet sector (204t) and below average landings from the Nova Scotia weirs (1,198t; Table 1). According to the management plan, 80% of the TAC is initially allocated to the mobile gear sector and 20% to the fixed gear sector and, as in past years, a transfer of unused quota to the mobile fleet occurred near the end of the fishing season.

Purse seine catches are summarized by fishing grounds using definitions of the various grounds based on groupings of 10 minute boxes of latitude and longitude (Table 4a, b; Figure 4). Catches by fishing grounds in 2010 showed that the largest proportions came from the German Bank (40%) and Grand Manan (35%) areas (Table 4b; Figure 8). There was a decrease in catches from the Gannet/Dry Ledge area (down from 8,656t to 723t). The New Brunswick coastal area also decreased from 5,023t to 2,762t. Catches were again below the long term average from Scots Bay and the Long Island shore areas, however, the 2010 Scots Bay landings showed a 4.5-fold increase (4,086t) over the 2009 landings (902t).

Purse seine landings of 1,664t were reported in the October/November 2009 fall fishery and 1,123t in the January 2010 winter fishery (Table 1, Figure 9). These fisheries, which take place at the beginning of each quota year, are usually concentrated on the New Brunswick side of the Bay of Fundy.

The largest single fishery of the SWNS/BoF stock component is the summer purse seine fishery, which occurs from May to October in the Bay of Fundy area. In 2010, this fishery took place in similar areas and months as in previous years with total landings of 41,345t (Table 1; Figure 10). A large part of this fishery is directed toward pre-spawning, feeding aggregations in

May and June. Catches on the major spawning grounds during the spawning period in Scots Bay and on German Bank are found primarily within the pre-defined acoustic survey areas (Melvin and Power 1999).

During the 1970's and 1980's, a large purse seine fishery took place on over-wintering aggregations in Chedabucto Bay, with total landings as high as 17,878t as recently as 1991 (Table 3, 4a, b; Figure 8). The last recorded landing occurring in 2000 (1,012t) and 2002 (367t). Since 1999, there has been a small fishery on over-wintering herring in January near Halifax Harbour (Chebucto Head), but the majority of the fall and winter herring landings for the past several years have come from the New Brunswick side of the Bay of Fundy.

Catches of non-stock component herring by purse seine came mainly from the Offshore Banks and Western Hole areas on the Scotian Shelf with 11,837t landed in 2010, up from the 9,032t landed in 2009 (Table 5). There have been no catches from the Georges Bank area since 2000 when 265t were landed (Table 5).

### **Main Fishing Areas for the SWNS/BoF Component**

The main fishing areas for the SWNS/BoF component are the German Bank, Scots Bay, and Trinity Ledge areas, which also include spawning grounds fisheries. Additional fishing takes place by the Nova Scotia weirs in St. Marys Bay and along the Long Island shore. There is also an occasional small gillnet fishery in the spring on spawning herring near Spectacle Buoy, which is just southeast of Yarmouth.

#### **German Bank**

German Bank is one of the primary herring fishing grounds in the Bay of Fundy area. Since 1985, catches from this area have ranged from 9,003t to 35,977t during the main fishery period from early May to late October (Table 6). Catches in the 2010 pre-spawning period (defined as the period from January 1 to August 14) decreased to 1,756t from 12,092t in 2009 during the same period. In 2008, catches during the pre-spawning period reached 16,845t, the highest since 1999 (Table 6). Catches during the 2010 spawning period (defined as the period from August 15 to October 15) were slightly higher (16,953t) than in 2009 (16,454t). The contribution of German Bank catch to the overall TAC was 52% in 2009 and decreased to 34% in 2010 (Table 6; Figure 11).

The distribution of catches on German Bank in the 2010 pre-spawning period (January 1 to August 14) is shown in Figure 12. Catches on German Bank during the spawning period within the spawning box area are primarily of spawning "roe" fish (Figure 13). However, not all catches are spawners, with juvenile sized non-spawning groups often located to the north of the spawning box. In 2010, catches of spawning herring were widespread with localized groups seen in both the northern and southern portions of the standard survey area on German Bank (Figure 13). The highest fishery catches during the spawning period in 2010 occurred in September (Figure 14) with less catches occurring in the latter half of August. The total catch for German Bank area declined to 18,708t (from 28,546t in 2009) making up 34% of the overall TAC (Table 6).

#### **Scots Bay**

The Scots Bay herring purse seine fishery has been an important component of the summer fishery with catches since 1987 ranging from 902t (2009) to 24,388t (2004) during the period of early July to late August-early September (Table 7; Figure 15). The 2006 fishery had catches

scattered mainly within the defined spawning area, but there was a reduction in overall fishing activity with 3,350t landed and less than half of the number of daily landings (purchase slips) than in 2005 (Table 7; Figure 16). The peak year of 2004 was unusual in several aspects, with the highest recorded catch of 24,400t, the longest season extending to September 16 and the most days with catch recorded (Table 7; Figure 17). Landings in 2008 were substantially reduced from 2007, with 2,373t caught from July 14 to August 27 (Table 7; Figure 17). There was a gap in landings similar to that seen in 2006 from July 22 to August 8. The 2010 Scots Bay fishery continued to be restricted by a 5,000t cap imposed due to the poor performance of the spawning component since 2005. Landings in 2010 increased from the 902t (over the 31-day fishing period) to 4,086t (over a 61-day fishing period; Table 7; Figure 17).

### Trinity Ledge

Catches were limited for Trinity Ledge in 2010 with 202t recorded between August 11 to September 24 (Table 8; figures 18 and 19). This is an increase over the catches in 2009 of 116t recorded between September 1 and September 11. In 2010, the total estimated biomass (with the Calibration Integration Factor (CIF)) from the acoustic surveys was 2,405t, up from the 1,575t in 2009 (Table 8; Figure 19). More work is needed to monitor the status of this spawning area, which once supported a major portion of the overall stock catch (Table 4a, b; Figure 8).

### Nova Scotia Weirs

The 2010 Nova Scotia weir catch (4Xr) from weirs located in St. Marys Bay and along the Long Island shore was 1,198t, up from the low of 387t in 2009 (tables 3, 9; Figure 20). The seasonal timing of the Nova Scotia weir landings has shifted to the later months of the season in recent years, with most of the catch in June, July and August in 2010 (Table 9). Catches for the Nova Scotia weirs have been highly variable in recent years and are not as consistent in their amount or timing, having occurred early in the season in the 1990's and later in the season in the last decade. There has also been a decline in the total number of herring weirs with six to 14 active weirs in the last decade, down from 20 or more in the 1980's, with only eight reporting catch in 2010 (Table 10).

### Spectacle Buoy

The spring gillnet fishery for roe has occurred in recent years for a short period in June in the vicinity of Spectacle Buoy located just southwest of Yarmouth, Nova Scotia. The fishery is dependent upon the availability of fish and to some extent market conditions, and may or may not occur in any given year. In 2008, there was virtually no fishery with only one landing of 6t and very limited acoustic surveys completed. In 2009, there was little fishing (less than 1t) and no survey activity in this area, while in 2010 there was no fishing with a survey biomass of 1,859t based on two valid surveys (Table 8).

## **RESOURCE STATUS**

### **Commercial Catch Rate Indices**

Catch and effort for gillnet data in the SWNS/BoF spawning component have been examined in previous assessments. They showed little trend and were considered unrepresentative due to the small amounts and variable timing and location of catch and effort (Table 3; Power et al. 2004). The 2010 catch from the gillnet fishery in the SWNS/BoF spawning component increased from 117t in 2009 to 204t in 2010.

Purse seine landings make up most of the overall catch and are allocated 80% of the TAC for the SWNS/BoF component under the current management plan. The purse seine catch has fluctuated between 44,476t and 103,537t since 1989, primarily reflecting changes in the TAC (Table 11; Figure 21). The number of boats fishing and days fished has dropped since 1990 due to fleet rationalization. This has resulted in increases in catch per boat and catch per day in recent years but these are also affected by the reduced TAC. In general, purse seine catch rates are not considered to reflect trends in population abundance due to the nature of herring schooling behavior and the acoustic technology used to find these concentrated schools. Catch rates can remain high or stable even at low stock levels. These data are reported to document the overall effort by the purse seine fleet (Table 11).

### **Acoustic Surveys**

Automated acoustic recording systems deployed on commercial fishing vessels have been used since 1997 to document the distribution and abundance of herring. Scheduled surveys are now conducted each year with surveys every two weeks on each of the main spawning components. An index of spawning stock biomass (SSB) is estimated by summing these results (Melvin and Power 1999).

In 2008, biomass estimates in the traditional survey areas of Scots Bay, Trinity Ledge and German Bank decreased by approximately 160,000t from the 2007 estimate. The 2008 estimate was a 42% decrease from 2007 and the lowest recorded since acoustic surveys began in 1997. In 2009, the biomass estimate for Scots Bay, Trinity Ledge and German Bank (in and out of the box) increased to 383,700t (Table 12, figures 22-23). The 2010 estimate showed a decrease in biomass to 252,600t.

### **Spawning Ground Turnover Rates from Tagging Studies**

The current acoustic survey methodology on spawning grounds is dependent on periodic turnover of spawning fish on the grounds. Acoustic surveys are required to be separated by at least 10 to 14 days to allow for turnover and to prevent double counting (Power et al. 2002). A tagging study to examine herring turnover rate on the German Bank spawning grounds was conducted during the summer/fall of 2009 (Maxner et al. 2010). The ongoing project to analyse and interpret the data will continue in 2012-13 in an attempt to gain a better understanding of residency time of herring throughout the spawning season for this area.

### **Exploitation Rates on Spawning Grounds**

The acoustic survey estimates and catches from individual spawning areas were examined to estimate relative exploitation rates on the different spawning groups and for the overall complex. In this analysis, exploitation was calculated as the ratio of catch divided by acoustic survey biomass. These estimates can be used to assess the impact of fishing and also to estimate the relative size of individual spawning units within the complex. These rates are dependent on the assumptions that the acoustic survey SSB is complete, that catches have been properly allocated and, most critically, that the acoustic SSB provides an absolute measure of biomass. As a result of these uncertainties, the absolute fishing mortalities cannot be determined or inferred, but instead the trends over time may be used in a relative sense from year to year.

For this analysis, the three main spawning components for Scots Bay, German Bank and Trinity Ledge, which have received relatively consistent survey effort since 1999, were used. The acoustic SSB for nearby Seal Island and Spectacle Buoy areas were allocated to the German Bank spawning area. All catches throughout the year captured on each spawning ground were

assumed to be site specific (Table 13-C1), while catches from other non-spawning areas were allocated based on the relative spawning ground SSB proportions from annual acoustic surveys (Table 13-A2). The adjusted total catch was thus made equal to the reported stock catch (Table 13-C2). Exploitation rates were then calculated (Catch / SSB) for both the actual catch on the spawning grounds and the overall adjusted catch as proportions (Table 13-E1, E2).

The trends in spawning area proportions as estimated from acoustic surveys (Table 13-A2) have been stable since 2005, with about 80-90% of survey SSB found in the German Bank area and 10-20% in the Scots Bay area. The increase in 2005 for German Bank corresponded with a dramatic decline seen in Scots Bay in 2005, which made up as much as 36% of the overall SSB before this decline.

Calculation of exploitation rates since 1999 by component (Table 13-E2) showed that the larger grounds (Scots Bay and German Bank) have an average exploitation of 21% and 16%, respectively. The smaller Trinity Ledge area had a very high average exploitation of 57%. The overall adjusted exploitation rate for the three areas combined showed a range from 14-25% from 1999 to 2010 (Figure 24). These exploitation values are useful in a relative sense for year to year comparisons and show that the overall adjusted estimate was stable between 14-18% between 1999 and 2004. There was an increase to 21% in 2005 coinciding with a large decrease in total survey biomass. The rate declined in 2006 to 2007 to a low of 13% followed by an increase to the series high of 25% in 2008. In 2009 the rate declined to 14% and increased to 18% in 2010 (Table 13-E2; Figure 24).

### **Biological Sampling**

Comprehensive biological sampling continued for this fishery with substantial involvement of the fishing industry, which supplied data in the form of length frequencies and maturity reports and saved frozen fish samples for analysis by DFO personnel. In 2010, a total of 1,331 samples (146,348 fish) were measured for length, while 4,582 fish were sampled for sex, weight, maturity and age (Table 14). The sources of the samples are shown in Table 15, with the bulk coming from the processing industry since 1996. Additional samples were collected by DFO personnel, observers deployed on fishing vessels and from DFO research surveys. Sampling from the commercial fishery was well matched to the spatial and temporal distribution of the fishery and additional sampling from research vessel surveys during the spring and summer resulted in widespread geographic coverage as in the past (Figure 25).

### **Catch at Age**

Consistent with previous assessments, the catch at length and age was constructed using the 'Catch at Age' application (version 11.5), which is a program for computing catch at age statistics as part of the stock assessment process. Data files used by 'Catch at Age' were selected directly from biological sample data in the Pelagic Samples Database. These data included a 2% adjustment for the shrinkage due to freezing on the length measurements for frozen samples (Hunt et al. 1986).

The size and age composition was characterized by month, unit area and gear type using all available length and age samples (Table 16). The length-weight relationships, needed for the calculations, were calculated on a monthly basis. The catch at age statistics were then calculated from length frequency and age-length key samples expanded to total catch using appropriate monthly length-weight relationships. The data were grouped or combined and then age-length keys were applied to length frequencies to produce catch at age statistics by NAFO unit area, gear-type and month.

Table 17 and Figure 26 show the catch at age by month and overall for the season for the 2010 summer purse seine fishery conducted on the SWNS/BoF spawning component (4WX stock). Table 18 and Figure 27 show the catch at age by fishing ground for the 2010 summer purse seine fishery conducted on the SWNS/BoF spawning component (4WX stock). Table 19 and Figure 28 show the catch at age for the overall 2008-09 and 2009-10 quota years for the purse seine, gillnet and weir fisheries conducted on the SWNS/BoF spawning component (4WX stock).

The 2010 catch was dominated by the 2008 year-class (at age 2), representing about 60% of the numbers and 32% of the weight of herring landed in the SWNS/BoF component (Table 20a,b, Figure 29). The 2007 year-class (at age 3) was the second most important by number at 22% and contributed 35% by weight of the landings. The proportion of the catch older than age five decreased in 2010 to 8% from 24% in 2009. The total number of fish removed by the fishery in 2010 was calculated to be 796 million, an increase of 209 million or 36% from 2009, which has the same overall TAC as 2010.

The historical time series of catch at age still shows very few fish older than age 8 since 1995 and has been dominated by ages 2 through 5 (Table 20a,b; Figure 30). Older ages had been a feature when strong year-classes (i.e., 1976 and 1983) were progressing through the fishery. These stronger year-classes had persisted in the catch to older ages in the 1970's through to early 1990's. In recent years, the rapid decline of year-classes in the catch and the continued lack of older fish imply a high total mortality (Power et al. 2006). The trend toward catches at younger ages results in reduced yield and is reflected in the increase in the number of individual fish caught as the landings have decreased (Figure 31).

### **Weight at Age**

The fishery weighted average weight at age continued to be below the long term 1965-2010 average in recent years possibly reflecting changes in fishing patterns and timing (Table 21; Figure 32). There was a general decline in weight at age that occurred for all ages around 1987 (Figure 33). A further decline is also apparent for older ages (6 to 10) after 1997 with ages 8+ fish now consistently below 300g. The 2010 weights at age in particular are similar to the most recent 5-year and 10-year averages, which are consistently lighter than the overall series average (Figure 32).

### **Total Mortality Estimates from Acoustic Data**

Estimates of total mortality ( $Z = \text{Fishing mortality} + \text{Natural mortality}$ ) were calculated using the acoustic catch at age data.  $Z$  calculations are typically quite variable when done in this manner, but can often be used to detect broad patterns. Total mortality was calculated using ages 4 to 8 combined compared with ages 5 to 9 in the following year (Table 22; Figure 34). The acoustic age composition for the German Bank component from 1999 to 2010 and the biological characteristics from sampling for German Bank acoustic surveys from 1999 to 2010 are shown in tables 23 and 24. The acoustic age composition is assumed to be representative of the overall spawning biomass at these ages. The results for 2000 to 2010 have highly variable values of  $Z$  between 0 and 1.8 (Figure 35). There is no apparent trend as the series is very short.

### **Stock Trends**

In 2008, the acoustic biomass estimates decreased for all survey areas in Scots Bay, Trinity Ledge and German Bank to an overall amount of 223,100t (Power et al. 2010a). This was a 42% decrease from the previous year, and was the lowest recorded since acoustic surveys began in 1997. The 2008 acoustic SSB estimate for the overall area remained well below the long term average, as it has since 2005. The proportion of the catch greater than 30cm increased slightly in 2008, which may indicate improved survival but it is important to note that these catch data may not reflect the overall population composition and so must be used with caution when considering population trends.

In the past, industry and DFO Management have explored ways to manage the complexity within each component (such as distributing fishing effort among spawning areas according to their relative size) and taking appropriate account of the interaction among components (such as fishing restrictions on some areas of mixing). The total removals of fish by number were reduced by close to 50% from 2005 to 2008 relative to 2004, but increased in 2009 when the catch consisted of 45% by number of 2 year olds. This increase in the catch of 2 year olds was attributed to a potentially large year-class.

In 2012, the acoustic biomass estimates decreased for all survey areas in Scots Bay, Trinity Ledge and German Bank to an overall amount of 252,600t (Table 12) down from the 383,700t estimated for 2009. This was a 34% decrease from the estimate for 2009. The 2008 year-class made up 60% (by number) of the catch at age 2 in 2010.

### **SOURCES OF UNCERTAINTY**

There are several sources of uncertainty in this assessment that need to be considered. The use of the acoustic survey results as a measure of absolute abundance has a number of unknowns including residence time on the spawning grounds and estimation of biomass in the acoustic dead/blind zones at the surface and close to bottom. Between 1999 and 2003 acoustic survey results were used as minimum estimates of absolute SSB abundance and the population was considered to be approximately 500,000t. An SSB of that size would have been expected to result in substantial growth of the population, improved age composition and low fishing mortality, given reasonable recruitment and the landings over that period. This has not occurred.

The assumption that the surveys are additive continues to be a source of uncertainty (DFO 2007). Other significant issues relate to the completeness of coverage of the survey area on Trinity Ledge, inter-annual turn-over processes on each area, and factors that influence the target strength and acoustic backscatter (DFO 2007). Additionally, the mechanisms causing changes in fish condition is not understood.

The acoustic survey index provides fisheries independent information on the SSB but does not provide data on younger age classes. The size of recruiting herring year-classes is known to be highly variable and with no index of recruitment there is a large fraction of the catch dependent on recruiting year-classes of uncertain abundances. The size of the recruiting 2008 year-class is unknown but made up 60% (by number) of the catch at age 2 in 2010. This assessment uses relative trends in SSB and exploitation rate because there is no accepted population assessment model. This creates a difficulty in putting current SSB levels in a historical context when using trend data only for the period from 1999-2010.

## ECOSYSTEM CONSIDERATIONS

Herring is a keystone forage species prominent in the diet of many fish, seabirds and marine mammals, and should be managed with these interactions in mind. At present, use of a natural mortality rate of 0.2 and maintenance of SSB at moderate to high levels are assumed to take into consideration these interactions.

Management initiatives to protect spawning components are intended to maintain the spatial and temporal diversity of herring spawning. Any increase in the fishing on juveniles, which are of mixed or unknown stock affinity, would be inconsistent with this objective.

## 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 conservation objectives. The “survey, assess, then fish” protocol is effective in spreading the catch appropriately among spawning components in proportion to their relative size and is considered an important safeguard. Acoustic surveys have become critical to stock status evaluation. It is important that there be continued attention to coverage and survey design in order to assure year-to-year consistency in all spawning areas.

Evaluations of the progress in 2006 to 2009 against biological objectives in the management plan are documented in Power et al. (2010b). In the 2010 fishery evaluation, the assessment of SSB showed a 36% decrease from the level in 2009 in the main areas for Scots Bay and German Bank. The amount of spawning fish documented on Trinity Ledge in 2010 was again extremely low. This assessment indicated stability at the lower level from 2005-2010 and showed little or no signs of improvement. Scots Bay showed an increase in the length of spawning period recently. German Bank had a spawning period in 2010 similar to previous years. The duration of spawning in the Trinity area was very short. There was a change in spatial distribution in Scots Bay with more catches and biomass outside the survey area box. German Bank in 2010 showed good spawning distribution in comparison to recent historical distribution. A very restricted spawning area was evident in the Trinity area.

The 2010 fishery catch at age composition consisted of 60% fish by number at age 2 and only 3% older than age 5 in the catch. The mean age of the acoustic catch at age increased from 4.3 to 4.8 years in 2010 and was higher than the mean age in the catch. The relative exploitation rate has been constant in response to changes in survey biomass. There has been a trend of declining mean-weight at age and about 10-15% of the observed decline in stock spawning biomass (SSB) from 2009 to 2010 can be attributed to this reduced mean weight at age. This unexpected reduction was consistent with the unusual environmental conditions in 2010. Declining trends in mean-weight at age since the 1970's have reduced productivity of the stock. The lack of SSB rebuilding despite reduced catch levels in recent years is cause for concern. There were few positive signs from this fishery in 2010 and only a few of the conservation objectives appear to have been met (Table 25).

### Other Considerations

Observer reports of by-catch in purse seine sets have reported very small amounts of non-herring species, most of which are released unharmed.

## OFFSHORE SCOTIAN SHELF BANKS SPAWNING COMPONENT

There continues to be little information on stock size, distribution and spawning behavior for this offshore component which currently supports a limited spring fishery on feeding herring. Recent information comes primarily from sampling of this fishery and from catches and samples from the summer research bottom trawl survey. Spawning is presumed to take place in the fall but there is no information on spawning timing or location for the offshore. There was a single acoustic survey completed for the offshore area in 2010, which documented 3,500t of biomass.

### THE FISHERY

A foreign fishery during 1963-1973 is estimated to have removed an average of 28,000t per year and as much as 121,000t in 1969 from the offshore Scotian Shelf banks (Stephenson et al. 1987). Few herring were caught after the extension of jurisdiction in 1977 until 1996, when a fishery was initiated by the Scotia-Fundy purse seine fleet and 11,700t were taken (Table 3). Since 1996, a fishery has taken place on feeding aggregations on the offshore banks, primarily in May and June, with catches ranging from 1,000t to 20,000t (Figure 36). The variability in catch levels is often due to problems of fish being too deep, weather and market conditions rather than in the abundance of herring in these areas.

In both 2009 and 2010, at-sea fishery observers were present on five trips on 'The Patch' area. The by-catch in 2009 was only small amounts of mackerel and dogfish, while in 2010 there was an increase in the number of species recorded as by-catch (Appendix A). This increase in additional species was based on one observer's records in particular.

In 2010, the landings were above average at 11,862t, up from the 9,088t in 2009. Most landings were caught by purse seine gear in May-June, in the vicinity of 'The Patch', Emerald Bank and the Western Hole (Figure 37). The increased landings were mainly due to good fishing conditions and the availability of the fish to the purse seine gear. Additional by-catch (25t) was reported from otter trawl fisheries for groundfish and silver hake on the Scotian Shelf. The age composition of the catch was primarily adult herring (age 3+) with substantial proportions at age 3 (23%) and age 5 (32%; Table 31; Figure 38).

### RESEARCH AND INDUSTRY SURVEYS

#### Industry Surveys

An industry survey of the offshore Scotian Shelf area was conducted on 'The Patch' in June 2010, with 3.5kt of biomass estimated.

#### July Bottom Trawl Survey

Summer research bottom trawl surveys 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; Power et al. 2004; Stephenson et al. 2001). There are several shortcomings to this data series, which preclude its use as an indicator of overall abundance for a schooling pelagic species like herring. These include variable behavior and availability to the gear from year to year and the lack of year-class tracking when this was explored previously (Power et al. 2005). The bottom trawl data, while useful for documenting size, maturity and distribution, are not considered indicative of overall herring abundance. Table 27 shows herring abundance indices from the summer bottom trawl surveys from 1970-2010. The trawl survey index increased substantially from a below average level in 2009 (39 to 300

per tow). Figure 39 shows the herring catches from DFO summer bottom trawl survey from 2001-2010. Figure 40 shows the 2000-2010 herring size distribution from the summer bottom trawl research survey for the entire 4VWX area. Herring abundance in the summer bottom trawl research survey was again at a high level with large increases in all areas except the Bay of Fundy.

## **OUTLOOK AND MANAGEMENT CONSIDERATIONS**

The industry has been encouraged to explore and undertake structured surveys of the offshore area. Industry, and DFO Science and Management branches continue to work together to improve the biological basis for management. There is little new information to add and no reason to change the previous recommendation that the initial catch allocation for 2011 should not exceed the 12,000t as described in the Scotia-Fundy Fisheries Integrated Herring Management Plan (DFO 2003b).

## **COASTAL (SOUTH SHORE, EASTERN SHORE AND CAPE BRETON) NOVA SCOTIA SPAWNING COMPONENT**

There is no quota for the Coastal Nova Scotia spawning component and, apart from three areas, the size and historical performance of spawning groups are poorly documented. A fourth area, the Bras d'Or Lakes, has had no research or surveys for herring since 2000, and this fishery remains closed. Since 1996, as the inshore gillnet roe fisheries off Glace Bay, East of Halifax and Little Hope have developed, participants have contributed to sampling and surveying, and the fisheries have attempted to follow the 'survey, assess, fish' protocol. In addition to the traditional bait and personal-use fisheries, directed roe fisheries have occurred on several spawning grounds since the 1990's (Clark et al. 1999).

## **THE FISHERY AND RESOURCE STATUS**

The landings in the gillnet roe fisheries along the coast of Nova Scotia decreased from 9,780t in 2009 to 5,573t in 2010 (Table 28a).

### **Little Hope/Port Mouton**

The 2010 herring gillnet fishery in Little Hope/Port Mouton area extended to October 13, 2010. The total catch was down slightly to 3,106t from 3,730t in 2009. The catches occurred in three main areas off Port Mouton, near Liverpool and Port Medway (Figure 41). Overall, five acoustics surveys were conducted in the Little Hope/ Port Mouton area between September 21 and October 25, but only four were used to determine the biomass estimate. There was a decrease in the surveyed biomass in 2010 for the Little Hope/Port Mouton area from 36,600t in 2009 to 26,700t, but the 2010 SSB is still above the recent 5-year average of 20,940t (Table 28b; Figure 42).

### **East of Halifax (4W Eastern Shore)**

Landings decreased from 6,045t in 2009 to 2,456t in 2010 in the Eastern Shore area (Table 28a; figures 43, 45). This was primarily a herring roe fishery with catches reported from three main areas; near Halifax Harbour approaches, southwest of Jeddore Head and south of Ship Harbour (Figure 43). Four surveys were completed in the area between September 21 and October 20, but only three surveys were used to estimate the biomass. The surveyed biomass in the Halifax/Eastern shore area saw a decrease in 2010 to 27,700t down from the high in 2009

from of 54,200t. The 2010 SSB is below the recent 5-year average of 41,880t observed for this area (Table 28b; Figure 44).

### **Glace Bay**

Landings were minimal for Glace Bay with only 11t reported in May and June (Table 28a; Figure 45). Survey coverage for the Glace Bay area was poor in 2010 with two surveys attempted on September 15 and October 20, respectively. There were very little spawning herring documented. The estimated biomass for the area was 8t (Figure 45).

### **Bras d'Or Lakes**

This fishery remained closed. No sampling or acoustic surveys have been undertaken in the Bras d'Or lakes to document the size distribution or abundance of herring since 2000. It has been noted since 1997 that the status of herring in the Bras d'Or Lakes is cause for concern. With no sampling or acoustic surveys in recent years, there is no evidence to support any change. It is, therefore, appropriate to reiterate, from a biological perspective, that no fishing should take place on this spawning component.

### **Age Composition**

In 2010, the age composition of the catch for the overall Coastal Nova Scotia spawning component was primarily adult herring from this size selective gillnet fishery with a substantial proportion (99%) at age 4 and older (Table 29; Figure 46).

## **OUTLOOK AND MANAGEMENT CONSIDERATIONS**

Management approaches and recent research efforts have improved knowledge in three areas (Little Hope/Port Mouton, Halifax/Eastern Shore and Glace Bay), but there has been no information for any adjacent areas. Individual spawning groups within this component are considered vulnerable to fishing because of their relatively small size and proximity to shore. It has been recommended that no coastal spawning area experience a large effort increase in new areas until enough information is available to evaluate the status of the new group.

Since 1997, the status of herring in the Bras d'Or Lakes has been recognized as cause for concern, but since there has been no research or surveys in recent years, it is appropriate to reiterate that no fishing should take place on this spawning component.

The main areas for Little Hope/Port Mouton and Halifax/Eastern Shore use a 5-year average of recent catches and/or 10% of surveyed acoustic biomass calculated with the CIF to set annual removals. The provision to document sufficient quantities of fish each year before the fishery begins was waived in some recent years due to substantial abundances. It is recommended that given the recent variability in survey biomass from year to year, the "survey, assess, then fish" protocol should be adhered to.

## **SOUTHWEST NEW BRUNSWICK MIGRANT JUVENILES**

The SWNB weir and shutoff fisheries have 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 fish have been considered to be a mixture of juveniles, dominated by those originating from NAFO Subarea 5 spawning components, and have, therefore, been excluded from the 4WX quota.

The success of this passive fishery is historically unpredictable, and catches are inherently susceptible to many natural variables in addition to abundance. The number and distribution of active weirs have decreased over the past decade, due in part to the conversion of sites to aquaculture, as well as reduced landings in the past 30 years in the Passamaquoddy Bay area (Table 10). Figure 47 shows the locations of the New Brunswick weirs and the corresponding catches for the 2010 fishing season.

Landings in the 2010 New Brunswick weir and shut-off fishery were 10,958t, up from the low of 4,031t in the previous year. It is notable that as recently as 2007 landings were 30,944t, the highest in nearly 20 years and higher than the long term average of 23,560t (Table 30; Figure 48). The age distribution of fish caught in the 2010 New Brunswick weir and shutoff fishery were mostly juveniles, which are well suited to the sardine market, with 95% at age 2 (Table 31; Figure 49). The number of weirs with catches increased in the 2010 season, but effort (number of active weirs) remained similar.

## **5Z GEORGES BANK**

The activities of midwater trawlers and herring purse seiners on the Canadian portion of Georges Bank (area 5Z) are monitored using the Vessel Monitoring System (VMS) and there were no trips to the area and no reported landings in 2010.

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Table 1. 4VWX herring fishery landings (t) by month, gear sector and management unit for 2009-2010 quota year.

			Month												Total
2009-2010 quota year	Area	Gear	1	2	3	4	5	6	7	8	9	10	11	12	
S.W. Nova Scotia	4X	Fall P. Seine (2009)										1,091	573		1,664
	4X	Winter P. Seine (2010)	1,123												1,123
	4X	Summer P. Seine (2010)					1,377	2,509	7,176	11,377	15,590	3,316			41,345
	4X	Gillnet "Stock" (2010)								161	41	1			204
	4X	N.S. Weirs (2010)					89	391	320	398					1,198
S.W. Nova Scotia total for 2009-2010 quota year			1,123	-	-	-	1,466	2,900	7,496	11,937	15,631	4,408	573	-	45,534
Coastal Nova Scotia (South Shore, Eastern Shore, Cape Breton) Upper Bay of Fundy	4Vn, 4X	Trap													-
	4Vn	Glance Bay Gillnet					0	0	-		11	-			11
	4W	Eastern Shore Gillnet					1	-		1	1,813	642	-		2,456
	4X	Little Hope Gillnet					0	-		0	1,998	1,108			3,106
	4X	Gillnet				1	0	0							1
Coastal Nova Scotia total for 2010 calendar year							2	0	-	1	3,822	1,749	-		5,575
Offshore Scotian Shelf	4WX	Offshore P. Seine					8,053	3,758		27					11,837
	4WX	Bottom Trawl + Misc.	0	0	0	2	6	11	2	0	1	3	0		25
Offshore Scotian Shelf total for 2010 calendar year			0	0	0	2	8,059	3,768	2	27	1	3	0	-	11,862
S.W. New Brunswick Migrant Juveniles	4X	N.B. Weirs				6	64	1,912	2,560	3,903	1,933	247	46		10,671
	4X	N.B. Shutoff							16	202	70				287
S.W. New Brunswick Migrant Juveniles for 2010 calendar year							64	1,912	2,575	4,105	2,003	247			10,958
Total 2009-2010														73,929	

Table 2. 4WX herring fishery landings (t) by month and gear sector for 2010-2011 quota year (as of March 2, 2011).

			Month												Total
	Area	Gear	1	2	3	4	5	6	7	8	9	10	11	12	
2010-2011 quota year	4X	Fall 2010 P. Seine										878	706		1,584
		Winter 2011 P. Seine													-
2011 Calendar year															-
2010-2011 Total (from Oct. 15, 2010 to Jan. 11, 2011)			-	-	-							878	706		1,584

Table 3. Historical series of nominal and adjusted annual landings (t) by major gear components and seasons of the 4WX herring fishery, 1963-2010 (the 1963-1973 Offshore Scotian Shelf landings are from Stephenson et al. (1987)).

Year <sup>^</sup>	4W Winter Purse Seine	4Xs Fall&Winter Purse Seine	4Xqr Summer Purse Seine	4X Summer Gillnet	4Xr Nova Scotia Weir	4WX Stock Nominal Landings	4WX Stock Adjusted Landings*	4WX Stock TAC	Non-Stock 4Xs N.B. Weir & Shutoff	4VWX Coastal Nova Scotia	Offshore Scotian Shelf Banks	Total 4VWX Adjusted Landings
1963		6,871	15,093	2,955	5,345	30,264	30,264		29,366		3,000	62,630
1964		15,991	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	77,545	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	1,450	11,745	87,176
1997	1,759	2,926	40,357	6,816	4,019	56,117	56,117	57,000	20,552	2,340	20,261	99,270
1998	1,405	1,494	67,433	2,231	4,464	77,027	77,027	90,000	20,091	4,120	5,591	106,829
1999	1,235	4,764	64,432	1,660	5,461	77,552	77,552	105,000	18,644	5,618	12,646	114,460
2000	1,012	4,738	78,010	823	701	85,284	85,284	100,000	16,829	4,283	2,182	108,578
2001	0	4,001	62,004	1,857	3,708	71,570	71,570	78,000	20,209	6,006	12,503	110,288
2002	367	5,257	69,894	393	1,143	77,054	77,054	78,000	11,874	10,375	7,039	106,342
2003	0	8,860	79,140	439	921	89,360	89,360	93,000	9,003	9,162	998	108,523
2004	0	5,659	69,015	225	3,130	78,029	78,029	83,000	20,686	6,924	4,165	109,804
2005	0	2,601	43,487	566	2,245	48,899	48,899	50,000	13,055	6,311	5,263	73,528
2006	0	930	45,002	719	2,508	49,159	49,159	50,000	12,863	6,566	9,809	78,397
2007	0	1,847	46,045	1,334	1,130	50,356	50,356	50,000	30,944	5,240	5,385	91,925
2008	0	2,000	50,022	15	2,524	54,561	54,561	55,000	6,447	3,704	918	65,631
2009	0	2,807	50,802	117	387	54,113	54,113	55,000	4,031	9,783	9,088	77,015
2010	0	2,787	41,345	204	1,198	45,534	45,534	55,000	10,958	5,575	11,862	73,929

<sup>^</sup>Annual landings by purse seiners are defined for the period from October 15 of the preceding year to October 14 of the current year.

\*Adjusted totals includes misreporting adjustments for 1978-84 (Mace 1985) and for 1985-93 (Stephenson 1993, Stephenson et al 1994)

All landings by other gear types are for the calendar year.

Table 4a. Herring purse seine catches (t) by fishing ground areas (as identified from the 10-mile boxes shown in Figure 4) from 1985-2010 for the 4WX stock component.

**a) Catches (t) by grounds for the 4WX stock area from 1985-2010.**

Stock Areas	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
Browns Bank		732						86		1,903	1,554	40	14
Chedabucto Bay	4,216	7,498	6,374	7,523	8,325	12,470	12,596	3,084	1,378	1,407	2,049	1,759	
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
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
Grand Manan	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
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
Lurcher	476	132		2,928	18	65	151	2,141	1,560	530	382	243	599
N.B. Coastal	188	621	960	1,031	3,033	2,347	488	992	598	99	1,502	271	1,176
Pollock Point													
S.W. Grounds	558	1,108	184	181	276	56	521	225	2,961	3,444	6,205	3,035	797
Scots Bay		36	3,822	4,145	6,583	9,003	7,982	7,987	5,258	10,840	980	8,984	4,894
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
Trinity	35,860	13,505	18,744	18,539	266	1,113	3,259	4,612	1,348	2,366	370	3,448	5,308
Yankee Bank				194	250	3,647	817	119	10	175	323	9	4
Unknown	184	500	200			200	579	494	140		73		
4WX Stock Total	82,458	57,745	71,661	102,015	78,287	94,127	82,314	57,888	27,703	50,345	49,348	47,606	40,319

Stock Areas	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	Recent Decade Average 01-10	All Series Avg 85-10	2010 vs Avg 01-10
Browns Bank	3,139	2,197	1,137	486			45		88	34				163	818	
Chedabucto Bay	1,583	1,151	10												4,762	
Gannet, Dry Ledge	4,156	10,296	12,674	3,877	9,047	6,965	4,456	3,117	6,764	11,344	10,006	8,656	723	6,495	6,236	-5,773
German Bank	20,556	24,660	25,631	24,139	22,355	21,573	14,175	14,171	16,522	15,085	22,437	19,354	17654	18,747	16,581	-1,093
Grand Manan	15,983	7,912	18,185	10,545	17,753	17,258	7,542	5,740	7,716	10,011	10,493	12,368	15395	11,482	8,361	3,913
Long Island	12,360	18,286	11,199	12,904	6,642	12,639	13,115	8,037	1,884	4,604	3,207	2,983	1658	6,767	8,127	-5,109
Lurcher	57		715	227	7,683	1,872	7,268	1,692	2,809	2,305	684	3,676	348	2,856	1,607	-2,508
N.B. Coastal	782	1,867	361	1,250	3,113	3,914	2,707	787	1,889	851	2,205	5,023	2762	2,450	1,570	312
Pollock Point				1,563										1,563	1,563	-1,563
S.W. Grounds	1,239	3,241	1,879	53	791	73		1,228	1,206	30	752	178	169	498	1,216	-329
Scots Bay	8,210	1,789	10,926	10,739	8,202	19,196	24,869	6,239	3,352	4,116	2,373	902	4086	8,407	7,020	-4,321
Seal Island	617	567	206	101	238	1,096		1,358	209		15	12		433	6,039	-433
Trinity	2,825	1,220	103	113	1,609		370	1,448	3,725	112		325	616	1,040	5,050	-423
Yankee Bank	159	82	133	8	78			528	2	62	178	131		141	345	-141
Unknown	62	84	27			1,103	127	181	396	39		14	641	357	280	284
4WX Stock Total	71,727	73,350	83,186	66,005	77,511	85,689	74,674	44,526	46,561	48,594	52,350	53,621	44052	59,358	63,987	-15,306

Table 4b. Herring purse seine catches (%) by fishing ground areas (as identified from the 10-mile boxes shown in Figure 4) from 1985-2010 for the 4WX stock component.

**b) Percentage by grounds for the 4WX stock area from 1985-2010.**

Stock Areas	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
Browns Bank		1%						0%		4%	3%	0%	0%
Chedabucto Bay	5%	13%	9%	7%	11%	13%	15%	5%	5%	3%	4%	4%	
Gannet, Dry Ledge	7%	4%	2%	15%	3%	4%	8%	32%	11%	5%	5%	4%	11%
German Bank	19%	23%	23%	18%	10%	12%	28%	6%	15%	19%	40%	33%	34%
Grand Manan	6%	10%	6%	4%	5%	6%	5%	5%	3%	14%	11%	13%	13%
Long Island	1%	6%	10%	11%	28%	20%	12%	6%	10%	15%	16%	9%	9%
Lurcher	1%	0%		3%	0%	0%	0%	4%	6%	1%	1%	1%	1%
N.B. Coastal	0%	1%	1%	1%	4%	2%	1%	2%	2%	0%	3%	1%	3%
Pollock Point													
S.W. Grounds	1%	2%	0%	0%	0%	0%	1%	0%	11%	7%	13%	6%	2%
Scots Bay		0%	5%	4%	8%	10%	10%	14%	19%	22%	2%	19%	12%
Seal Island	17%	15%	16%	19%	30%	27%	15%	18%	14%	6%	1%	3%	1%
Trinity	43%	23%	26%	18%	0%	1%	4%	8%	5%	5%	1%	7%	13%
Yankee Bank				0%	0%	4%	1%	0%	0%	0%	1%	0%	0%
Unknown	0%	1%	0%			0%	1%	1%	1%		0%		
Total	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

Stock Areas	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	Recent Decade Average 01-10	All Series Avg 85-10	2010 vs Avg 01-10
Browns Bank	4%	3%	1%	1%			0%		0%	0%				0%	1%	
Chedabucto Bay	2%	2%	0%											0%	4%	
Gannet, Dry Ledge	6%	14%	15%	6%	12%	8%	6%	7%	15%	23%	19%	16%	2%	13%	10%	-11%
German Bank	29%	34%	31%	37%	29%	25%	19%	32%	35%	31%	43%	36%	40%	32%	26%	8%
Grand Manan	22%	11%	22%	16%	23%	20%	10%	13%	17%	21%	20%	23%	35%	18%	13%	17%
Long Island	17%	25%	13%	20%	9%	15%	18%	18%	4%	9%	6%	6%	4%	13%	12%	-9%
Lurcher	0%		1%	0%	10%	2%	10%	4%	6%	5%	1%	7%	1%	4%	3%	-3%
N.B. Coastal	1%	3%	0%	2%	4%	5%	4%	2%	4%	2%	4%	9%	6%	3%	2%	3%
Pollock Point				2%										0%	0%	
S.W. Grounds	2%	4%	2%	0%	1%	0%		3%	3%	0%	1%	0%	0%	1%	2%	-1%
Scots Bay	11%	2%	13%	16%	11%	22%	33%	14%	7%	8%	5%	2%	9%	12%	11%	-3%
Seal Island	1%	1%	0%	0%	0%	1%		3%	0%		0%	0%		1%	8%	-1%
Trinity	4%	2%	0%	0%	2%		0%	3%	8%	0%		1%	1%	2%	7%	0%
Yankee Bank	0%	0%	0%	0%	0%			1%	0%	0%	0%	0%		0%	0%	0%
Unknown	0%	0%	0%			1%	0%	0%	1%	0%		0%	1%	0%	0%	1%
Total	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	

Table 5. Herring purse seine catches (t) and percentage by fishing ground for 1985- 2010 from non-stock areas.

**a) Catches (t) by grounds for non-stock areas from 1985-2010.**

Non-stock Areas	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
Georges Bank						91	64			266		2,491
Liverpool							13		4,067	4,177		
Shelburne			59				64		526	161		56
Halifax									652	1,945		585
Offshore Banks												11,800
Western Hole		41	154				213	3,451	2,255	1,495	108	127
Nonstock Total		41	213			91	353	3,451	7,500	8,044	108	15,058

Non-stock Areas	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	Average 01-10	Avg 85-10
Georges Bank	79			265												542
Liverpool																2,752
Shelburne									29						29	128
Halifax	455			1,002	472	367									280	685
Offshore Banks	18,770	4,284	8,669	1,645	3,977	5,078	722	4,054	4,115	4,846	2,515	829	8,918	7,432	4,249	5,478
Western Hole	691	1,012	1,057	47	7,712	1,884	156		214	192	220	52	114	4,405	1,661	1,219
Nonstock Total	19,995	5,296	9,726	2,958	12,161	7,329	878	4,054	4,358	5,038	2,735	881	9,032	11,837	5,830	10,805

**b) Percentage by grounds for non-stock areas from 1985-2010.**

Non-stock Areas	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
Georges Bank						100%	18%			3%		17%
Liverpool							4%		54%	52%		
Shelburne			28%				18%		7%	2%		0%
Halifax									9%	24%		4%
Offshore Banks												78%
Western Hole		100%	72%				60%	100%	30%	19%	100%	1%
Non-stock Total		100%	100%			100%	100%	100%	100%	100%	100%	100%

Non-stock Areas	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	Average 01-10	Avg 85-10
Georges Bank	0%			9%												6%
Liverpool																5%
Shelburne									1%						0%	2%
Halifax	2%			34%	4%	5%									1%	3%
Offshore Banks	94%	81%	89%	56%	33%	69%	82%	100%	94%	96%	92%	94%	99%	63%	82%	54%
Western Hole	3%	19%	11%	2%	63%	26%	18%		5%	4%	8%	6%	1%	37%	17%	29%
Non-stock Total	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

Table 6. German Bank (defined here as the acoustic survey box as shown in Figure 15 )herring purse seine catches for 1985-2010 with start date, end date, catch before August 15 (pre-spawning period), catch after August 14 (defined as spawning period) and proportion of TAC.

Year	Start Date	End Date	Duration No. Days	Total No. Slips	Catch before Aug. 15 (prespawn)	Catch on/after Aug. 15 (spawning)	Total Catch t	% Catch on/after Aug-14	TAC	German as % TAC
1985	22-Jun-85	08-Oct-85	109	428	8,856	14,228	23,084	62%	125,000	18%
1986	18-Jun-86	01-Oct-86	106	349	2,349	13,542	15,892	85%	97,600	16%
1987	26-May-87	14-Oct-87	142	403	5,138	13,218	18,357	72%	126,500	15%
1988	29-May-88	06-Oct-88	131	610	14,776	18,348	33,125	55%	151,200	22%
1989	28-May-89	15-Oct-89	141	313	2,061	12,087	14,148	85%	151,200	9%
1990	23-May-90	23-Oct-90	154	428	1,220	23,647	24,867	95%	151,200	16%
1991	02-Jun-91	15-Oct-91	136	621	11,800	18,328	30,127	61%	151,200	20%
1992	31-May-92	04-Oct-92	127	556	13,175	10,985	24,160	45%	125,000	19%
1993	24-May-93	29-Sep-93	129	192	7,912	1,092	9,003	12%	151,200	6%
1994	05-May-94	28-Sep-94	147	252	1,186	11,454	12,641	91%	151,200	8%
1995	05-Jun-95	06-Oct-95	124	301	434	21,339	21,773	98%	80,000	27%
1996	20-Jun-96	27-Oct-96	130	260	2,229	16,091	18,320	88%	57,000	32%
1997	11-Jul-97	14-Oct-97	96	327	2,009	17,110	19,119	89%	57,000	34%
1998	10-Jun-98	14-Oct-98	127	516	3,231	21,489	24,720	87%	90,000	27%
1999	20-Apr-99	20-Oct-99	184	666	18,508	16,401	34,909	47%	105,000	33%
2000	18-Apr-00	26-Oct-00	192	598	9,806	26,171	35,977	73%	100,000	36%
2001	22-May-01	20-Oct-01	152	521	5,312	22,156	27,468	81%	78,000	35%
2002	18-Apr-02	12-Oct-02	178	643	10,871	19,935	30,806	65%	78,000	39%
2003	05-May-03	15-Oct-03	164	392	8,900	20,070	28,970	69%	93,000	31%
2004	10-May-04	15-Oct-04	159	238	5,680	12,345	18,025	68%	83,000	22%
2005	16-May-05	13-Oct-05	151	364	8,069	12,039	20,107	60%	50,000	40%
2006	27-Jun-06	16-Oct-06	112	475	12,227	12,504	24,731	51%	50,000	49%
2007	15-May-07	05-Oct-07	144	540	13,948	13,307	27,255	49%	50,000	55%
2008	03-May-08	16-Oct-08	167	590	16,845	14,447	31,291	46%	55,000	57%
2009	05-May-09	13-Oct-09	162	502	12,092	16,454	28,546	58%	55,000	52%
2010	03-May-10	14-Oct-10	165	382	1,756	16,953	18,708	91%	55,000	34%

Table 7. Scots Bay herring purse seine catches for 1987-2010.

Year	Min. Date	Max. Date	Duration in Days	Days with Catch	Catch t	No. Slips	Catch/Day with Catch	Catch/Slip
1987	08-Jul-87	06-Aug-87	30	20	3,398	91	169.88	37.34
1988	20-Jul-88	29-Jul-88	10	9	3,780	65	419.99	58.15
1989	19-Jul-89	13-Sep-89	57	35	6,021	164	172.04	36.72
1990	22-Jul-90	14-Aug-90	24	11	8,088	108	735.24	74.89
1991	05-Jul-91	14-Aug-91	41	16	7,365	163	460.30	45.18
1992	25-Jul-92	11-Aug-92	18	18	7,960	189	442.22	42.12
1993	25-Jul-93	01-Sep-93	39	32	5,228	100	163.36	52.28
1994	10-Jul-94	25-Aug-94	47	36	10,610	286	294.72	37.10
1995	24-Jul-95	26-Jul-95	3	3	907	33	302.33	27.48
1996	25-Jul-96	20-Aug-96	27	13	8,939	151	687.58	59.20
1997	30-Jul-97	27-Aug-97	29	19	4,847	91	255.11	53.26
1998	20-Jul-98	10-Sep-98	53	29	7,880	163	271.72	48.34
1999	19-Jul-99	17-Aug-99	30	16	1,789	40	111.81	44.73
2000	25-Jul-00	30-Aug-00	37	26	10,853	171	417.44	63.47
2001	10-Jul-01	21-Aug-01	43	30	10,739	176	357.97	61.02
2002	22-Jul-02	09-Sep-02	50	36	7,994	160	222.06	49.96
2003	21-Jul-03	05-Sep-03	47	34	19,196	237	564.59	81.00
2004	19-Jul-04	16-Sep-04	60	42	24,388	330	580.67	73.90
2005	26-Jul-05	09-Sep-05	46	27	5,872	96	217.48	61.17
2006	24-Jul-06	04-Sep-06	43	16	3,352	43	209.50	77.95
2007	16-Jul-07	31-Aug-07	47	21	4,116	79	196.00	52.10
2008	14-Jul-08	27-Aug-08	45	14	2,373	43	169.50	55.19
2009	12-Jul-09	11-Aug-09	31	8	902	18	112.75	50.11
2010	09-Jul-10	07-Sep-10	61	17	4,086	70	240.35	58.37

Table 8. Summary of 1998- 2010 Spectacle Buoy and Trinity Ledge herring gillnet catches with start and end dates, catches and overall amounts.

Year	Spec. Buoy catches and surveys				Trinity Ledge catches and surveys				Exploitation Catch/SSB
	Start Day	End Day	Catch t	Survey SSB t*	Start Day	End Day	Catch t	Survey SSB t*	
1998	10-May-98	30-Jun-98	484	n/s	24-Aug-98	21-Sep-98	1,668	n/s	
1999	10-May-99	16-Jul-99	355	n/s	12-Aug-99	15-Sep-99	1,257	3,885	32%
2000	11-Jun-00	14-Jun-00	80	n/s	30-Aug-00	12-Sep-00	734	621	118%
2001	11-Jun-01	10-Jul-01	699	1,110	21-Aug-01	26-Sep-01	1,012	14,797	7%
2002	15-May-02	01-Jul-02	137	n/s	02-Sep-02	30-Sep-02	256	8,096	3%
2003	04-Jun-03	06-Jun-03	69	1,420	21-Aug-03	18-Sep-03	369	12,117	3%
2004	17-Jun-04	15-Jul-04	5	n/s	02-Sep-04	15-Sep-04	225	12,022	2%
2005	09-Jun-05	11-Jul-05	124	290	05-Sep-05	20-Sep-05	447	10,701	4%
2006	03-Jun-06	22-Jun-06	2	n/s	23-Aug-06	21-Sep-06	717	16,076	4%
2007	07-May-07	22-Jun-07	243	310	27-Aug-07	20-Sep-07	1,091	3,113	35%
2008	29-May-08	19-Jun-08	6	0	21-Aug-08	25-Sep-08	7	516	1%
2009	11-Jun-09	25-Jun-09	0.2	n/s	01-Sep-09	11-Sep-09	116	1,575	7%
2010	02-Jun-10	19-Jun-10	-	1,859	11-Aug-10	24-Sep-10	202	2,405	8%
Average			170	832			623	7,160	

\* Survey SSB calculated with Calibration Integration Factor after 2003 inclusive

Table 9. Monthly Nova Scotia weir landings (t) for 1978-2010.

YEAR	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Year Total
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						16	151	326	191				683
2001					105	1,439	1,565	391	207				3,708
2002					23	95	240	558	228				1,143
2003					98	126	68	344	284				921
2004						667	873	1,370	219				3,130
2005				11	84	731	472	828	118				2,245
2006					195	138	414	1,447	182	115			2,491
2007					26	11	290	579	224				1,130
2008						1,136	381	836	171				2,524
2009						110	233	44	0				387
2010					89	391	320	398					1,198
NS Average Catch (t)				5	385	1,090	852	604	200	72	65	79	3,108
NS Minimum Catch (t)				1	16	11	68	44	0	5	11	79	387
NS Maximum Catch (t)				11	1,958	3,704	2,990	1,447	538	136	198	79	7,858

Table 10. Annual catch (t), number of active weirs and the catch per weir (t) for New Brunswick and Nova Scotia weirs from 1978-2010.

Year	Annual Catch (t)			No. Active Weirs			Catch per weir (t)		
	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	19,529	4,048	23,577	108	15	123	181	270	192
1999	19,063	4,537	23,600	100	14	114	191	324	207
2000	16,376	683	17,058	77	3	80	213	228	213
2001	20,064	3,708	23,772	101	14	115	199	265	207
2002	11,807	1,143	12,950	83	9	92	142	127	141
2003	9,003	921	9,924	78	8	86	115	115	115
2004	20,620	3,130	23,750	84	8	92	245	391	258
2005	12,639	2,245	14,884	76	10	86	166	225	173
2006	11,641	2,491	14,132	89	6	95	131	415	149
2007	30,145	1,130	31,275	97	8	105	311	141	298
2008	6,041	2,524	8,565	76	8	84	79	315	102
2009	3,603	387	3,990	38	7	45	95	55	89
2010	10,671	1,198	11,868	77	8	85	139	150	140
Average	20,939	2,968	23,907	120	15	135	172	211	175

Table 11. Annual effort with number of days fished, number of active boats, total catch (t), average catch per day and average catch per boat for 1989- 2010 herring purse seine boats from all areas in 4WX-5Y.

Year	No. Days Fished	No. of Boats Fishing	Total Catch t	CPUE (catch/day)	CPUE (catch/boat)
1989	2198	40	87,383	40	2185
1990	2390	42	103,537	43	2465
1991	2333	40	88,830	38	2221
1992	2431	39	95,072	39	2438
1993	2542	36	92,828	37	2579
1994	2227	36	75,652	34	2101
1995	1682	32	56,441	34	1764
1996	1781	32	60,038	34	1876
1997	1731	30	61,769	36	2059
1998	2290	28	70,931	31	2533
1999	1775	28	78,574	44	2806
2000	1572	28	78,727	50	2812
2001	1826	21	75,343	41	3588
2002	1838	19	76,210	41	4011
2003	1652	18	85,499	52	4750
2004	1358	18	76,361	56	4242
2005	945	16	48,517	51	3032
2006	789	16	44,476	56	2780
2007	914	16	50,667	55	3167
2008	923	15	53,019	57	3535
2009	1099	14	62,162	57	4440
2010	989	14	55,890	57	3992

Note: CPUE = catch per unit effort.

Table 12. Summary of the minimum observed SSB for each of the surveyed spawning grounds in the SWNS/BoF component of the 4WX stock complex. Total SSB is rounded to nearest 100t and all data was calculated without the use of the CIF (Power et al. 2010b).

Location/Year	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	Average 1999- 2010
Scots Bay (inbox)	41,000	106,300	163,900	141,000	133,900	107,600	16,800	28,600	45,700	19,400	67,600	35,500	75,608
Scots Bay (outbox)									2,000	100	5,300	9,900	4,325
Trinity Ledge	3,900	600	14,800	8,100	14,500	6,500	5,100	8,500	1,400	300	700	1,000	5,450
German Bank (inbox)	460,800	356,400	190,500	393,100	343,500	367,600	211,000	245,500	337,200	201,700	308,700	190,000	300,500
German Bank (outbox)								4,100	2,820	1,700	1,400	15,400	5,084
Spec Buoy (spring)	0	0	1,100		1,400	n/s	300	n/s	100		0	800	411
Spec Buoy (fall)			87,500					16					43,758
Sub-Total	505,700	463,300	457,800	542,200	493,300	481,700	233,200	286,716	389,220	223,200	383,700	252,600	392,720
Seal Island			3,300	1,200	12,200			8,100					6,200
Browns Bank			45,800					6,100					25,950
Total	505,700	463,300	506,900	543,400	505,400	481,700	233,200	300,916	389,220	223,200	383,700	252,600	399,103
Overall SE t	94,600	64,900	50,800	49,500	86,100	74,200	64,900	47,251	94,257	61,075	61,425	32,132	65,095
Overall SE %	19	14	10	9	17	15	28	16	25	27	27	13	18

Table 12b. Summary of observed spawning stock biomass calculated WITH the calibration integration factor since 2001.

Location/Year	1999*	2000*	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	Average 2001- 2010
Scots Bay (inbox)	41,000	106,300	216,000	129,700	123,000	115,000	21,200	31,600	50,500	23,300	81,600	42,300	83,420
Scots Bay (outbox)									2,200	100	6,100	11,700	5,025
Scots Bay total	41,000	106,300	216,000	129,700	123,000	115,000	21,200	31,600	52,700	23,400	87,700	54,000	85,430
German Bank (inbox)	460,800	356,400	257,300	416,200	348,800	392,000	268,600	290,500	495,400	238,600	395,900	234,700	333,800
German Bank (outbox)								4,900	4,000	2,400	1,700	19,100	6,420
German Bank total	460,800	356,400	257,300	416,200	348,800	392,000	268,600	295,400	499,400	241,000	397,600	253,800	337,010
Trinity Ledge	3,900	600	14,800	8,900	12,100	12,000	10,700	16,100	3,100	500	1,600	2,400	8,220
Spec Buoy (spring)	0	0	1,100		1,200	n/s	600	n/s	300	0		1,900	850
Spec Buoy (fall)			87,500					30					43,765
Stock Area Sub-Total	505,700	463,300	576,700	554,800	485,100	519,000	301,100	343,130	555,500	264,900	486,900	312,100	439,923
Seal Island			3,900	1,200	11,900			10,000					6,750
Browns Bank			50,400					7,700					29,050
Total All Areas	505,700	463,300	631,000	556,000	497,000	519,000	301,100	360,830	555,500	264,900	486,900	312,100	448,433
Long term Average since 2001			439,923	439,923	439,923	439,923	439,923	439,923	439,923	439,923	439,923	439,923	
Difference from Long Term Average			136,777	114,877	45,177	79,077	-138,823	-96,793	115,577	-175,023	46,977	-127,823	
% difference from Long Term Average			31%	26%	10%	18%	-32%	-22%	26%	-40%	11%	-29%	

\*Biomass estimates for 1999 to 2000 were calculated 'without' the CIF.

Table 13. Relative exploitation rates (%) by major spawning grounds and for the overall SWNS/BoF component with (A1) acoustic survey SSB, (A2) acoustic survey proportion of total SSB, (C1) catch by spawning component areas, (C2) adjusted catch including non-spawning area catches, (E1) exploitation rate as percentage of acoustic SSB for spawning area catch and (E2) adjusted catch.

A1) Acoustic Survey SSB (t)	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	Avg 99-10
Scots Bay	40,972	106,316	163,900	141,000	133,900	107,600	16,800	28,600	45,700	19,400	67,600	45,419	76,434
Trinity	3,885	621	14,800	8,100	14,500	6,500	5,100	8,500	1,400	300	700	1,026	5,453
German Bank	460,823	356,372	282,400	394,357	357,100	367,600	211,000	249,600	337,300	201,700	308,700	205,423	311,031
Total SSB	505,680	463,309	461,100	543,457	505,500	481,700	232,900	286,700	384,400	221,400	377,000	251,868	392,918

A2) Acoustic Survey Proportions	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	Avg 99-10
Scots Bay	8%	23%	36%	26%	26%	22%	7%	10%	12%	9%	18%	18%	18%
Trinity	1%	0%	3%	1%	3%	1%	2%	3%	0%	0%	0%	0%	1%
German Bank	91%	77%	61%	73%	71%	76%	91%	87%	88%	91%	82%	82%	81%
Total	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

C1) Catch by Spawn Area	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	Avg 99-10
Scots Bay	1,789	10,926	10,739	8,202	19,196	24,869	6,239	3,352	4,116	2,373	902	4,086	8,066
Trinity (purse seine+gillnet)	2,526	843	1,271	1,865	369	595	2,014	4,444	1,203	15	442	820	1,367
German Bank	24,660	25,631	24,139	22,355	21,573	14,175	14,171	16,522	15,085	22,437	19,354	17,654	19,813
Spawn Area Total	28,974	37,400	36,149	32,422	41,138	39,639	22,424	24,318	20,404	24,825	20,698	22,560	29,246
Overall SW Nova Catch	77,552	85,284	71,570	77,054	89,461	78,029	48,981	49,159	50,529	54,561	54,113	45,534	65,152
Non-spawning area catch remaining	48,578	47,884	35,421	44,632	48,323	38,390	26,557	24,841	30,125	29,736	33,415	22,974	35,906

C2) Adjusted Catch by Area	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	Avg 99-10
Scots Bay	5,725	21,914	23,330	19,782	31,996	33,444	8,155	5,830	7,697	4,979	6,894	8,229	14,831
Trinity	2,899	907	2,408	2,530	1,755	1,113	2,596	5,181	1,313	55	504	914	1,848
German Bank	68,929	62,462	45,832	54,742	55,710	43,472	38,231	38,148	41,519	49,527	46,715	36,391	48,473
Adjusted Catch Total	77,552	85,284	71,570	77,054	89,461	78,029	48,981	49,159	50,529	54,561	54,113	45,534	65,152

E1) Exploitation rate (C1/SSB)	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	Avg 99-10
Scots Bay	4%	10%	7%	6%	14%	23%	37%	12%	9%	12%	1%	9%	12%
Trinity	65%	136%	9%	23%	3%	9%	39%	52%	86%	5%	63%	80%	47%
German Bank	5%	7%	9%	6%	6%	4%	7%	7%	4%	11%	6%	9%	7%
Overall (C1/SSB)	6%	8%	8%	6%	8%	8%	10%	8%	5%	11%	5%	9%	7%

E2) Exploitation rate adjusted (C2/SSE)	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	Avg 99-10
Scots Bay	14%	21%	14%	14%	24%	31%	49%	20%	17%	26%	10%	18%	21%
Trinity	75%	146%	16%	31%	12%	17%	51%	61%	94%	18%	72%	89%	57%
German Bank	15%	18%	16%	14%	16%	12%	18%	15%	12%	25%	15%	18%	16%
Overall Adjusted (Catch/Acoustic SSB)	15%	18%	16%	14%	18%	16%	21%	17%	13%	25%	14%	18%	17%

Table 14. Summary of biological samples by gear and month as collected during the 2010 4VWX herring fisheries. '# LF Samples' is the number of length frequency samples collected, '# Measured' is the number of lengths taken and '# Processed' is the number of detail fish with sex and maturity determined.

Gearname	Data	Month												Total
		1	2	3	4	5	6	7	8	9	10	11	12	
4W Purse Seine	# LF Samples					20	26							46
	# Measured					2,533	3,032							5,565
	# Aged					98	165							263
	# Processed					98	167							265
5Y CAN P.Seine	# LF Samples						11	33	65	51				160
	# Measured						1,345	3,898	8,299	6,540				20,082
	# Aged						20	128	115	67				330
	# Processed						20	129	115	67				331
5Y USA P.Seine/MWT	# LF Samples											2	2	4
	# Measured											230	237	467
	# Aged											0	0	0
	# Processed											0	0	0
5Z USA P.Seine/MWT	# LF Samples	26	11										10	47
	# Measured	3,188	1,255										1,174	5,617
	# Aged	0	0										0	0
	# Processed	0	0										0	0
Gillnet	# LF Samples								1	9	7			17
	# Measured								90	1,197	985			2,272
	# Aged								28	84	117			229
	# Processed								28	84	119			231
N.B. Purse Seine	# LF Samples	39					13	17	9	11	88	37		214
	# Measured	4,942					1,522	2,173	1,053	1,488	13,175	5,656		30,009
	# Aged	100					65	35	11	8	83	14		316
	# Processed	101					65	35	11	8	83	14		317
N.B. Shut-off	# LF Samples							1	2					3
	# Measured							119	248					367
	# Aged							10	0					10
	# Processed							10	0					10
N.B. Weirs	# LF Samples				1	7	44	72	85	50	16	2		277
	# Measured				15	877	5,230	8,685	9,803	5,838	1,888	228		32,564
	# Aged				15	16	29	71	87	44	36	28		326
	# Processed				15	19	29	71	88	44	36	28		330
N.S. Purse Seine	# LF Samples					31	40	38	53	124	45			331
	# Measured					4,473	4,784	4,681	7,402	17,890	6,656			45,886
	# Aged					45	52	279	430	412	97			1,315
	# Processed					45	53	279	435	413	97			1,322
N.S. Weirs	# LF Samples					2	12	6	3					23
	# Measured					295	1,425	732	340					2,792
	# Aged					0	34	0	0					34
	# Processed					0	34	0	0					34
Resrch. Otter Trawl	# LF Samples		8	60				122	7		6			203
	# Measured										102			102
	# Aged		78	409				1,117	54		37			1,695
	# Processed		79	409				1,130	54		37			1,709
Resrch. MW Trawl	# LF Samples								4	2				6
	# Measured								383	242				625
	# Aged								43	21				64
	# Processed								43	21				64
Total # LF Samples		65	19	60	1	60	146	289	229	247	162	41	12	1,331
Total # Measured		8,130	1,255		15	8,178	17,338	20,288	27,618	33,195	22,806	6,114	1,411	146,348
Total # Aged		100	78	409	15	159	365	1,640	768	636	370	42	0	4,582
Total # Processed		101	79	409	15	162	368	1,654	774	637	372	42	0	4,613

Table 15. Number of herring samples from 4VWX-5Y collected by DFO personnel from commercial fisheries (Commercial), by members of the fishing industry (Industry), observer program (Observer), independent observers on foreign vessels for Over-the-Side Sales or from newly implemented Dockside Monitoring Program (OSS/DMP) and DFO research surveys (Research).

Year	Sample Source					Total
	Commercial	Industry	Observer	OSS/DMP^	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
2001	47	1,455	96		190	1,788
2002	17	1,339	84		181	1,621
2003	58	1,292	56		199	1,605
2004	50	1,270	60		105	1,485
2005	48	1,017	23		152	1,240
2006	33	1,049	70		99	1,251
2007	10	1,139	29		137	1,315
2008	16	781	17		130	944
2009	26	980	21*		135	1,162
2010	29	947	38*	146^	209	1,223
<b>Average</b>	<b>123</b>	<b>1,182</b>	<b>62</b>	<b>242</b>	<b>122</b>	<b>1,183</b>

\* 2009-2010 observer samples in observer database only

^Dockside Monitoring Program for purse seine in the Bay of Fundy began in Aug. 2010

Table 16. Herring catch at age by gear component and overall for the quota year for the 2009-2010 fisheries conducted on the SWNS/BoF spawning component (4WX stock).

2009 fall purse seine-Q09-10	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)	223	34,967	1,665	221	15	4	2	2	1	1	0	37,102
% numbers	1%	94%	4%	1%	0%	0%	0%	0%	0%	0%	0%	100%
Catch wt. (t)	3	1,501	129	27	2	1	0	1	0	0	0	1,664
% catch wt.	0%	90%	8%	2%	0%	0%	0%	0%	0%	0%	0%	100%
Avg. len (cm)	12.5	18.7	22.4	25.6	27.3	29.0	30.1	30.9	31.2	32.4	33.0	18.8
Avg. wt. (g)	11.5	42.9	77.6	122.9	154.5	186.2	211.6	232.6	240.7	271.0	288.8	44.8

4X BOF winter purse seine	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)	-	2,534	30,125	267	-	-	-	-	-	-	-	32,927
% numbers	0%	8%	91%	1%	0%	0%	0%	0%	0%	0%	0%	100%
Catch wt. (t)	-	34	1,069	20	-	-	-	-	-	-	-	1,123
% catch wt.	0%	3%	95%	2%	0%	0%	0%	0%	0%	0%	0%	100%
Avg. len (cm)	-	13.2	18.2	22.8	-	-	-	-	-	-	#DIV/0!	17.8
Avg. wt. (g)	-	13.6	35.5	73.6	-	-	-	-	-	-	#DIV/0!	34.1

4X BOF summer purse seine	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)	-	442,849	108,975	50,716	62,404	6,640	3,469	4,372	3,838	1,725	902	685,890
% numbers	0%	65%	16%	7%	9%	1%	1%	1%	1%	0%	0%	100%
Catch wt. (t)	-	13,435	7,928	6,121	9,302	1,198	727	1,022	941	436	235	41,345
% catch wt.	0%	32%	19%	15%	22%	3%	2%	2%	2%	1%	1%	100%
Avg. len (cm)	-	16.2	21.7	25.5	27.2	28.6	30.0	31.0	31.5	31.8	32.1	19.2
Avg. wt. (g)	-	30.3	72.7	120.7	149.1	180.5	209.5	233.9	245.1	252.5	260.2	60.3

4X BOF stock gillnet	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)	-	-	32	235	713	72	57	41	27	11	7	1,194
% numbers	0%	0%	3%	20%	60%	6%	5%	3%	2%	1%	1%	100%
Catch wt. (t)	-	-	4	34	119	14	12	9	6	3	1	203
% catch wt.	0%	0%	2%	17%	59%	7%	6%	5%	3%	1%	1%	100%
Avg. len (cm)	-	-	25.3	26.8	27.9	29.3	29.7	30.6	31.0	31.5	31.8	28.0
Avg. wt. (g)	-	-	119.0	144.5	167.3	197.1	206.0	227.1	237.8	251.6	259.1	170.1

Nova Scotia weirs	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)	-	36,171	3,070	57	61	3	0	-	-	-	-	39,362
% numbers	0%	92%	8%	0%	0%	0%	0%	0%	0%	0%	0%	100%
Catch wt. (t)	-	1,067	116	7	8	0	0	-	-	-	-	1,198
% catch wt.	0%	89%	10%	1%	1%	0%	0%	0%	0%	0%	0%	100%
Avg. len (cm)	-	16.6	17.7	25.2	25.7	26.6	27.4	-	-	-	#DIV/0!	16.7
Avg. wt. (g)	-	29.5	37.7	119.0	126.6	142.1	155.8	-	-	-	#DIV/0!	30.4

SW NS Component Q09-10	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)	-	481,777	177,168	52,940	63,400	6,730	3,530	4,414	3,868	1,737	910	796,474
% numbers	0%	60%	22%	7%	8%	1%	0%	1%	0%	0%	0%	100%
Catch wt. (t)	-	14,539	10,617	6,311	9,456	1,215	739	1,032	948	439	237	45,533
% catch wt.	0%	32%	23%	14%	21%	3%	2%	2%	2%	1%	1%	100%
Avg. len (cm)	-	16.2	20.5	25.4	27.2	28.6	30.0	31.0	31.5	31.8	32.1	19.0
Avg. wt. (g)	-	30.2	59.9	119.2	149.2	180.6	209.5	233.8	245.1	252.5	260.2	57.2

Table 17. Herring catch at age by month and overall for the season for the 2010 summer purse seine fishery conducted on the SWNS/BoF spawning component (4WX stock).

BOF Purse Seine May	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)	-	150,312	4,083	618	361	44	9	6	12	8	1	155,454
% numbers	0%	97%	3%	0%	0%	0%	0%	0%	0%	0%	0%	100%
Catch wt. (t)	-	999	260	59	43	7	2	1	3	2	0	1,377
% catch wt.	0%	73%	19%	4%	3%	0%	0%	0%	0%	0%	0%	100%
Avg. len (cm)	-	11.4	21.3	23.9	25.5	27.2	29.4	30.4	31.4	31.6	32.0	11.7
Avg. wt. (g)	-	6.6	63.8	95.6	119.1	152.9	205.7	225.6	255.1	260.7	272.2	8.9

BOF Purse Seine June	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)	-	21,348	13,284	1,705	2,313	698	147	123	65	59	7	39,749
% numbers	0%	54%	33%	4%	6%	2%	0%	0%	0%	0%	0%	100%
Catch wt. (t)	-	888	897	185	341	115	27	27	15	14	2	2,509
% catch wt.	0%	35%	36%	7%	14%	5%	1%	1%	1%	1%	0%	100%
Avg. len (cm)	-	18.2	21.0	24.4	26.8	27.8	28.6	30.3	30.8	31.0	31.9	20.2
Avg. wt. (g)	-	41.6	67.5	108.7	147.2	164.1	181.0	218.7	228.7	234.3	258.1	63.1

BOF Purse Seine July	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)	-	74,831	23,097	6,360	7,019	1,362	625	464	325	113	31	114,228
% numbers	0%	66%	20%	6%	6%	1%	1%	0%	0%	0%	0%	100%
Catch wt. (t)	-	3,161	1,612	758	1,060	239	130	107	75	27	8	7,176
% catch wt.	0%	44%	22%	11%	15%	3%	2%	1%	1%	0%	0%	100%
Avg. len (cm)	-	18.4	21.3	25.2	27.1	28.3	29.8	30.8	30.8	31.0	31.3	20.2
Avg. wt. (g)	-	42.2	69.8	119.2	151.0	175.5	207.6	230.9	231.3	235.1	244.0	62.8

BOF Purse Seine Aug	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)	-	114,304	25,912	7,746	15,508	2,237	817	1,547	1,222	496	137	169,926
% numbers	0%	67%	15%	5%	9%	1%	0%	1%	1%	0%	0%	100%
Catch wt. (t)	-	4,782	1,887	954	2,340	397	184	370	302	126	35	11,377
% catch wt.	0%	42%	17%	8%	21%	3%	2%	3%	3%	1%	0%	100%
Avg. len (cm)	-	18.6	21.7	25.5	27.2	28.3	30.5	31.0	31.2	31.5	31.7	20.6
Avg. wt. (g)	-	41.8	72.8	123.1	150.9	177.7	225.7	239.0	246.9	253.5	258.9	67.0

BOF Purse Seine Sept	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)	-	58,717	35,842	29,179	31,053	1,810	1,639	1,882	1,850	830	612	163,413
% numbers	0%	36%	22%	18%	19%	1%	1%	1%	1%	1%	0%	100%
Catch wt. (t)	-	2,630	2,788	3,558	4,638	354	340	441	463	216	162	15,590
% catch wt.	0%	17%	18%	23%	30%	2%	2%	3%	3%	1%	1%	100%
Avg. len (cm)	-	19.2	22.4	25.7	27.2	29.5	30.0	31.1	31.7	32.1	32.2	23.2
Avg. wt. (g)	-	44.8	77.8	121.9	149.4	195.7	207.5	234.4	250.4	260.2	264.9	95.4

BOF Purse Seine Oct	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)	-	23,336	6,758	5,108	6,149	488	231	351	365	219	114	43,120
% numbers	0%	54%	16%	12%	14%	1%	1%	1%	1%	1%	0%	100%
Catch wt. (t)	-	976	484	607	880	86	44	76	83	52	28	3,316
% catch wt.	0%	29%	15%	18%	27%	3%	1%	2%	3%	2%	1%	100%
Avg. len (cm)	-	18.6	21.9	25.8	27.3	29.2	29.9	31.2	31.6	32.0	32.2	21.7
Avg. wt. (g)	-	41.8	71.6	118.9	143.1	177.0	190.4	218.0	227.5	235.2	241.6	76.9

4X BOF summer purse seine	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)	-	442,849	108,975	50,716	62,404	6,640	3,469	4,372	3,838	1,725	902	685,890
% numbers	0%	65%	16%	7%	9%	1%	1%	1%	1%	0%	0%	100%
Catch wt. (t)	-	13,435	7,928	6,121	9,302	1,198	727	1,022	941	436	235	41,345
% catch wt.	0%	32%	19%	15%	22%	3%	2%	2%	2%	1%	1%	100%
Avg. len (cm)	-	16.2	21.7	25.5	27.2	28.6	30.0	31.0	31.5	31.8	32.1	19.2
Avg. wt. (g)	-	30.3	72.7	120.7	149.1	180.5	209.5	233.9	245.1	252.5	260.2	60.3

Table 18. Herring catch at age by fishing ground for the 2010 summer purse seine fishery conducted on the SWNS/BoF spawning component (4WX stock).

Purse German Bank (17,794t)	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)	-	10,870	31,789	36,933	45,135	3,664	2,328	3,065	2,865	1,301	803	138,754
% numbers	0%	8%	23%	27%	33%	3%	2%	2%	2%	1%	1%	100%
Catch wt. (t)	-	554	2,851	4,510	6,742	685	487	716	707	331	210	17,794
% catch wt.	0%	3%	16%	25%	38%	4%	3%	4%	4%	2%	1%	100%
Avg. len (cm)	-	19.6	23.4	25.7	27.2	29.0	30.1	31.1	31.6	31.9	32.2	25.7
Avg. wt. (g)	-	51.0	89.7	122.1	149.4	186.9	209.3	233.7	246.7	254.7	261.4	128.2
Purse GM Banks (9,726t)	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)	-	271,182	38,400	2,826	1,669	300	74	33	16	4	2	314,505
% numbers	0%	86%	12%	1%	1%	0%	0%	0%	0%	0%	0%	100%
Catch wt. (t)	-	6,659	2,463	294	235	49	14	7	4	1	0	9,726
% catch wt.	0%	68%	25%	3%	2%	1%	0%	0%	0%	0%	0%	100%
Avg. len (cm)	-	15.0	21.0	24.2	26.5	27.7	29.1	29.9	30.3	30.5	30.7	15.9
Avg. wt. (g)	-	24.6	64.1	104.2	140.8	163.0	192.2	209.7	218.8	224.2	228.1	30.9
Purse Grand Manan (6,307t)	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)	-	128,857	19,050	496	81	0	0	1	1	1	1	148,488
% numbers	0%	87%	13%	0%	0%	0%	0%	0%	0%	0%	0%	100%
Catch wt. (t)	-	5,191	1,059	46	9	0	0	0	0	0	0	6,307
% catch wt.	0%	82%	17%	1%	0%	0%	0%	0%	0%	0%	0%	100%
Avg. len (cm)	-	18.3	20.1	23.7	25.6	29.1	29.2	32.9	32.9	33.0	33.0	18.6
Avg. wt. (g)	-	40.3	55.6	92.9	115.7	172.8	175.9	257.2	258.2	259.5	259.5	42.5
Purse Scots Bay (4,086t)	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)	-	191	7,054	7,516	11,724	1,720	632	585	415	143	45	30,024
% numbers	0%	1%	23%	25%	39%	6%	2%	2%	1%	0%	0%	100%
Catch wt. (t)	-	12	684	940	1,745	295	133	135	97	34	11	4,086
% catch wt.	0%	0%	17%	23%	43%	7%	3%	3%	2%	1%	0%	100%
Avg. len (cm)	-	20.9	23.8	25.6	27.0	28.1	29.9	30.8	30.9	31.0	31.4	26.1
Avg. wt. (g)	-	61.8	96.9	125.0	148.9	171.7	210.6	231.6	233.2	237.3	246.5	136.1
Purse Long Island (1,585t)	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)	-	18,121	9,396	966	741	140	23	15	9	7	0	29,420
% numbers	0%	62%	32%	3%	3%	0%	0%	0%	0%	0%	0%	100%
Catch wt. (t)	-	739	613	99	102	22	4	3	2	2	0	1,585
% catch wt.	0%	47%	39%	6%	6%	1%	0%	0%	0%	0%	0%	100%
Avg. len (cm)	-	18.1	21.0	24.1	26.3	27.3	28.4	30.4	30.5	30.7	31.4	19.5
Avg. wt. (g)	-	40.8	65.2	102.4	137.5	155.7	177.7	220.3	223.0	228.1	243.4	53.9
Purse Gannet/Dry Ledge (723t)	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)	-	30	1,211	1,185	1,705	424	167	178	123	78	17	5,118
% numbers	0%	1%	24%	23%	33%	8%	3%	3%	2%	2%	0%	100%
Catch wt. (t)	-	2	111	142	264	76	34	41	29	19	4	723
% catch wt.	0%	0%	15%	20%	37%	10%	5%	6%	4%	3%	1%	100%
Avg. len (cm)	-	20.8	23.7	25.5	27.4	28.5	29.7	30.8	31.1	31.2	31.7	26.5
Avg. wt. (g)	-	59.6	92.0	120.3	154.9	178.5	204.7	230.2	237.8	239.5	253.6	141.3
BOF Purse Trinity (689t)	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)	-	4,283	393	188	526	180	192	466	387	179	34	6,828
% numbers	0%	63%	6%	3%	8%	3%	3%	7%	6%	3%	0%	100%
Catch wt. (t)	-	203	29	23	87	38	44	113	97	46	9	689
% catch wt.	0%	29%	4%	3%	13%	5%	6%	16%	14%	7%	1%	100%
Avg. len (cm)	-	19.3	21.8	25.6	27.8	29.7	30.7	31.1	31.4	31.6	31.6	22.8
Avg. wt. (g)	-	47.3	74.0	124.7	166.3	209.0	231.7	242.8	250.3	256.4	256.6	101.0
Purse Lurcher (218t)	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)	-	648	370	263	551	172	43	22	11	4	0	2,085
% numbers	0%	31%	18%	13%	26%	8%	2%	1%	1%	0%	0%	100%
Catch wt. (t)	-	29	31	31	83	28	8	5	2	1	0	218
% catch wt.	0%	13%	14%	14%	38%	13%	3%	2%	1%	0%	0%	100%
Avg. len (cm)	-	19.0	22.6	25.1	27.0	27.8	28.4	30.2	30.5	30.8	31.2	23.6
Avg. wt. (g)	-	44.7	84.8	118.9	149.9	164.8	175.9	215.5	223.3	229.6	239.7	104.7

Table 19. Herring catch at age for the overall 2009 quota year purse seine, gillnet and weir fisheries conducted on the SWNS/BoF spawning component (4WX stock).

SWNS Quota Year 2008-2009	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)	702	263,298	117,708	138,589	22,198	11,954	11,487	13,084	6,008	1,418	314	586,760
% numbers	0%	45%	20%	24%	4%	2%	2%	2%	1%	0%	0%	100%
Catch wt. (t)	8	10,846	9,990	19,106	3,817	2,429	2,660	3,221	1,545	399	93	54,113
% catch wt.	0%	20%	18%	35%	7%	4%	5%	6%	3%	1%	0%	100%
Avg. len (cm)	12.2	18.1	22.3	25.9	27.7	29.1	30.2	30.8	31.2	32.0	32.6	22.1
Avg. wt. (g)	10.8	41.2	84.9	137.9	171.9	203.2	231.5	246.2	257.2	281.2	297.4	92.2

SWNS Quota Year 2009-2010	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)	-	481,777	177,168	52,940	63,400	6,730	3,530	4,414	3,868	1,737	910	796,474
% numbers	0%	60%	22%	7%	8%	1%	0%	1%	0%	0%	0%	100%
Catch wt. (t)	-	14,539	10,617	6,311	9,456	1,215	739	1,032	948	439	237	45,533
% catch wt.	0%	32%	23%	14%	21%	3%	2%	2%	2%	1%	1%	100%
Avg. len (cm)		16.2	20.5	25.4	27.2	28.6	30.0	31.0	31.5	31.8	32.1	19.0
Avg. wt. (g)		30.2	59.9	119.2	149.2	180.6	209.5	233.8	245.1	252.5	260.2	57.2

Differences 2010 minus 2009	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)	-702	218,479	59,460	-85,649	41,202	-5,224	-7,957	-8,670	-2,140	319	596	209,713
% numbers	-0.00	0.16	0.02	-0.17	0.04	-0.01	-0.02	-0.02	-0.01	-0.00	0.00	0.00
Catch wt. (t)	-8	3,693	627	-12,796	5,639	-1,213	-1,920	-2,189	-597	40	143	-8,580
% catch wt.	-0.00	0.12	0.05	-0.21	0.14	-0.02	-0.03	-0.04	-0.01	0.00	0.00	0.00
Avg. len (cm)	-12.2	-1.9	-1.9	-0.5	-0.6	-0.5	-0.2	0.2	0.2	-0.3	-0.5	-3.1
Avg. wt. (g)	-10.8	-11.0	-24.9	-18.7	-22.8	-22.6	-22.1	-12.4	-12.1	-28.6	-37.2	-35.1

Table 20a. Catch at age (thousands) for the SWNS/BoF herring spawning component for 1965-2010 with revisions from 1999-2005 and new data for 2006-2010.

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	9	151	253	72	104	63	26	6	2	0	1	686
2000	0	378	53	123	109	56	30	12	1	1	0	764
2001	0	81	311	54	64	31	17	5	3	0	0	566
2002	16	310	107	189	84	25	9	6	3	2	2	753
2003	0	479	255	81	109	19	10	3	3	2	1	961
2004	4	322	315	161	40	37	11	2	3	1	2	897
2005	1	66	131	174	59	12	9	4	1	0	1	457
2006	3	112	102	68	82	34	16	4	0	0	0	422
2007	0	186	56	34	39	71	25	7	1	0	0	419
2008	1	78	220	53	25	32	31	11	4	0	0	457
2009	1	263	118	139	22	12	11	13	6	1	0	587
2010		482	177	53	63	7	4	4	4	2	1	796

Table 20b. Catch at age (percent numbers) for the SWNS/BoF herring spawning component, 1965-2010 with revisions from 1999-2010. Proportions for some relatively strong year-classes that persisted in the fishery catch have been highlighted.

Historical catch at age in percentages

Year	Age											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	0	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	1	22	37	10	15	9	4	1	0	0	0	100
2000	0	49	7	16	14	7	4	2	0	0	0	100
2001	0	14	55	10	11	5	3	1	1	0	0	100
2002	2	41	14	25	11	3	1	1	0	0	0	100
2003	0	50	27	8	11	2	1	0	0	0	0	100
2004	0	36	35	18	4	4	1	0	0	0	0	100
2005	0	15	29	38	13	3	2	1	0	0	0	100
2006	1	26	24	16	19	8	4	1	0	0	0	100
2007	0	44	13	8	9	17	6	2	0	0	0	100
2008	0	17	48	12	5	7	7	2	1	0	0	100
2009	0	45	20	24	4	2	2	2	1	0	0	100
2010	-	60	22	7	8	1	0	1	0	0	0	100

Note - green highlight for age 2 >= 50%

Table 21. Average (fishery weighted) weights at age (g) for the SWNS/BoF component of the 4WX herring fishery for 1965-2010. Data for 1965-1967 and 1979-1983 are averages for the period 1968-1978.

Average weight (kg)	1	2	3	4	5	6	7	8	9	10	11
1965	0.010	0.041	0.112	0.172	0.218	0.254	0.286	0.323	0.354	0.389	0.389
1966	0.010	0.041	0.112	0.172	0.218	0.254	0.286	0.323	0.354	0.389	0.389
1967	0.010	0.041	0.112	0.172	0.218	0.254	0.286	0.323	0.354	0.389	0.392
1968	0.010	0.033	0.112	0.148	0.185	0.244	0.276	0.399	0.338	0.410	0.409
1969	0.010	0.037	0.105	0.162	0.207	0.242	0.282	0.306	0.334	0.390	0.391
1970	0.010	0.032	0.119	0.169	0.211	0.257	0.292	0.332	0.369	0.389	0.389
1971	0.010	0.066	0.143	0.199	0.230	0.254	0.293	0.329	0.362	0.388	0.388
1972	0.010	0.044	0.138	0.192	0.223	0.262	0.292	0.322	0.345	0.380	0.380
1973	0.010	0.029	0.106	0.143	0.225	0.252	0.279	0.331	0.360	0.389	0.389
1974	0.010	0.048	0.110	0.175	0.206	0.240	0.277	0.322	0.342	0.352	0.344
1975	0.010	0.021	0.094	0.179	0.216	0.240	0.268	0.333	0.358	0.379	0.379
1976	0.010	0.033	0.114	0.159	0.233	0.249	0.277	0.317	0.382	0.404	0.404
1977	0.010	0.065	0.113	0.174	0.214	0.274	0.293	0.325	0.328	0.416	0.416
1978	0.010	0.028	0.112	0.181	0.229	0.259	0.302	0.330	0.351	0.397	0.397
1979	0.010	0.041	0.112	0.172	0.218	0.254	0.286	0.323	0.354	0.389	0.389
1980	0.010	0.041	0.112	0.172	0.218	0.254	0.286	0.323	0.354	0.389	0.389
1981	0.010	0.041	0.112	0.172	0.218	0.254	0.286	0.323	0.354	0.389	0.389
1982	0.010	0.041	0.112	0.172	0.218	0.254	0.286	0.323	0.354	0.389	0.389
1983	0.010	0.041	0.112	0.172	0.218	0.254	0.286	0.323	0.354	0.389	0.389
1984	0.010	0.038	0.132	0.191	0.229	0.259	0.280	0.296	0.309	0.364	0.364
1985	0.010	0.053	0.118	0.204	0.249	0.278	0.315	0.334	0.344	0.440	0.440
1986	0.010	0.055	0.124	0.182	0.239	0.271	0.306	0.329	0.360	0.400	0.399
1987	0.012	0.050	0.098	0.153	0.199	0.245	0.274	0.290	0.318	0.350	0.349
1988	0.013	0.021	0.088	0.154	0.196	0.242	0.281	0.304	0.327	0.341	0.371
1989	0.007	0.033	0.079	0.162	0.207	0.238	0.274	0.303	0.324	0.353	0.365
1990	0.010	0.031	0.092	0.161	0.200	0.234	0.255	0.287	0.319	0.336	0.364
1991	0.010	0.048	0.100	0.147	0.186	0.217	0.251	0.270	0.303	0.322	0.332
1992	0.009	0.025	0.100	0.148	0.181	0.216	0.252	0.275	0.295	0.313	0.333
1993	0.018	0.029	0.108	0.153	0.188	0.215	0.251	0.279	0.302	0.324	0.357
1994	0.012	0.037	0.079	0.131	0.175	0.203	0.223	0.253	0.289	0.304	0.326
1995	0.015	0.042	0.076	0.136	0.187	0.223	0.247	0.293	0.300	0.326	0.363
1996	0.010	0.033	0.098	0.137	0.168	0.228	0.266	0.308	0.332	0.355	0.384
1997	0.019	0.034	0.080	0.161	0.190	0.238	0.284	0.314	0.358	0.376	0.397
1998	0.010	0.038	0.076	0.131	0.177	0.210	0.251	0.296	0.308	0.337	0.376
1999	0.024	0.052	0.087	0.137	0.166	0.199	0.213	0.243	0.259	0.311	0.274
2000	0.023	0.062	0.095	0.139	0.173	0.198	0.214	0.232	0.270	0.295	0.311
2001	0.023	0.058	0.109	0.147	0.185	0.221	0.249	0.269	0.263	0.317	0.312
2002	0.019	0.045	0.107	0.149	0.176	0.215	0.243	0.251	0.238	0.252	0.274
2003	0.013	0.044	0.090	0.146	0.176	0.196	0.225	0.253	0.250	0.257	0.260
2004	0.011	0.035	0.084	0.136	0.178	0.195	0.204	0.242	0.228	0.249	0.253
2005	0.022	0.035	0.074	0.130	0.153	0.184	0.207	0.214	0.246	0.273	0.254
2006	0.023	0.056	0.091	0.141	0.164	0.181	0.204	0.222	0.252	0.267	0.307
2007	0.027	0.055	0.104	0.148	0.184	0.204	0.215	0.242	0.270	0.269	0.287
2008	0.025	0.050	0.095	0.146	0.175	0.207	0.228	0.240	0.254	0.293	0.325
2009	0.011	0.041	0.085	0.138	0.172	0.203	0.232	0.246	0.257	0.281	0.297
2010	0.010	0.030	0.060	0.119	0.149	0.181	0.209	0.234	0.245	0.253	0.260
Average 1965-2010	0.013	0.041	0.102	0.158	0.199	0.233	0.262	0.295	0.316	0.347	0.355
Minimum	0.007	0.021	0.060	0.119	0.149	0.181	0.204	0.214	0.228	0.249	0.253
Maximum	0.027	0.066	0.143	0.204	0.249	0.278	0.315	0.399	0.382	0.440	0.440
Avg 1970-79	0.010	0.041	0.116	0.174	0.221	0.254	0.286	0.326	0.355	0.388	0.387
Avg 19 80-89	0.010	0.041	0.109	0.173	0.219	0.255	0.287	0.315	0.340	0.380	0.384
Avg 1990-99	0.014	0.037	0.090	0.144	0.182	0.218	0.249	0.282	0.307	0.330	0.351
Avg 2000-09	0.020	0.048	0.093	0.142	0.174	0.200	0.222	0.241	0.253	0.275	0.288
Last 10yr: 2001-2010	0.018	0.046	0.090	0.140	0.171	0.199	0.221	0.241	0.252	0.273	0.286
Last 5yr: 2006-2010	0.019	0.044	0.085	0.137	0.166	0.193	0.216	0.233	0.254	0.272	0.289

Note: highlighted cells have average weights for 1967-2000 applied

Table 22. Acoustic age composition for the overall SWNS/BoF component from 1999-2010.

Year and Area	Type Data	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11+	Total
1999 Acoustics Overall (newages)	% catch wt.	0%	0%	4%	14%	34%	31%	12%	3%	1%	0%	0%	100%
2000 Acoustics Overall (newages)	% catch wt.	0%	2%	3%	24%	29%	18%	14%	7%	1%	0%	0%	100%
2001 Sub-total Stock Acoustic (newages)	% catch wt.	0%	2%	38%	14%	21%	14%	8%	2%	2%	0%	0%	100%
2002 Acoustics Stock Overall (newages)	% catch wt.	0%	1%	15%	45%	21%	7%	4%	3%	2%	1%	1%	99%
2003 Overall Acoustics (newages)	% catch wt.	0%	2%	28%	21%	33%	7%	4%	1%	1%	1%	1%	99%
2004 Acoustics Overall (newages)	% catch wt.	0%	0%	21%	43%	16%	11%	3%	1%	2%	0%	1%	99%
2005 Acoustics Overall (newages)	% catch wt.	0%	0%	10%	47%	20%	8%	8%	4%	1%	0%	1%	99%
2006 Acoustics Overall (newages)	% catch wt.	0%	0%	8%	21%	37%	19%	11%	3%	0%	0%	0%	100%
2007 Overall Acoustics (newages)	% catch wt.	0%	1%	8%	13%	18%	37%	19%	3%	1%	0%	0%	100%
2008 Overall Acoustics (newages)	% catch wt.	0%	0%	24%	12%	9%	14%	24%	12%	5%	1%	0%	100%
2009 Acoustics Overall	% catch wt.	0%	1%	17%	49%	8%	5%	6%	8%	4%	1%	0%	100%
2010 BOF Stock Acoustics overall (w/o CIF)	% catch wt.	0%	0%	12%	21%	44%	6%	3%	6%	5%	2%	1%	100%
1999 Acoustics Overall (newages)	% numbers	0%	0%	6%	16%	37%	28%	10%	2%	1%	0%	0%	100%
2000 Acoustics Overall (newages)	% numbers	0%	7%	5%	29%	28%	15%	11%	5%	1%	0%	0%	100%
2001 Sub-total Stock Acoustic (newages)	% numbers	0%	4%	49%	14%	17%	9%	5%	1%	1%	0%	0%	100%
2002 Acoustics Stock Overall (newages)	% numbers	0%	3%	19%	47%	19%	5%	3%	2%	1%	1%	1%	99%
2003 Overall Acoustics (newages)	% numbers	0%	5%	37%	20%	27%	5%	3%	1%	1%	0%	0%	100%
2004 Acoustics Overall (newages)	% numbers	0%	1%	28%	45%	12%	9%	2%	1%	2%	0%	1%	99%
2005 Acoustics Overall (newages)	% numbers	0%	0%	14%	50%	19%	7%	6%	3%	1%	0%	0%	100%
2006 Acoustics Overall (newages)	% numbers	0%	0%	12%	23%	37%	17%	9%	2%	0%	0%	0%	100%
2007 Overall Acoustics (newages)	% numbers	0%	1%	13%	16%	17%	33%	17%	2%	1%	0%	0%	100%
2008 Overall Acoustics (newages)	% numbers	0%	0%	35%	14%	8%	12%	18%	9%	3%	0%	0%	100%
2009 Acoustics Overall	% numbers	0%	3%	23%	52%	7%	4%	4%	5%	2%	1%	0%	100%
2010 BOF Stock Acoustics overall (w/o CIF)	% numbers	0%	0%	17%	24%	43%	5%	2%	3%	3%	1%	0%	100%
1999 Acoustics Overall (newages)	Catch wt. (t)	-	84	22,216	69,469	173,595	155,515	61,022	16,493	4,242	1,754	1,291	505,680
2000 Acoustics Overall (newages)	Catch wt. (t)	-	11,400	14,380	112,184	134,684	84,156	66,464	32,791	4,742	2,039	469	463,309
2001 Sub-total Stock Acoustic (newages)	Catch wt. (t)	-	7,001	176,018	62,399	94,533	62,077	38,372	9,330	7,312	769	8	457,820
2002 Acoustics Stock Overall (newages)	Catch wt. (t)	52	5,304	80,806	244,021	116,212	40,702	22,607	14,424	9,574	4,792	4,906	543,401
2003 Overall Acoustics (newages)	Catch wt. (t)	-	11,921	144,848	104,594	167,789	36,704	19,940	6,841	5,765	3,767	3,263	505,432
2004 Acoustics Overall (newages)	Catch wt. (t)	-	1,706	101,072	207,633	75,581	55,374	16,618	5,998	11,296	1,917	4,568	481,764
2005 Acoustics Overall (newages)	Catch wt. (t)	-	219	23,804	111,443	47,155	18,710	18,720	8,591	2,414	456	1,656	233,168
2006 Acoustics Overall (newages)	Catch wt. (t)	-	349	22,840	59,161	105,088	52,822	32,210	8,241	934	636	265	282,548
2007 Overall Acoustics (newages)	Catch wt. (t)	-	2,115	32,457	50,989	67,778	142,394	72,708	9,699	4,516	982	741	384,379
2008 Overall Acoustics (newages)	Catch wt. (t)	-	13	53,013	26,693	19,720	30,353	54,061	26,910	10,370	1,716	221	223,071
2009 Acoustics Overall	Catch wt. (t)	-	4,314	63,651	186,373	30,773	20,455	24,377	28,454	14,128	3,727	780	377,031
2010 BOF Stock Acoustics overall (w/o CIF)	Catch wt. (t)	-	290	29,336	53,148	112,153	16,377	8,445	14,083	11,685	5,012	2,133	252,661
1999 Acoustics Overall (newages)	Numbers (x1,000)	-	854	167,854	437,601	970,567	733,451	257,034	60,631	13,956	5,445	3,389	2,650,782
2000 Acoustics Overall (newages)	Numbers (x1,000)	-	176,913	128,754	770,463	744,375	412,096	303,870	139,098	16,532	6,648	1,175	2,699,924
2001 Sub-total Stock Acoustic (newages)	Numbers (x1,000)	-	108,158	1,446,910	413,181	504,205	276,744	151,010	33,231	27,607	2,419	25	2,963,491
2002 Acoustics Stock Overall (newages)	Numbers (x1,000)	2,037	92,602	643,349	1,611,858	664,014	188,737	91,655	55,810	40,093	17,737	17,489	3,425,381
2003 Overall Acoustics (newages)	Numbers (x1,000)	-	187,496	1,317,612	719,568	968,611	191,900	90,384	27,540	23,373	14,877	12,977	3,554,338
2004 Acoustics Overall (newages)	Numbers (x1,000)	-	27,081	912,633	1,458,078	396,624	278,517	79,659	24,488	49,614	6,788	18,011	3,251,491
2005 Acoustics Overall (newages)	Numbers (x1,000)	-	4,483	209,985	765,947	290,870	99,540	87,118	39,532	9,769	1,670	6,702	1,515,617
2006 Acoustics Overall (newages)	Numbers (x1,000)	-	4,970	197,497	380,770	609,173	278,179	153,090	36,457	3,710	2,381	930	1,667,157
2007 Overall Acoustics (newages)	Numbers (x1,000)	-	21,462	266,920	331,681	364,304	696,015	346,312	37,429	17,093	3,456	2,516	2,087,187
2008 Overall Acoustics (newages)	Numbers (x1,000)	-	162	446,066	174,742	104,483	144,766	230,953	110,028	39,693	5,922	731	1,257,545
2009 Acoustics Overall	Numbers (x1,000)	-	65,642	586,617	1,297,340	176,290	98,834	103,880	113,808	53,951	13,370	2,616	2,512,347
2010 BOF Stock Acoustics overall (w/o CIF)	Numbers (x1,000)	-	4,435	298,756	422,868	737,319	90,715	39,180	59,589	47,658	19,999	8,294	1,728,812

Table 23. Acoustic age composition for the German Bank component from 1999-2010 with percent by weight, percent by number, catch/survey biomass(t) and numbers (thousands) by age.

Year and Area	Type Data	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11+	Total
1999 German Bank Acoustic Overall (newages)	% catch wt.	0%	0%	4%	14%	34%	31%	12%	3%	1%	0%	0%	100%
2000 German Bank Overall (newages)	% catch wt.	0%	3%	3%	24%	28%	17%	15%	7%	1%	0%	0%	100%
2001 German Bank Acoustic (newages)	% catch wt.	0%	4%	40%	12%	18%	13%	8%	2%	2%	0%	0%	100%
2002 German Bank Overall (newages)	% catch wt.	0%	1%	16%	42%	22%	7%	4%	3%	2%	1%	1%	99%
2003 German Bank Acoustics (newages)	% catch wt.	0%	3%	33%	20%	29%	8%	4%	1%	1%	1%	1%	99%
2004 Acoustics German Bank (newages)	% catch wt.	0%	0%	19%	46%	16%	10%	3%	1%	3%	0%	1%	99%
2005 German Bank Acoustics (newages)	% catch wt.	0%	0%	11%	47%	20%	8%	8%	4%	1%	0%	1%	99%
2006 German Bank Acoustics (newages)	% catch wt.	0%	0%	8%	21%	37%	19%	12%	3%	0%	0%	0%	100%
2007 German Bank Acoustics (newages)	% catch wt.	0%	1%	8%	12%	17%	38%	21%	2%	1%	0%	0%	100%
2008 German Bank Acoustics (newages)	% catch wt.	0%	0%	24%	12%	9%	13%	24%	12%	5%	1%	0%	100%
2009 German Bank Acoustics-v2	% catch wt.	0%	1%	16%	49%	8%	5%	6%	8%	4%	1%	0%	100%
2010 German Bank Acoustics Overall (w/o C)	% catch wt.	0%	0%	11%	20%	45%	6%	3%	6%	5%	2%	1%	100%
1999 German Bank Acoustic Overall (newages)	% numbers	0%	0%	6%	17%	36%	28%	10%	2%	1%	0%	0%	100%
2000 German Bank Overall (newages)	% numbers	0%	8%	5%	28%	26%	14%	12%	5%	1%	0%	0%	100%
2001 German Bank Acoustic (newages)	% numbers	0%	8%	50%	12%	15%	9%	5%	1%	1%	0%	0%	100%
2002 German Bank Overall (newages)	% numbers	0%	4%	20%	44%	20%	5%	3%	2%	1%	0%	0%	100%
2003 German Bank Acoustics (newages)	% numbers	0%	6%	41%	19%	23%	6%	3%	1%	1%	0%	0%	100%
2004 Acoustics German Bank (newages)	% numbers	0%	1%	26%	48%	12%	7%	2%	1%	2%	0%	1%	99%
2005 German Bank Acoustics (newages)	% numbers	0%	0%	14%	50%	19%	7%	6%	3%	1%	0%	0%	100%
2006 German Bank Acoustics (newages)	% numbers	0%	0%	12%	22%	36%	17%	9%	2%	0%	0%	0%	100%
2007 German Bank Acoustics (newages)	% numbers	0%	1%	12%	15%	17%	34%	18%	2%	1%	0%	0%	100%
2008 German Bank Acoustics (newages)	% numbers	0%	0%	36%	14%	8%	11%	19%	9%	3%	0%	0%	100%
2009 German Bank Acoustics-v2	% numbers	0%	2%	23%	52%	7%	4%	4%	5%	2%	1%	0%	100%
2010 German Bank Acoustics Overall (w/o C)	% numbers	0%	0%	16%	24%	43%	5%	2%	4%	3%	1%	1%	100%
1999 German Bank Acoustic Overall (newages)	Catch wt. (t)	-	82	20,275	64,082	156,669	141,083	55,806	15,607	4,213	1,726	1,280	460,823
2000 German Bank Overall (newages)	Catch wt. (t)	-	11,254	12,282	86,545	101,223	60,508	54,444	24,364	3,954	1,329	467	356,372
2001 German Bank Acoustic (newages)	Catch wt. (t)	-	6,761	77,041	23,033	35,156	25,112	15,986	3,598	3,410	396	-	190,494
2002 German Bank Overall (newages)	Catch wt. (t)	52	5,107	62,843	167,061	85,780	28,917	17,045	11,138	8,662	3,049	3,468	393,121
2003 German Bank Acoustics (newages)	Catch wt. (t)	-	9,507	112,696	67,780	99,837	27,194	13,970	4,477	3,513	2,068	2,445	343,486
2004 Acoustics German Bank (newages)	Catch wt. (t)	-	1,486	70,123	170,087	59,916	36,320	10,979	4,713	9,571	1,052	3,382	367,629
2005 German Bank Acoustics (newages)	Catch wt. (t)	-	205	22,372	100,193	42,169	17,344	17,060	7,550	2,122	422	1,523	210,959
2006 German Bank Acoustics (newages)	Catch wt. (t)	-	320	20,746	50,548	90,762	45,815	28,381	7,326	805	539	238	245,480
2007 German Bank Acoustics (newages)	Catch wt. (t)	-	1,782	25,749	41,552	57,675	127,509	69,264	7,873	4,291	869	628	337,192
2008 German Bank Acoustics (newages)	Catch wt. (t)	-	-	49,681	23,880	17,720	25,789	49,830	24,853	9,912	1,521	221	203,407
2009 German Bank Acoustics-v2	Catch wt. (t)	-	2,997	50,191	152,788	24,885	16,561	20,001	24,304	12,700	3,520	768	308,713
2010 German Bank Acoustics Overall (w/o C)	Catch wt. (t)	-	179	21,824	42,061	91,991	12,782	6,874	12,497	10,613	4,590	2,011	205,422
1999 German Bank Acoustic Overall (newages)	Numbers (x1,000)	-	832	153,058	403,585	877,171	664,394	233,385	57,062	13,860	5,352	3,362	2,412,061
2000 German Bank Overall (newages)	Numbers (x1,000)	-	175,500	110,521	594,633	558,315	302,698	251,590	105,361	13,780	4,298	1,171	2,117,866
2001 German Bank Acoustic (newages)	Numbers (x1,000)	-	105,643	654,813	156,616	190,336	113,455	63,690	12,901	13,236	1,241	-	1,311,930
2002 German Bank Overall (newages)	Numbers (x1,000)	2,021	89,756	504,599	1,102,271	493,104	134,970	69,343	43,173	36,391	11,165	12,237	2,499,028
2003 German Bank Acoustics (newages)	Numbers (x1,000)	-	154,745	1,018,475	477,351	578,705	143,619	63,515	18,151	14,263	8,160	9,889	2,486,873
2004 Acoustics German Bank (newages)	Numbers (x1,000)	-	23,650	638,371	1,197,723	310,760	183,630	53,172	19,343	42,320	3,373	13,418	2,485,760
2005 German Bank Acoustics (newages)	Numbers (x1,000)	-	4,212	196,739	683,438	258,828	92,400	79,193	34,675	8,605	1,550	6,205	1,365,846
2006 German Bank Acoustics (newages)	Numbers (x1,000)	-	4,567	178,930	322,966	523,053	239,322	134,161	32,351	3,208	2,040	839	1,441,435
2007 German Bank Acoustics (newages)	Numbers (x1,000)	-	17,815	210,166	268,885	309,544	621,725	330,001	29,818	16,301	3,030	2,134	1,809,417
2008 German Bank Acoustics (newages)	Numbers (x1,000)	-	-	418,278	156,610	93,175	123,733	213,104	102,230	37,838	5,239	731	1,150,937
2009 German Bank Acoustics-v2	Numbers (x1,000)	-	43,736	457,872	1,057,905	141,452	79,524	84,240	96,383	48,112	12,595	2,574	2,024,393
2010 German Bank Acoustics Overall (w/o C)	Numbers (x1,000)	-	2,652	221,594	334,499	601,995	69,790	31,717	52,678	43,049	18,218	7,791	1,383,983

Table 24. Biological characteristics from sampling for German Bank acoustic surveys from 1999-2010 with average length (cm) and average weight (g) by age.

Year and Area	Type Data	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11+	Total
1999 German Bank Acoustic Overall (newages)	Avg. len (cm)	-	23.2	25.4	26.9	27.9	29.4	30.5	31.9	33.1	33.6		28.4
2000 German Bank Overall (newages)	Avg. len (cm)	-	21.0	24.9	27.0	28.8	29.7	30.5	31.1	33.2	33.6		27.9
2001 German Bank Acoustic (newages)	Avg. len (cm)	-	20.9	25.1	26.8	28.6	30.2	31.4	32.4	31.6	33.7		26.3
2002 German Bank Overall (newages)	Avg. len (cm)	15.9	20.2	25.7	27.3	28.3	30.1	31.3	31.8	31.3	32.0		27.3
2003 German Bank Acoustics (newages)	Avg. len (cm)	-	20.4	24.6	26.5	28.2	29.0	30.3	31.4	31.4	31.6		26.1
2004 Acoustics German Bank (newages)	Avg. len (cm)	-	20.8	24.6	26.6	29.1	29.3	29.7	31.2	30.6	33.6		26.7
2005 German Bank Acoustics (newages)	Avg. len (cm)	-	19.2	24.8	26.8	27.6	28.9	30.1	30.2	31.4	32.3		27.1
2006 German Bank Acoustics (newages)	Avg. len (cm)	-	21.1	24.7	27.0	27.8	28.6	29.5	30.1	31.1	31.6		27.6
2007 German Bank Acoustics (newages)	Avg. len (cm)	-	23.8	25.2	27.0	28.5	29.3	29.4	31.5	31.5	32.2		28.4
2008 German Bank Acoustics (newages)	Avg. len (cm)	-	-	24.8	26.7	28.5	29.3	30.3	30.6	31.4	32.3		27.6
2009 German Bank Acoustics-v2	Avg. len (cm)	-	21.2	24.3	26.3	27.9	29.2	30.4	31.0	31.4	32.0	32.7	26.5
2010 German Bank Acoustics Overall (w/o CIF)	Avg. len (cm)	-	21.6	24.0	25.8	27.3	28.7	30.2	31.0	31.4	31.6	31.9	26.9
1999 German Bank Acoustic Overall (newages)	Avg. wt. (g)	2	99	132	159	179	212	239	274	304	322		191
2000 German Bank Overall (newages)	Avg. wt. (g)	2	64	111	146	181	200	216	231	287	309		168
2001 German Bank Acoustic (newages)	Avg. wt. (g)	2	64	118	147	185	221	251	279	258	319		145
2002 German Bank Overall (newages)	Avg. wt. (g)	2	57	125	152	174	214	246	258	238	273		157
2003 German Bank Acoustics (newages)	Avg. wt. (g)	2	61	111	142	173	189	220	247	246	253		138
2004 Acoustics German Bank (newages)	Avg. wt. (g)	2	63	110	142	193	198	206	244	226	312		148
2005 German Bank Acoustics (newages)	Avg. wt. (g)	2	49	114	147	163	188	215	218	247	272		154
2006 German Bank Acoustics (newages)	Avg. wt. (g)	2	70	116	157	174	191	212	226	251	264		170
2007 German Bank Acoustics (newages)	Avg. wt. (g)	2	100	123	155	186	205	210	264	263	287		186
2008 German Bank Acoustics (newages)	Avg. wt. (g)	2	-	119	152	190	208	234	243	262	290		177
2009 German Bank Acoustics-v2	Avg. wt. (g)	2	69	110	144	176	208	237	252	264	279	298	152
2010 German Bank Acoustics Overall (w/o CIF)	Avg. wt. (g)	2	67	98	126	153	183	217	237	247	252	258	148

Table 25. Progress against biological objectives in the management plan of the SWNS/BoF herring spawning component for the 2010 fishery.

Objective	2010: Observations
Persistence of all spawning components	Spawning observed in Scots Bay and German Bank. Spawning activity could not be determined on Seal Island or Browns due to a lack of fishing or survey effort. Trinity Ledge again had minimal spawning.
Maintain biomass of each component	Acoustic biomass estimates decreased substantially for each of the major survey areas. SSB for Trinity is extremely low. The overall SSB has been well below average for 4 of the past 6 years.
Maintain broad age composition	Appears to be a broad range of ages in the commercial catch (1-9), as well as in the acoustic survey catch at age (3-11).
Maintain long spawning period	Start of spawning in 2010 for German Bank was earlier based on survey results. Spawning in Scots Bay appeared to start earlier and end earlier than in previous years. Virtually no spawning occurred on Trinity Ledge.
Fishing mortality at or below $F_{0.1}$	Fishing mortality could not be determined. Relative exploitation rates based on acoustic SSB estimates and catch increased in 2010.
Maintain spatial and temporal diversity of spawning	Similar spatial and temporal distribution of spawning on German Bank. Duration of spawning in Scots was extended and similar to 2009. Trinity spawning is very restricted in space and time. There is a lack of documented spawning in other areas.
Maintain biomass at moderate to high levels	There was an decrease in acoustic SSB for Scots Bay and German Bank; however, SSB appears to be well below the 1999-2009 average.

Table 26. Herring catch at age for the 2010 Offshore Banks fisheries with numbers caught (thousands), weight (t) and percent, average length and average weight by age.

4W Offshore purse seine

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)	-	1,073	19,108	13,601	26,363	9,231	3,004	4,190	3,317	2,084	830	82,801	
% numbers	-	1%	23%	16%	32%	11%	4%	5%	4%	3%	1%	100%	
Catch wt. (t)	-	54	1,565	1,582	3,906	1,578	603	971	812	522	244	11,837	
% catch wt.	-	0%	13%	13%	33%	13%	5%	8%	7%	4%	2%	100%	
Avg. len (cm)	-	19.9	22.8	25.2	26.9	28.0	29.4	30.7	31.2	31.4	32.9	26.3	Avg. Len
Avg. wt. (g)	-	50.1	81.9	116.3	148.2	170.9	200.7	231.8	244.7	250.3	293.8	143.0	Avg. wt

Table 27. Herring abundance indices from the July bottom trawl survey (stratified numbers per tow): 1970-2010. Note 2005 had duplicate coverage of the entire area with comparative surveys by the Alfred Needler and Templeman.

Year	Cruise	4WX area combined strata 453/495			4W Only strata 453/466 Mean	4X Only strata 470/495 Mean	4X BOF strata 480/495 Mean	4V only strata 440/452 Mean	Offshore Banks strata 455/478 Mean
		Mean	SE	N					
1970	A175/176	4.1	1.5	95	4.9	1.6	1.0	12.8	5.7
1971	A188/189	4.0	1.9	86	2.6	3.6	1.4	4.4	5.3
1972	A200/201	1.4	0.6	105	1.7	0.5	0.3	4.5	2.0
1973	A212/213	0.9	0.3	96	0.4	1.0	1.0	19.2	0.9
1974	A225/226	0.7	0.3	102	0.2	1.0	1.4	0.0	0.5
1975	A236/237	0.9	0.4	104	0.8	0.7	1.3	2.2	0.7
1976	A250/251	0.4	0.2	103	0.1	0.5	0.9	0.0	0.1
1977	A265/266	0.5	0.3	106	0.0	0.8	1.5	1.6	0.1
1978	A279/280	0.3	0.3	103	0.5	0.1	0.1	0.0	0.5
1979	A292/293	0.6	0.5	106	0.0	1.0	1.5	0.0	0.2
1980	A306/307	0.5	0.5	105	0.0	0.8	1.6	0.0	0.0
1981	A321/322	1.5	1.4	104	0.0	2.3	4.6	0.0	0.0
1982	H080/081	1.5	0.9	108	0.5	1.9	0.8	0.0	2.5
1983	N012/013	2.4	0.8	106	2.6	2.2	3.1	0.1	2.1
1984	N031/032	7.0	3.5	102	3.3	10.5	4.6	4.0	8.5
1985	N048/049	3.4	1.8	111	6.6	0.3	0.4	0.0	5.0
1986	N065/066	23.2	14.9	118	30.8	16.0	24.9	0.5	23.4
1987	N85/86/87	10.4	5.6	135	17.0	4.0	6.3	117.4	12.9
1988	N105/106	2.1	0.6	127	2.7	1.5	2.3	0.3	2.0
1989	N123/124	8.4	1.8	124	11.8	4.5	4.9	3.6	9.8
1990	N139/140	5.6	1.9	156	7.4	3.4	3.4	0.3	6.5
1991	N154/H231	10.6	5.8	137	13.0	5.0	4.9	10.2	14.3
1992	N173/174	16.5	4.9	136	16.2	40.8	41.8	0.2	23.6
1993	N189/190	18.7	4.5	137	6.3	30.4	27.6	1.0	15.0
1994	N221/222	76.4	30.2	140	108.4	45.9	51.1	25.7	91.1
1995	N226/227	63.5	24.2	140	100.5	28.4	11.4	7.9	92.7
1996	N246/247	40.2	14.2	135	53.2	27.1	32.1	0.2	46.5
1997	N726/734	31.8	15.3	137	34.6	51.3	72.8	0.2	29.3
1998	N827/832	99.52	20.65	131	147.6	54.76	45.6	0.8	130.3
1999	N925/929	229.8	83.8	133	264.2	199.4	251.4	24.9	226.2
2000	NED2000-426/431	90.6	20.0	146	146.3	38.7	29.5	2.0	124.7
2001	NED2001-032/037	145.9	47.7	139	152.7	139.5	181.3	53.9	132.4
2002	NED2002-037/040	161.9	48.6	147	172.7	151.9	170.9	4.9	162.6
2003	NED2003-036/042	130.6	70.5	153	207.8	58.7	50.3	4.9	175.8
2004t	TEL2004-529/530	295.9	100.2	128	307.6	285.0	198.0	1.4	355.6
2005t	TEL2005-605/633	74.1	13.7	118	13.7	130.5	51.8	7.4	88.0
2005n	NED2005-027/034	63.1	20.9	150	36.0	88.2	61.0	13.6	66.2
2006	NED2006-030/036	85.7	29.7	150	133.3	40.7	26.7	15.2	118.6
2007	TEL2007-745	40.7	9.8	121	20.0	59.9	85.8	0.9	19.0
2008	TEM2008-830	43.7	12.9	118	46.8	40.9	50.8	2.0	40.2
2009	NED2009-027	53.3	11.9	136	44.6	61.4	85.4	6.1	38.6
2010	NED2010-027	211.5	115.4	137	163.4	256.4	50.8	38.4	300.5
Overall Mean		49.1	17.7	123	54.3	45.1	39.2	9.3	56.7
Minimum		0.3	0.2	86	0.0	0.1	0.1	0.0	0.0
Maximum		295.9	115.4	156	307.6	285.0	251.4	117.4	355.6

Table 28. Coastal Nova Scotia spawning component summary of a) herring landings (t) from gillnet fisheries 1996-2010, b) spawning biomass from acoustic surveys in the Coastal Nova Scotia spawning component from 1998-2010, and c) estimated exploitation as calculated as catch/SSB.

a - Landings by spawning area for coastal Nova Scotia with 5 year and overall averages

Landings (t)	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	Average Catch Last 5 yr.	Average Catch All Years
Little Hope/Port Mouton	1,170	2,919	2,043	2,904	3,982	4,526	1,267	2,239	3,133	1,506	1,108	3,731	3,106	2,517	2,437
Halifax/Eastern Shore	1,100	1,628	1,350	1,898	3,334	2,727	4,176	3,446	3,348	3,727	2,381	6,045	2,456	3,591	2,694
Glace Bay	1,730	1,040	834	1,204	3,058	1,905	1,481	626	85	7	12	4	11	24	869
Bras d'Or Lakes	120	31	56	0	1	4	0	0	0	0	0	0	0	0	36
<b>Total</b>	<b>4,120</b>	<b>5,618</b>	<b>4,283</b>	<b>6,006</b>	<b>10,375</b>	<b>9,162</b>	<b>6,924</b>	<b>6,311</b>	<b>6,566</b>	<b>5,240</b>	<b>3,500</b>	<b>9,780</b>	<b>5,573</b>	<b>6,132</b>	<b>5,816</b>

b - Acoustic SSB for coastal Nova Scotia with 5 year and overall averages (with CIF since 2003; w/o CIF pre-2003)

Survey SSB (t)	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	10% SSB Average Last 5 yr	10% SSB Average All years
Little Hope/Port Mouton	14,100	15,800	5,200	21,300	56,000	<b>53,100</b>	22,500	44,700	24,100	2,800	14,500	36,600	26,700	2,094	2,595
Halifax/Eastern Shore	8,300	20,200	<b>10,900</b>	16,700	<b>41,500</b>	92,600	28,400	36,950	68,900	28,300	30,300	54,200	27,700	4,188	3,577
Glace Bay		2,000		21,200	7,700	31,500		3,180	n/s	240	500	100	8	21	738
Bras d'Or Lakes		530	70	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	30

Note 1: shaded cells include mapping surveys which estimated biomass based on visual sounder estimates; bold cells include mapping and acoustic surveys.

Note 2: data for 1998-2002 calculated without the Calibration Integration Factor (CIF).

c - Exploitation estimates for coastal Nova Scotia spawning components with 5 year and overall averages (with CIF since 2003; w/o CIF pre-2003)

Survey SSB (t) with CIF	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	10% SSB Average Last 5 yr	10% SSB Average All years
Little Hope/Port Mouton	8%	18%	39%	14%	7%	<b>9%</b>	6%	5%	13%	54%	8%	10%	12%	19%	16%
Halifax/Eastern Shore	13%	8%	12%	11%	8%	3%	15%	9%	5%	13%	8%	11%	9%	9%	10%
Glace Bay		52%		6%	40%	6%		20%		3%	2%	4%	138%	37%	30%
Bras d'Or Lakes															

Table 29. Herring catch at age for the 2010 Coastal Nova Scotia gillnet fisheries with numbers caught (thousands), weight (t) and percent, average length and average weight by age.

Coastal NS 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 (x1,000)	-	-	32	741	5,788	1,583	1,250	1,755	2,039	1,128	716	15,033
% numbers			0%	5%	39%	11%	8%	12%	14%	8%	5%	100%
Catch wt. (t)	-	-	5	118	1,027	308	258	405	506	291	173	3,091
% catch wt.			0%	4%	33%	10%	8%	13%	16%	9%	6%	100%
Avg. len (cm)	-	-	27.3	28.0	28.9	29.7	30.2	31.3	31.9	32.4	32.5	30.2 Avg. Len
Avg. wt. (g)	-	-	147.3	159.4	177.4	194.6	206.6	230.9	248.0	258.1	262.5	206.6 Avg. wt

Table 30. Monthly landings (t) from weirs located in New Brunswick for 1978-2010.

YEAR	MONTH												Year Total
	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
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	7	2,105	7,533	4,940	1,713	69		16,376
2001					35	478	3,931	8,627	5,514	1,479			20,064
2002					84	20	1,099	6,446	2,878	1,260	20		11,807
2003					257	250	1,423	3,554	3,166	344	10		9,003
2004					21	336	2,694	8,354	8,298	913	3		20,620
2005						213	802	7,145	3,729	740	11		12,639
2006					8	43	1,112	3,731	3,832	2,328	125	462	11,641
2007	182		20	30	84	633	3,241	11,363	7,637	6,567	314	73	30,145
2008						81	1,502	2,479	1,507	389	49	32	6,041
2009					5	239	699	1,111	1,219	330			3,603
2010				6	64	1,912	2,560	3,903	1,933	247	46		10,671
NB Average Catch (t)	160	34	9	38	134	331	3,673	8,390	5,657	3,087	682	119	21,829
NB Minimum Catch (t)	3	12	1	6	5	3	230	1,111	1,219	48	3	10	3,603
NB Maximum Catch (t)	535	96	20	95	690	1,912	8,315	15,093	12,207	8,457	2,638	462	43,520

Table 31. Herring catch at age for the 2010 New Brunswick juvenile fisheries (weir and shutoff combined) with numbers caught (thousands), weight (t) and percent, average length and average weight by age.

	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)	7	371,401	16,968	523	463	29	22	29	16	6	1	389,464
% numbers	0%	95%	4%	0%	0%	0%	0%	0%	0%	0%	0%	100%
Catch wt. (t)	0	10,066	742	59	69	6	5	7	4	1	0	10,958
% catch wt.	0%	92%	7%	1%	1%	0%	0%	0%	0%	0%	0%	100%
Avg. len (cm)	16.5	16.2	18.5	25.0	27.2	29.3	30.1	30.8	30.9	31.0	31.5	16.3
Avg. wt. (g)	27.9	27.1	43.7	113.0	148.6	192.7	209.4	228.2	231.0	234.4	253.0	28.1

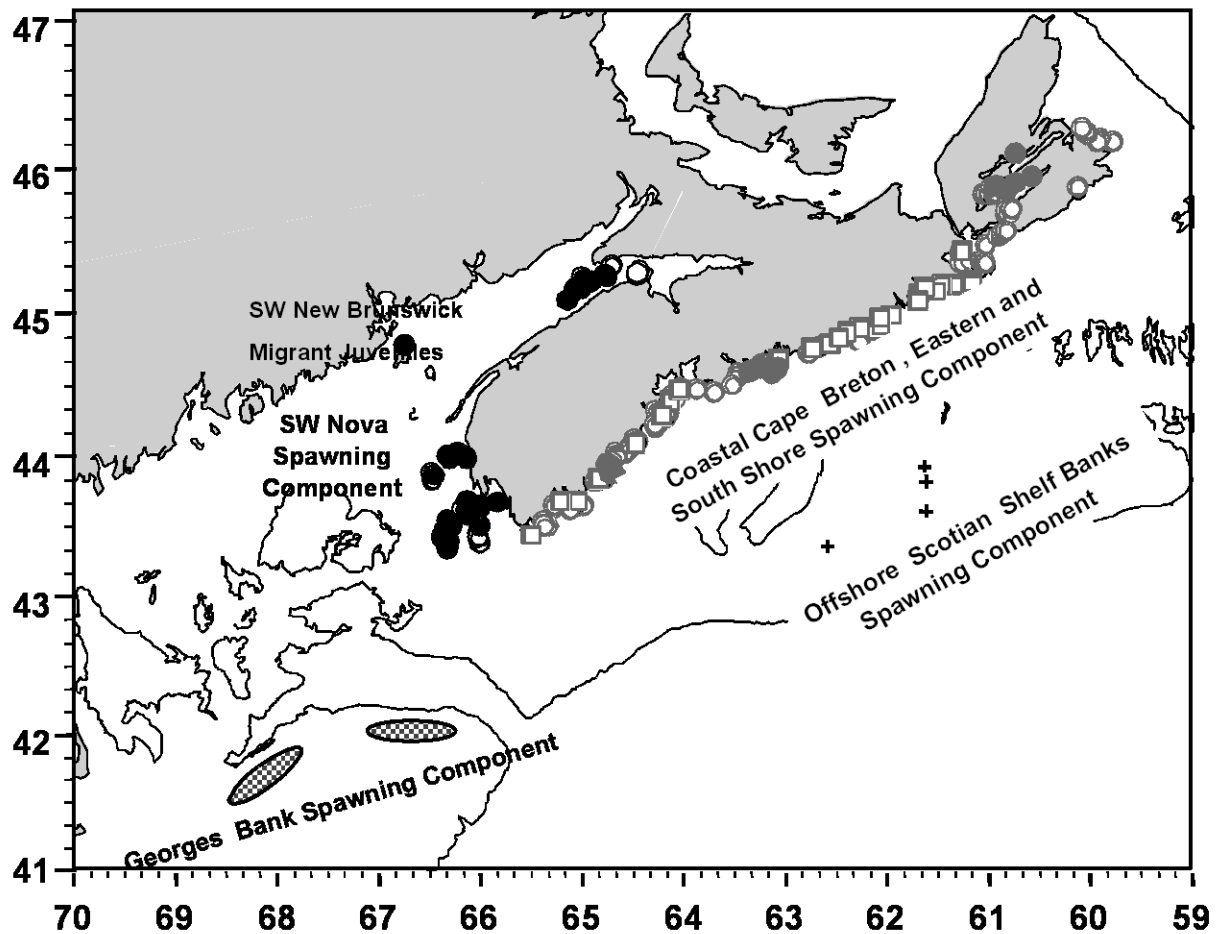


Figure 1. Management units for herring in NAFO Divisions 4VWX and 5YZ showing locations of known current (solid) and historical (open) spawning locations.

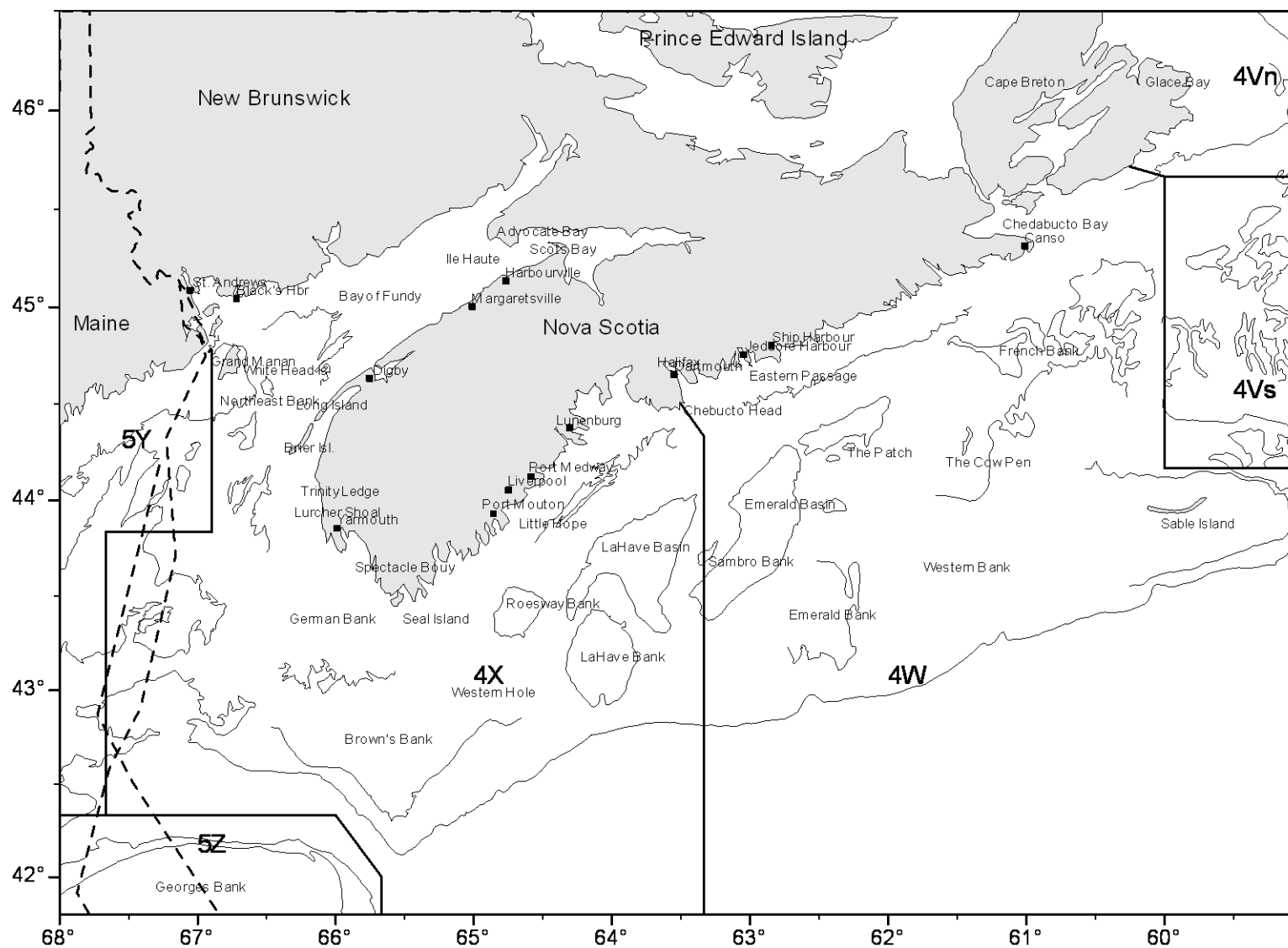


Figure 2. Place names and fishing locations for SWNB, Coastal Nova Scotia and Scotian Shelf.

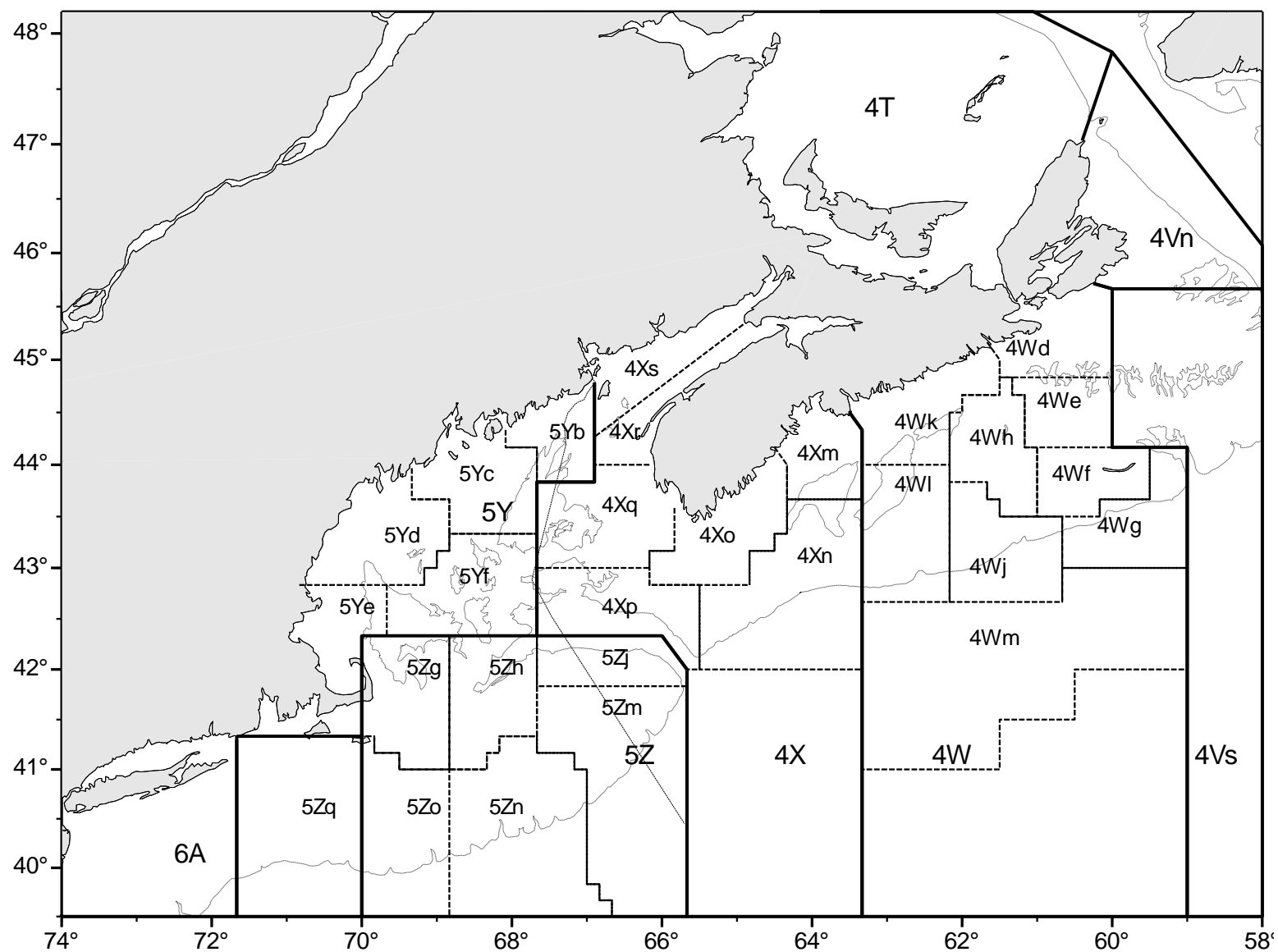


Figure 3. NAFO divisions, subareas and unit areas used for sample and catch data aggregation.

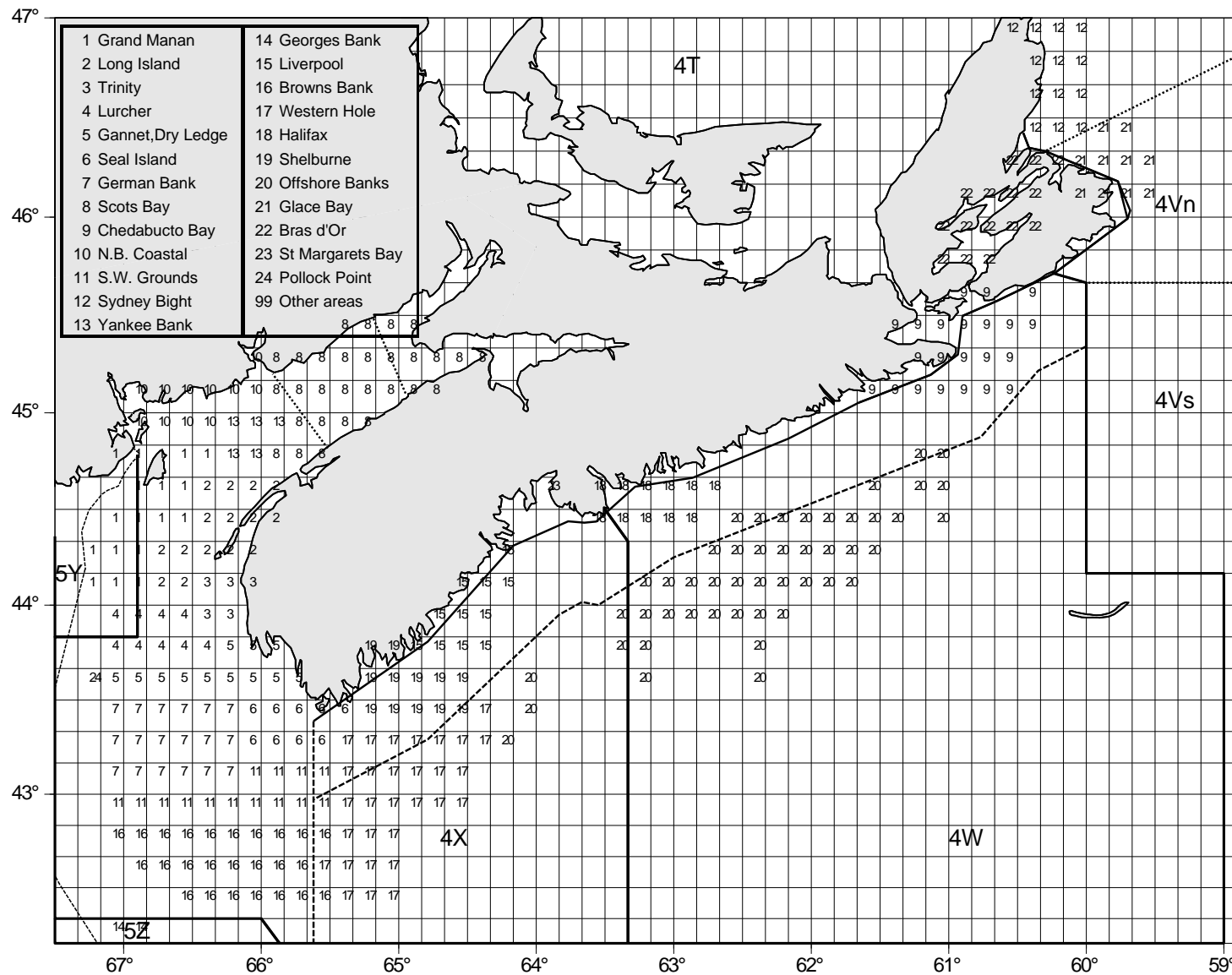


Figure 4. Herring fishing ground areas by 10 mile boxes and management lines for NAFO divisions, 25 mile offshore line, coastal embayment line and herring area lines.

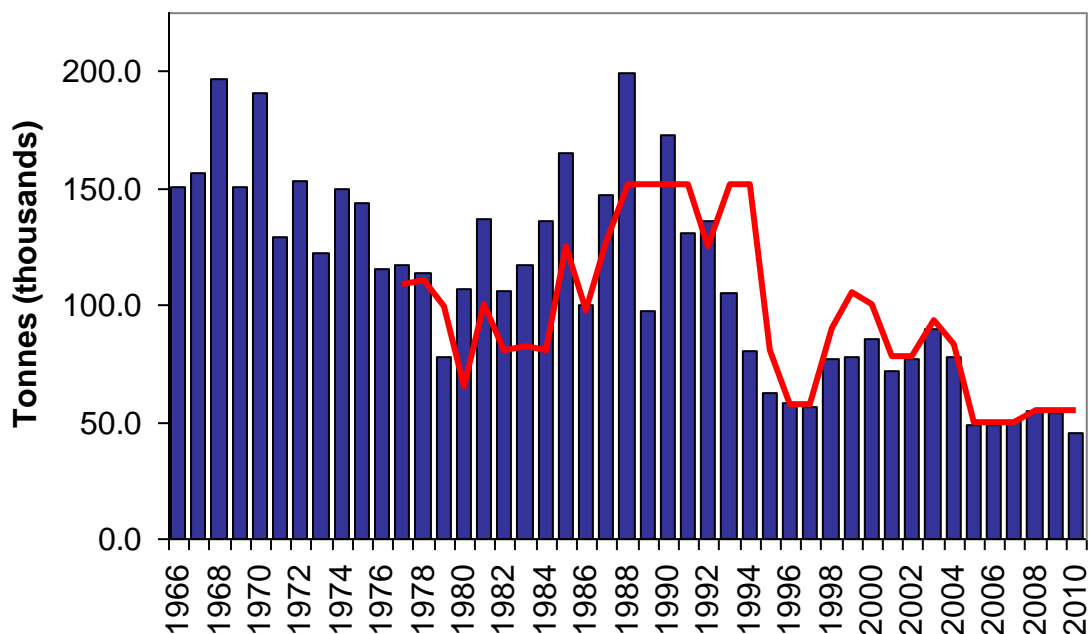


Figure 5. Annual adjusted herring landings [bars] and TAC [solid line] (quota) for the SWNS spawning component (4WX stock).

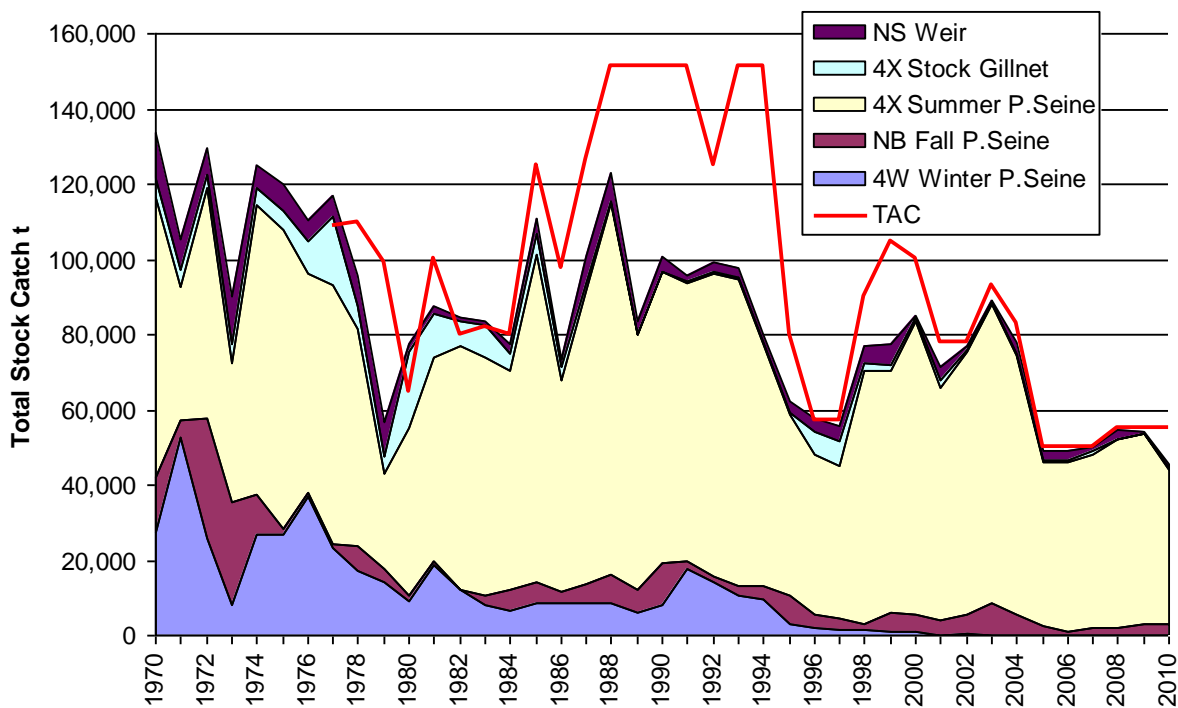


Figure 6. Annual herring landings by gear component for the SWNS spawning component (4WX stock).

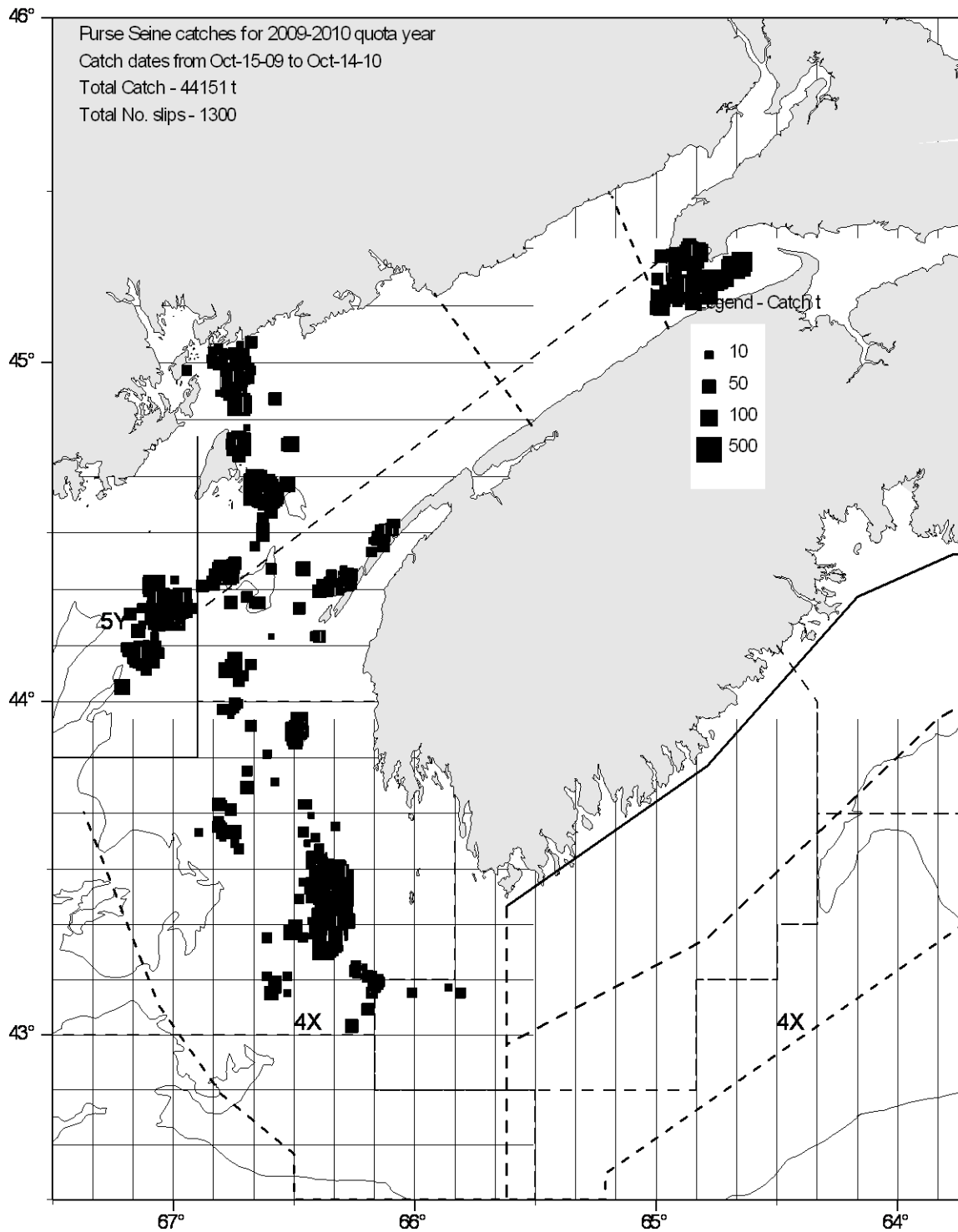


Figure 7. The 2009-2010 quota year herring purse seine catches (t) for NAFO Division 4X (from Statistics Division MARFIS database).

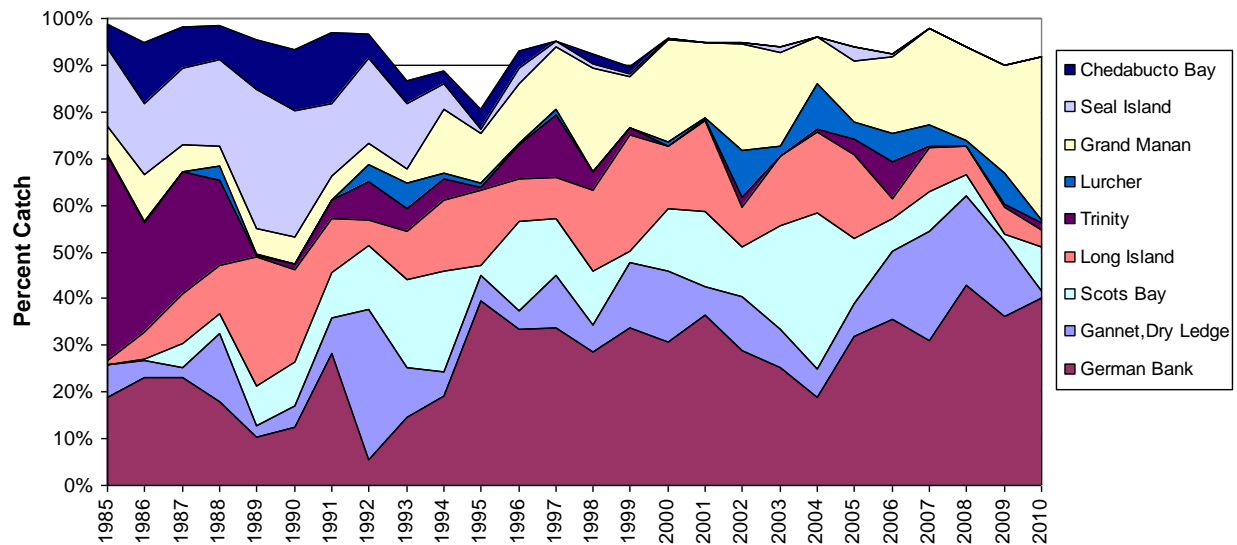


Figure 8. Herring purse seine catches as a proportion of overall landings for selected fishing grounds in the SWNS spawning component from 1985-2010.

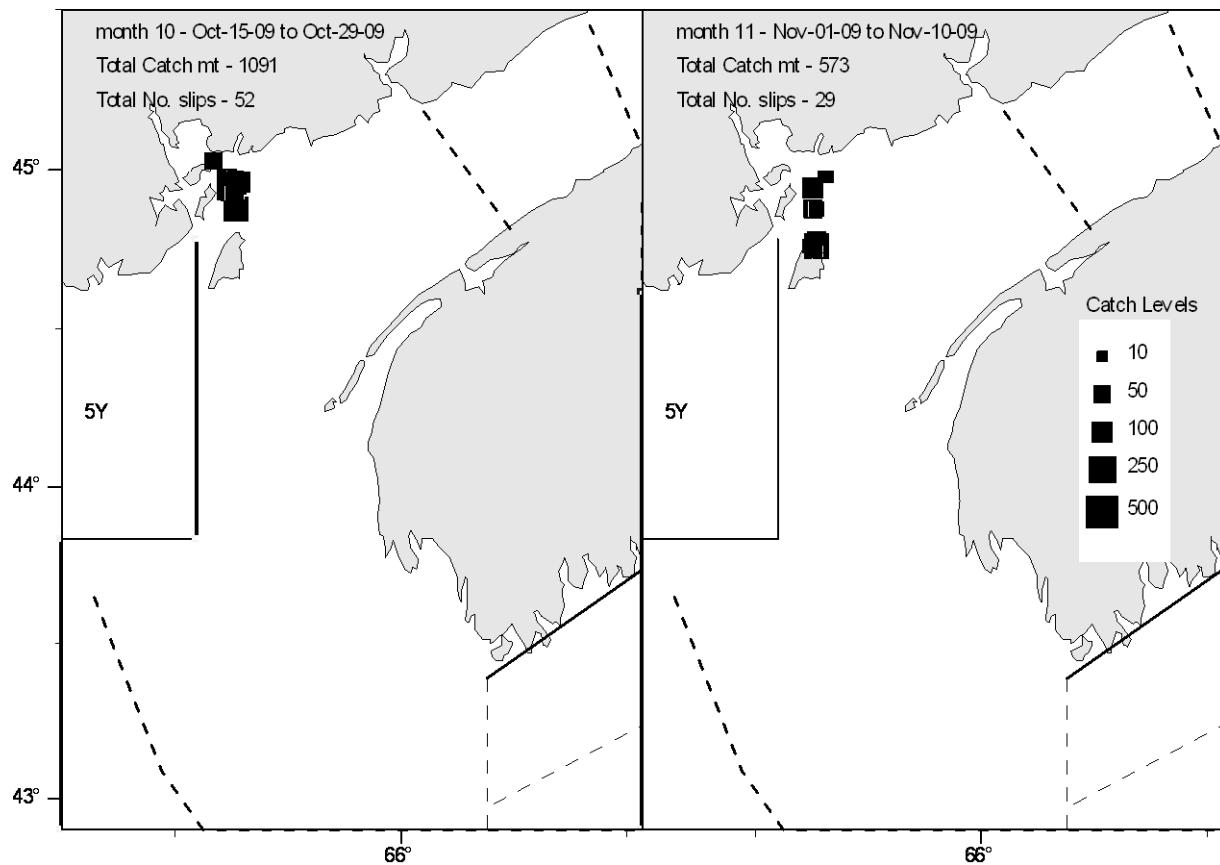


Figure 9. Fall 2009 herring purse seine catches by month in NAFO Division 4X (part of 2009-2010 quota year).

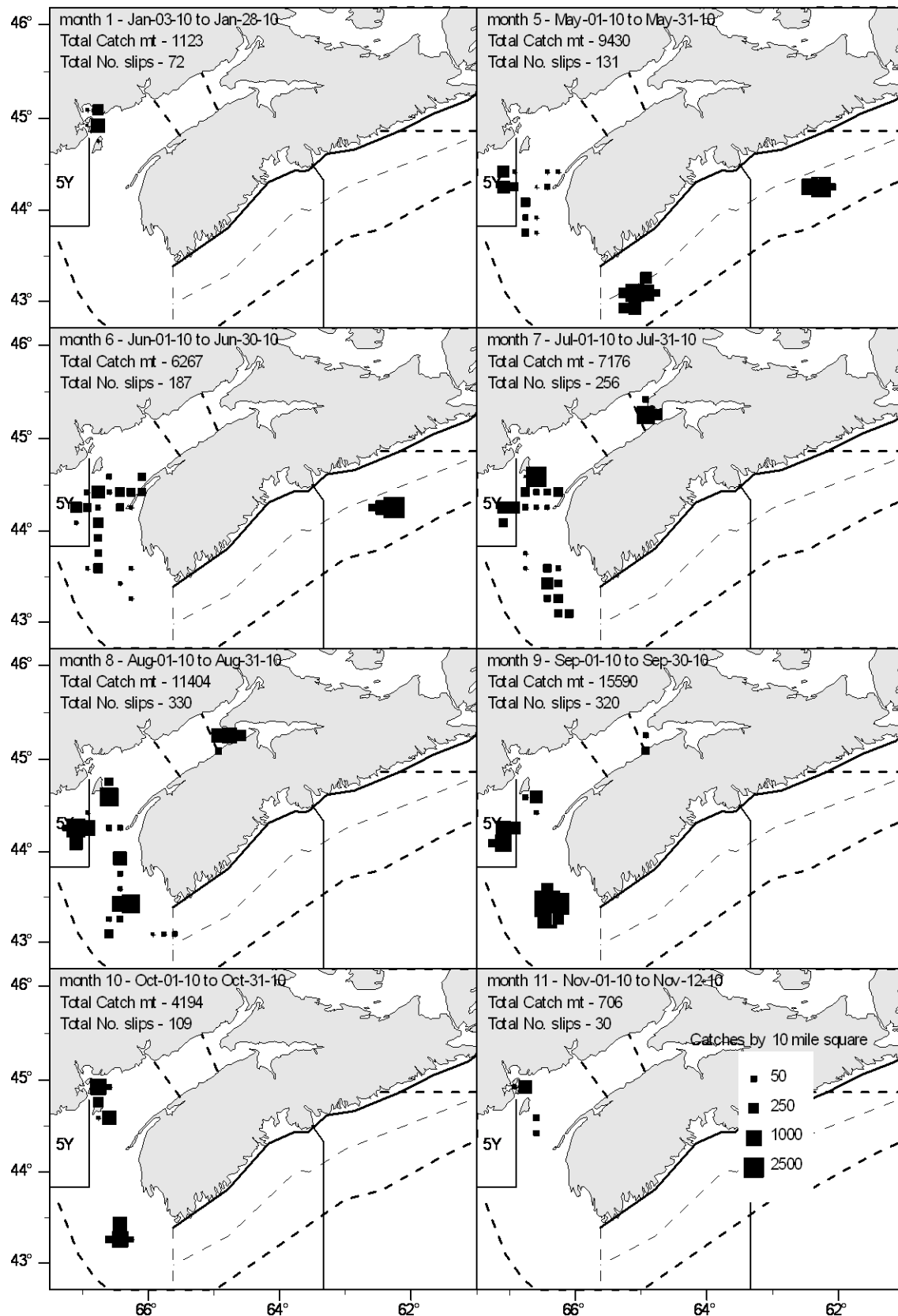


Figure 10. 2010 herring purse seine catches by month in NAFO Divisions 4WX for calendar year 2010 (from Statistics Division MARFIS database).

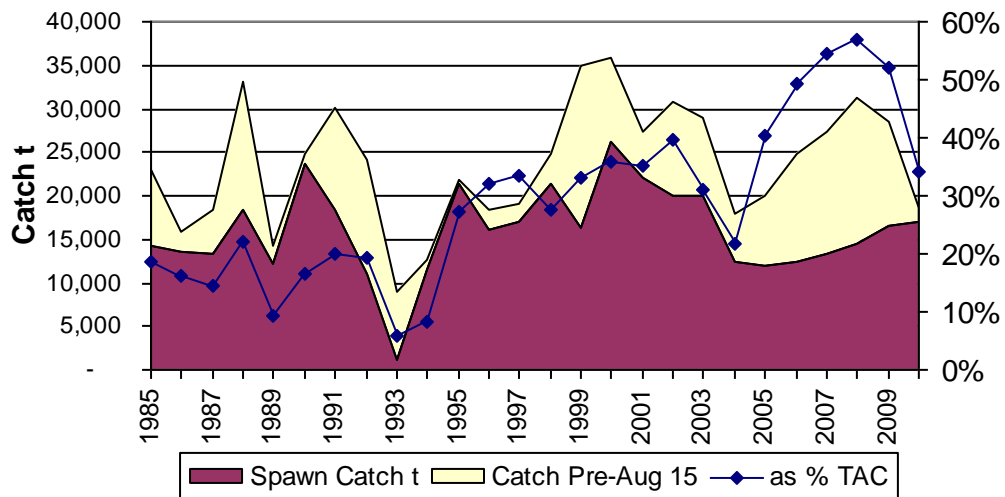


Figure 11. Annual herring purse seine catches for the German Bank area from 1985-2010 with pre-spawning and spawning period catches based on an August 15 start date for the defined spawning period and overall German Bank catches as a proportion of the TAC.

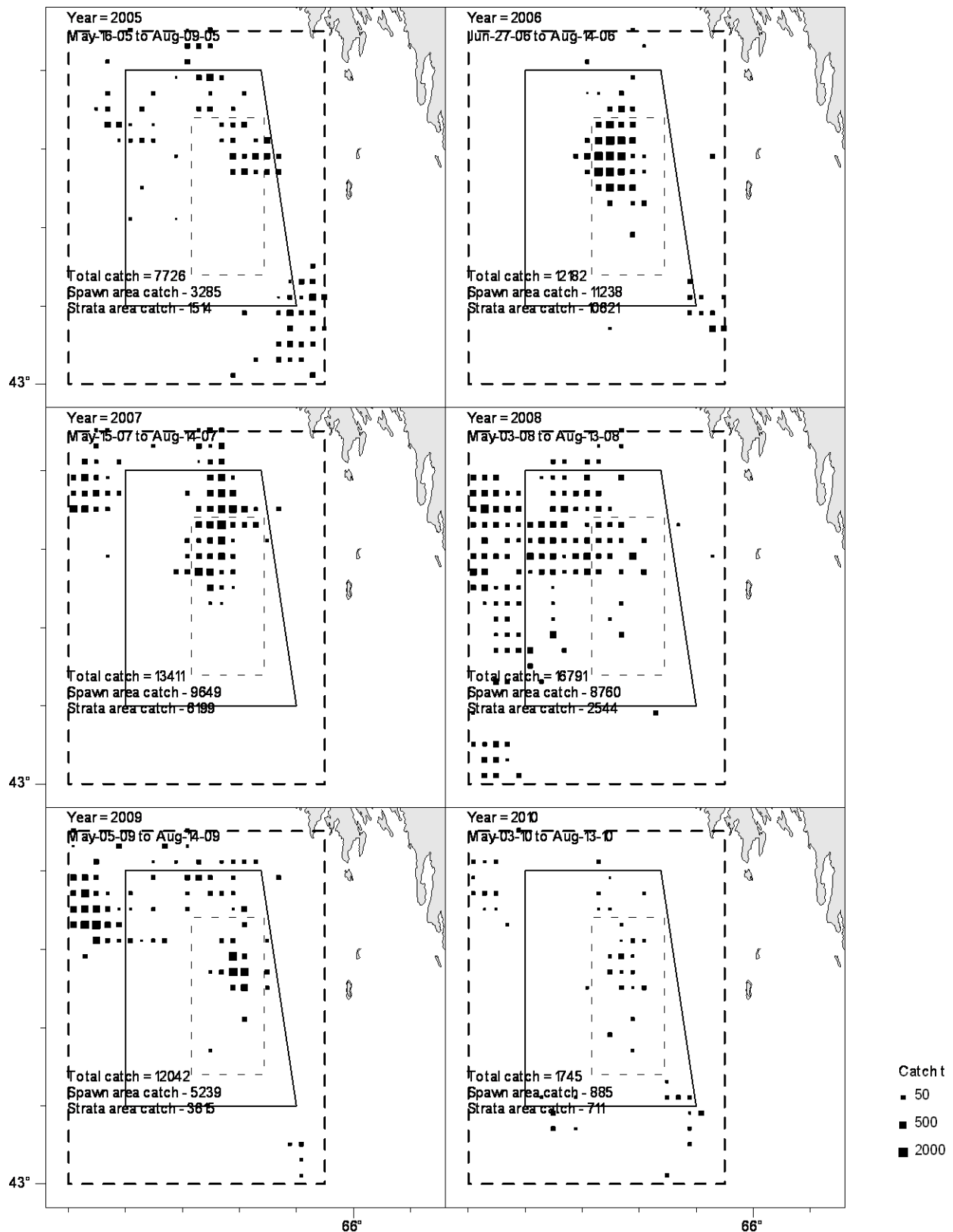


Figure 12. Herring purse seine pre-spawning period catches (January 1 to August 14) for German Bank from 2005-2010 with catch totals for the overall catch area, the middle 'Spawn Box' and the inner 'Strata Box', which was used as the primary search area in acoustic surveys.

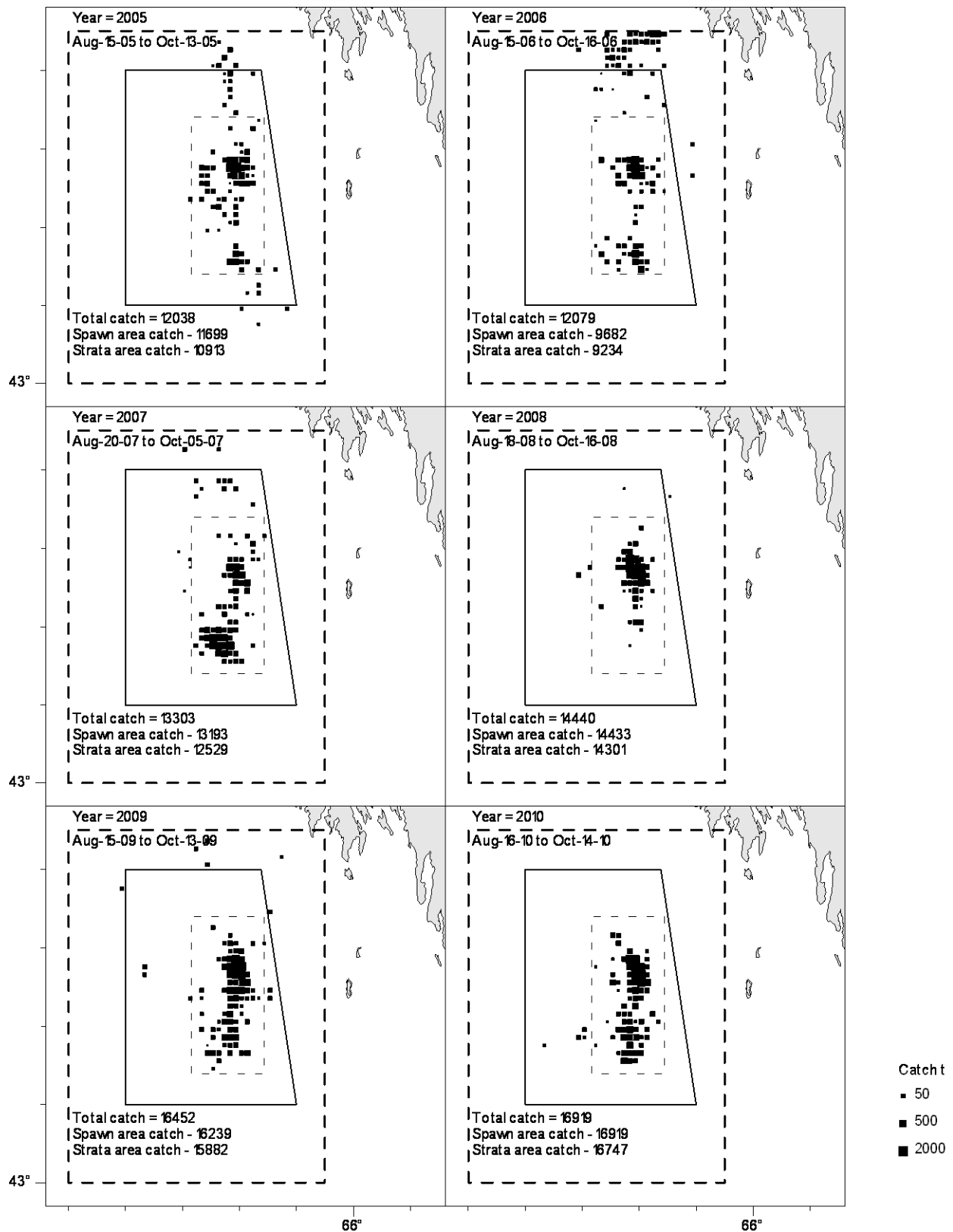


Figure 13. Herring purse seine spawning period catches (August 15 to October 31) for German Bank from 2005-2010 with catch totals for the overall catch area, the middle 'Spawn Box' and the inner 'Strata Box', which was used as the primary search area in acoustic surveys.

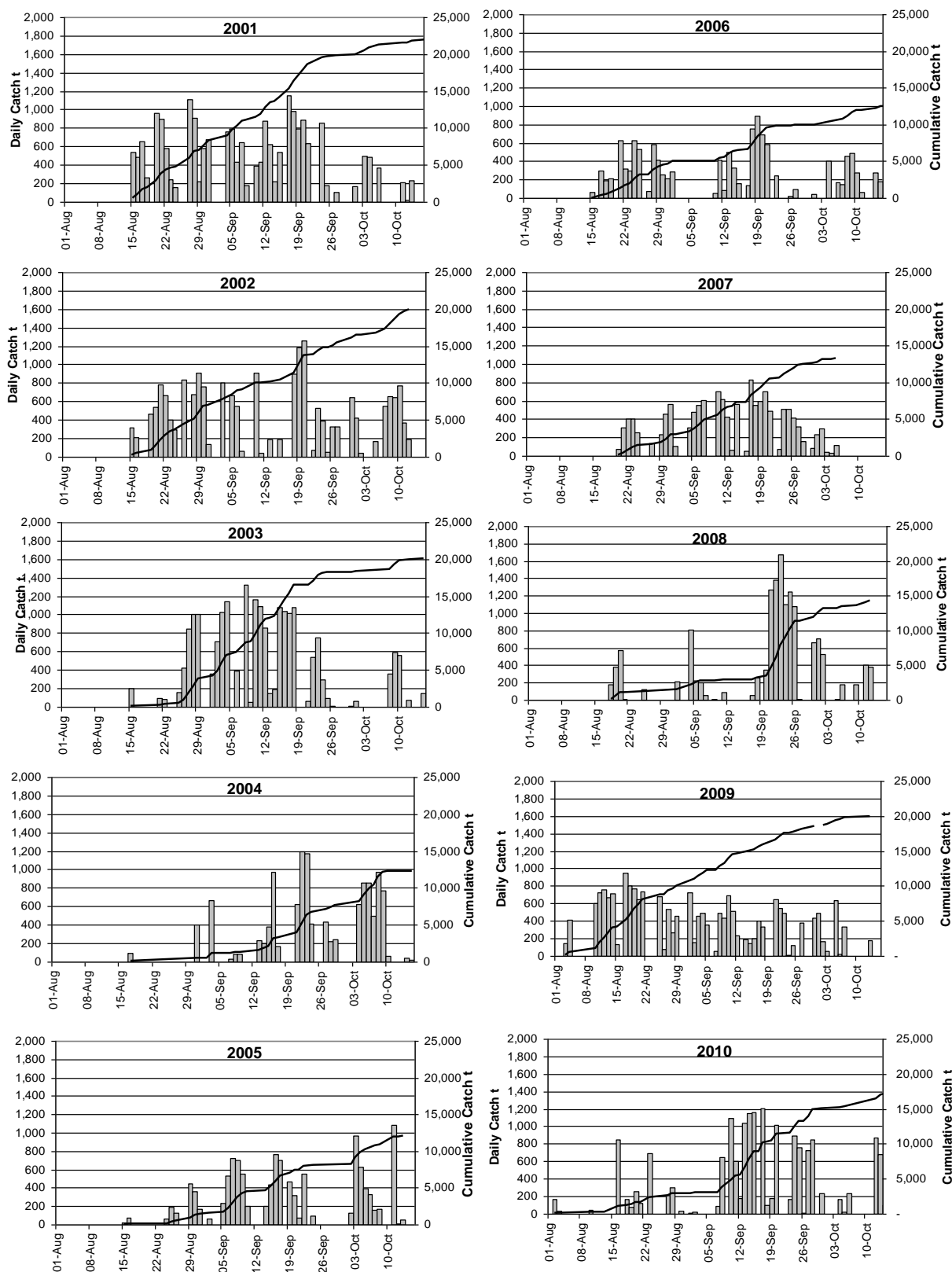


Figure 14. The 2000-2010 daily purse seine herring catches (t) [bars] for German Bank with the cumulative total catch [solid line] over the defined spawning season from August 15 to October 30 (note 2010 includes catch from August 1 to August 14).

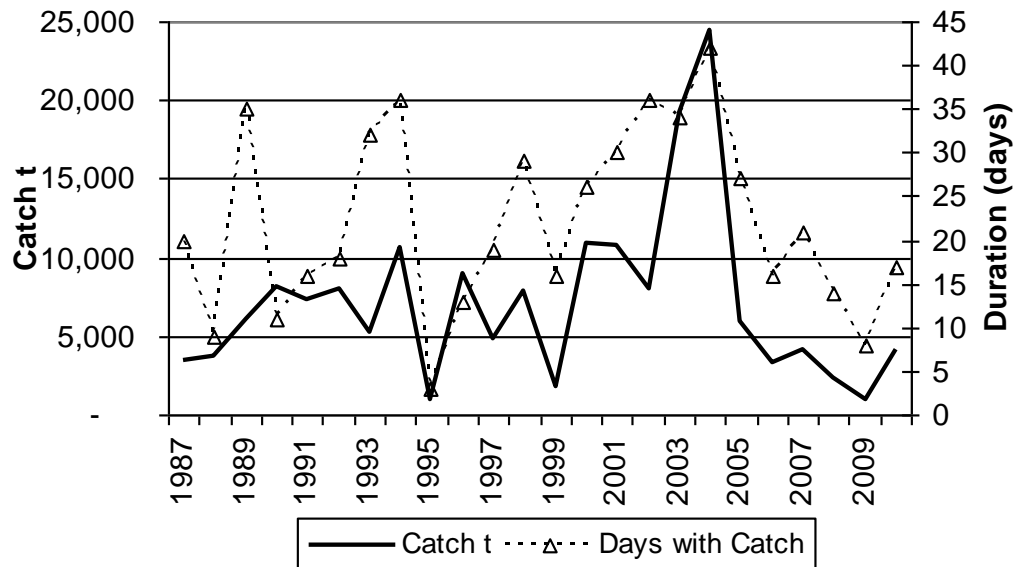


Figure 15. Annual herring purse seine catches for the Scots Bay area from 1987-2010 with duration of fishery in days (start date to end date).

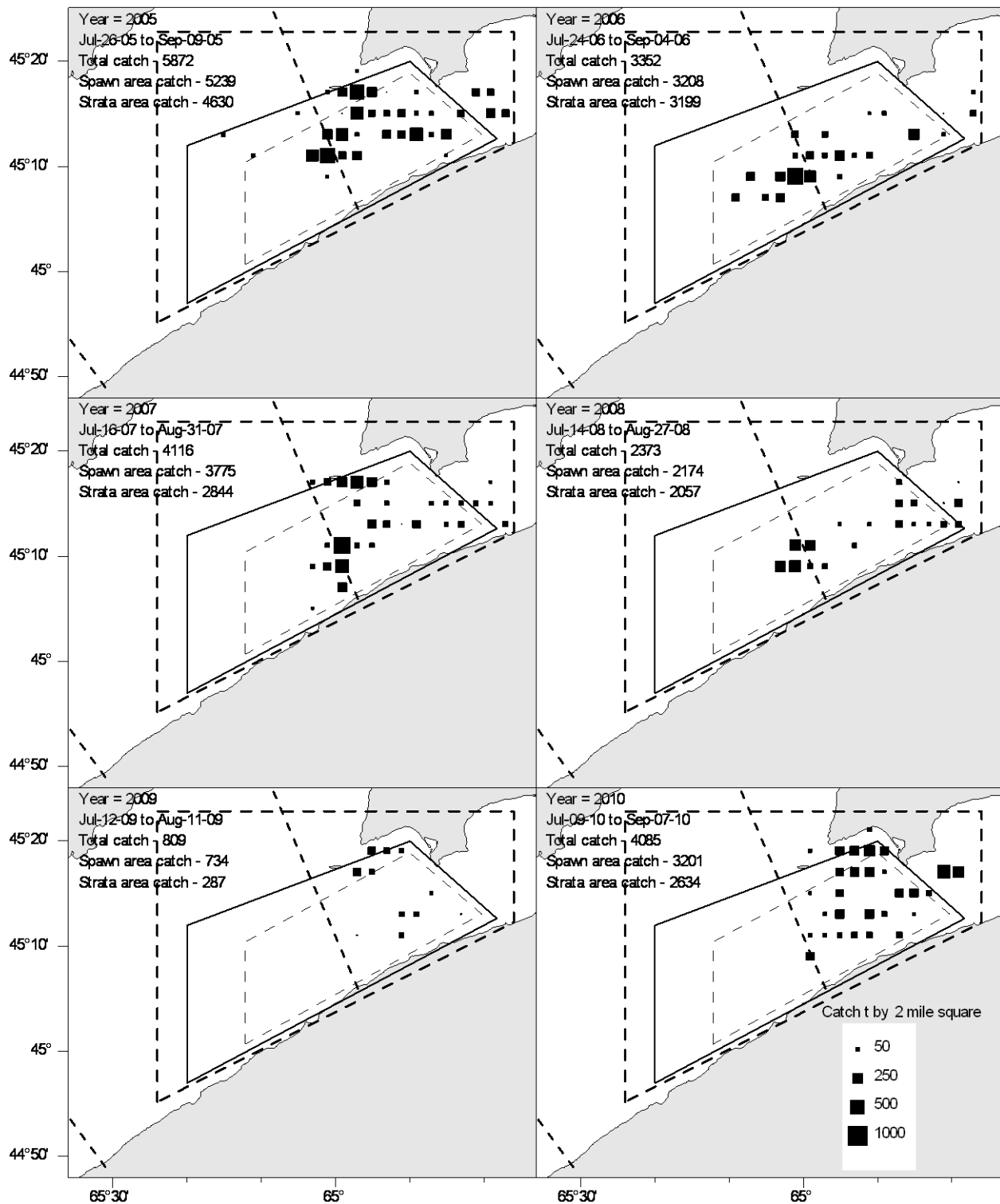


Figure 16. Herring purse seine catches for the Scots Bay area from 2005-2010 with catch totals for the overall area, the middle 'Spawning' area and the inner 'Strata' area, which is used as the primary search area in acoustic surveys.

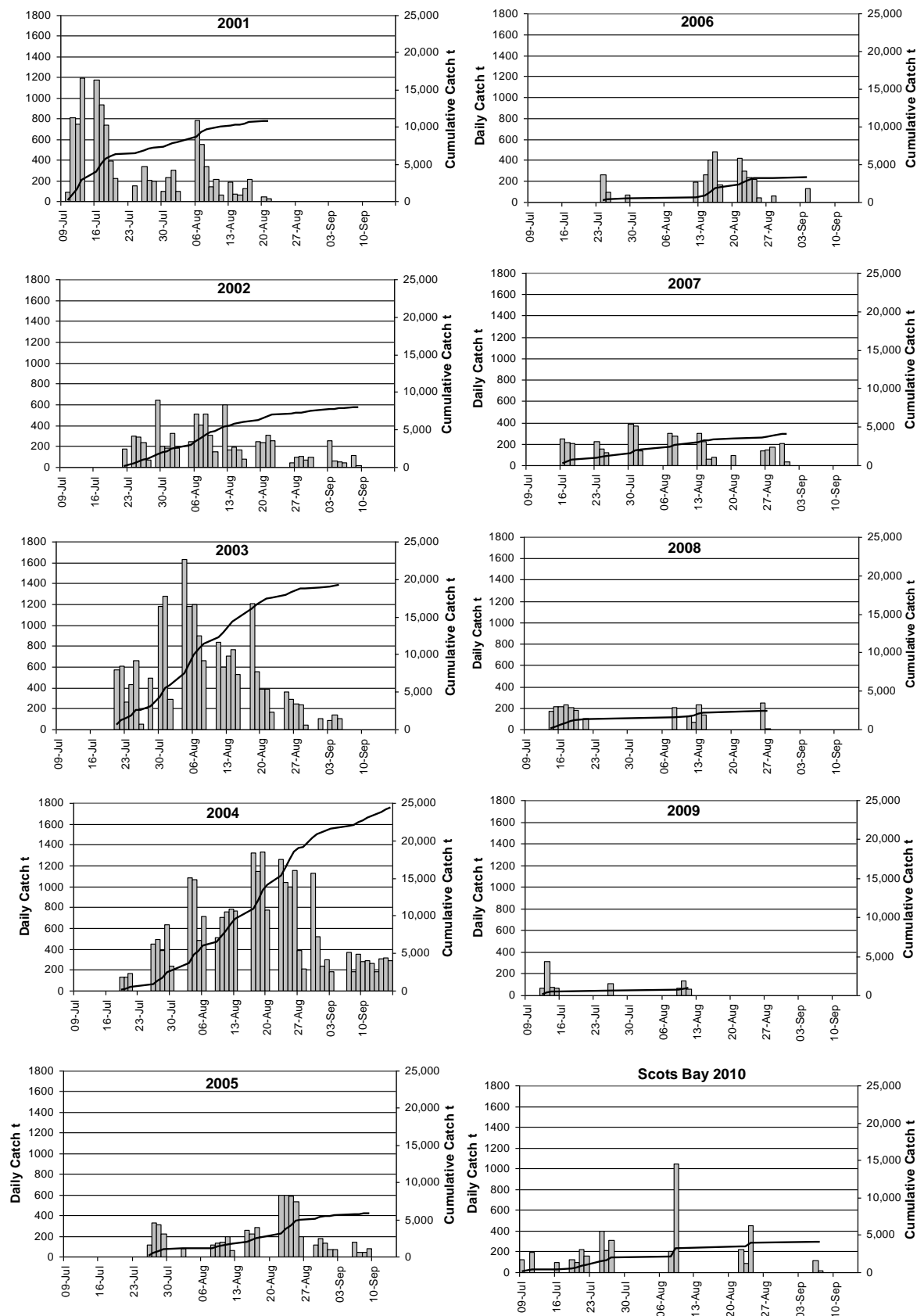


Figure 17. The 2000-2010 Scots Bay daily purse seine herring catches (t) [bars] for Scots Bay with the cumulative total catch [solid line] over the entire fishing season.

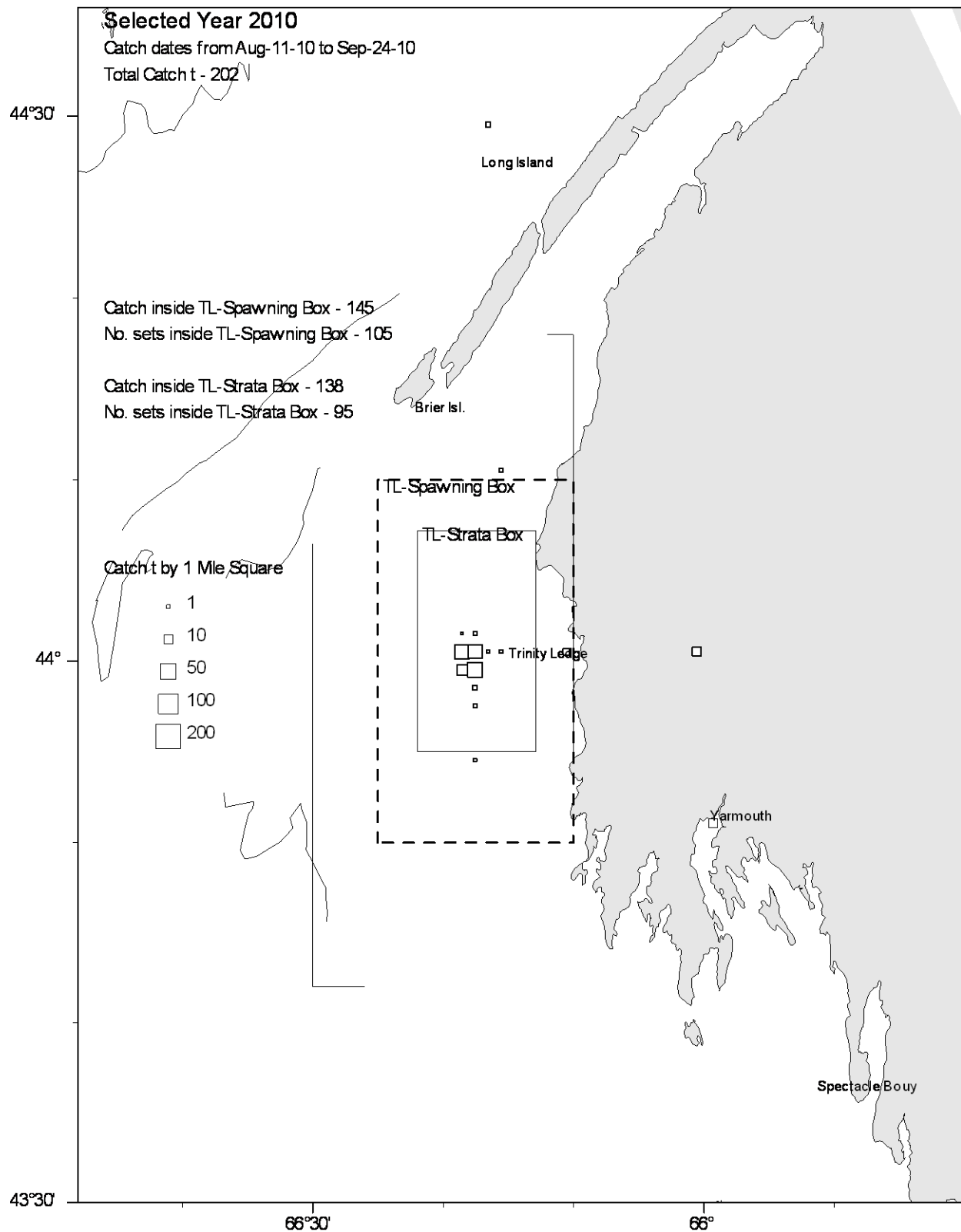


Figure 18. The 2010 Trinity Ledge herring gillnet catches in the survey strata box and spawning area box areas.

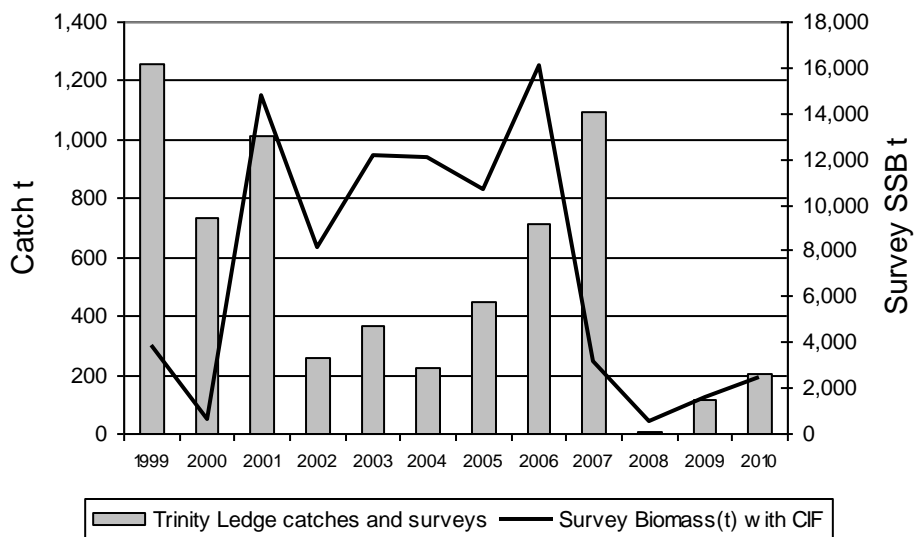


Figure 19. Trinity Ledge herring catches and acoustic survey biomass estimates from 1999-2010. All acoustic estimates prior to 2003 were calculated without the Calibration Integration Factor (CIF).

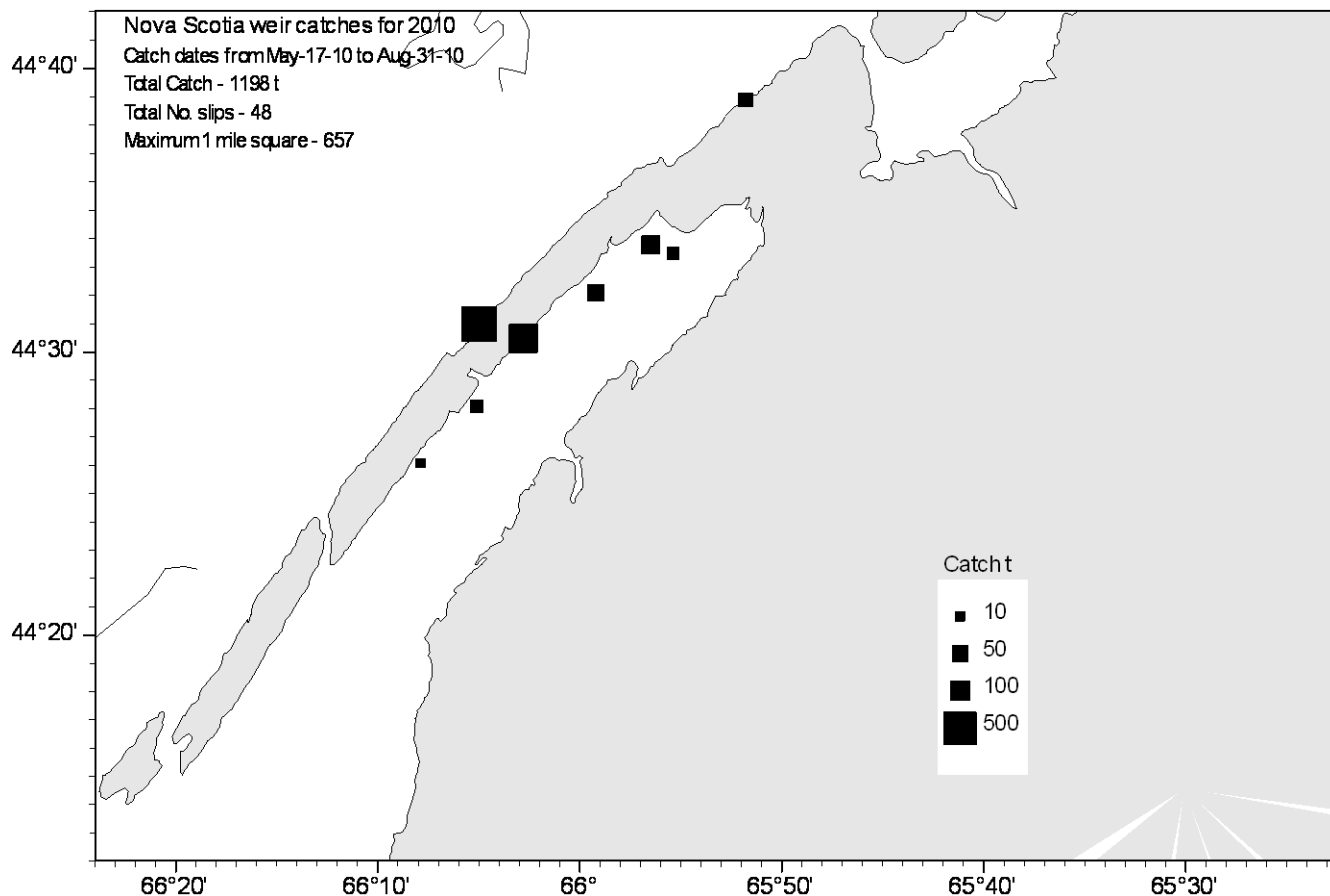


Figure 20. Nova Scotia herring weir catches by location for the 2010 calendar year.

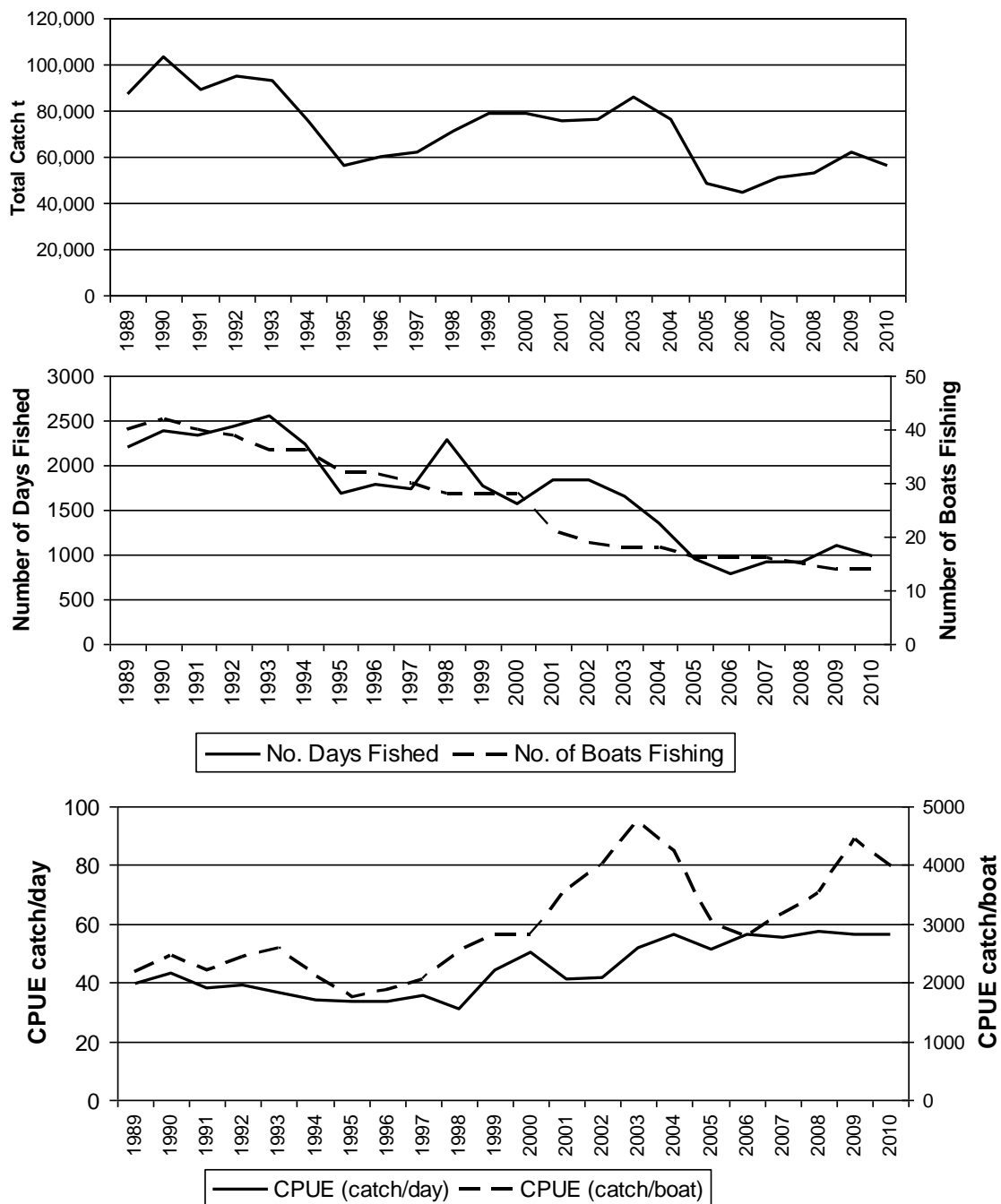


Figure 21. Purse seine catch (top panel), effort (middle panel) and catch per unit effort (CPUE; bottom) from 1989 to 2010 annual 4VWX herring landings data for the SWNS/BoF spawning component.

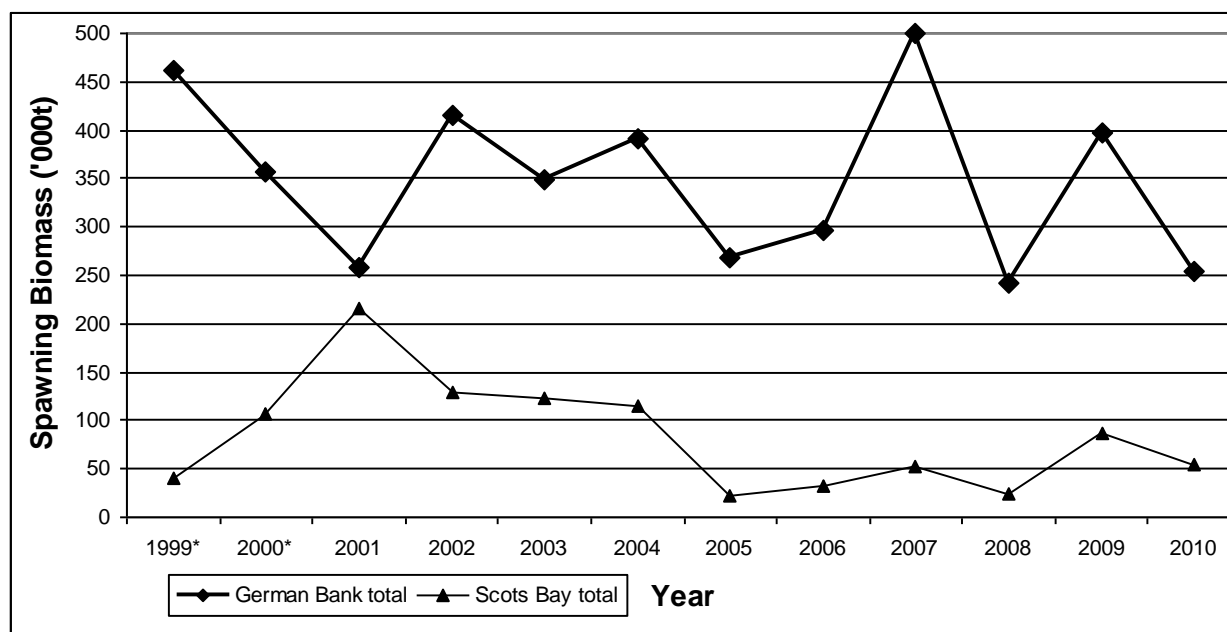


Figure 22. SSB index from acoustic surveys for the SWNS/BoF spawning component for the German Bank and Scots Bay areas with 95% confidence intervals (equivalent to two times standard error (SE)).

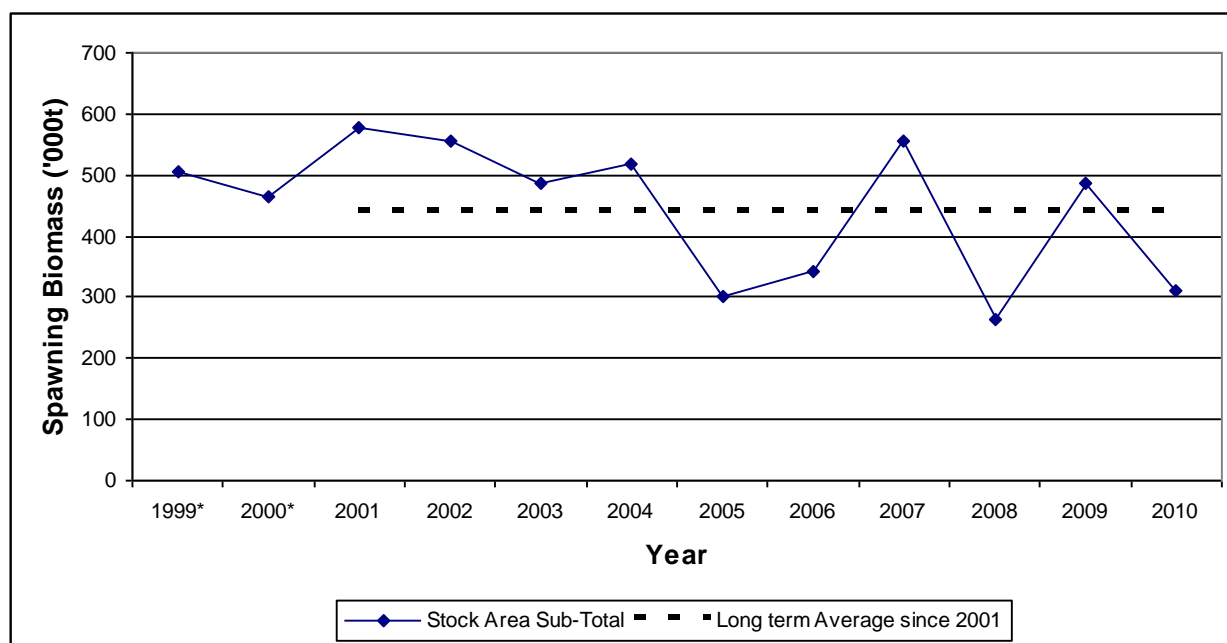


Figure 23. Herring spawning stock biomass from acoustic surveys for the combined SWNS/BoF spawning component with 95% confidence intervals (equivalent to two times SE).

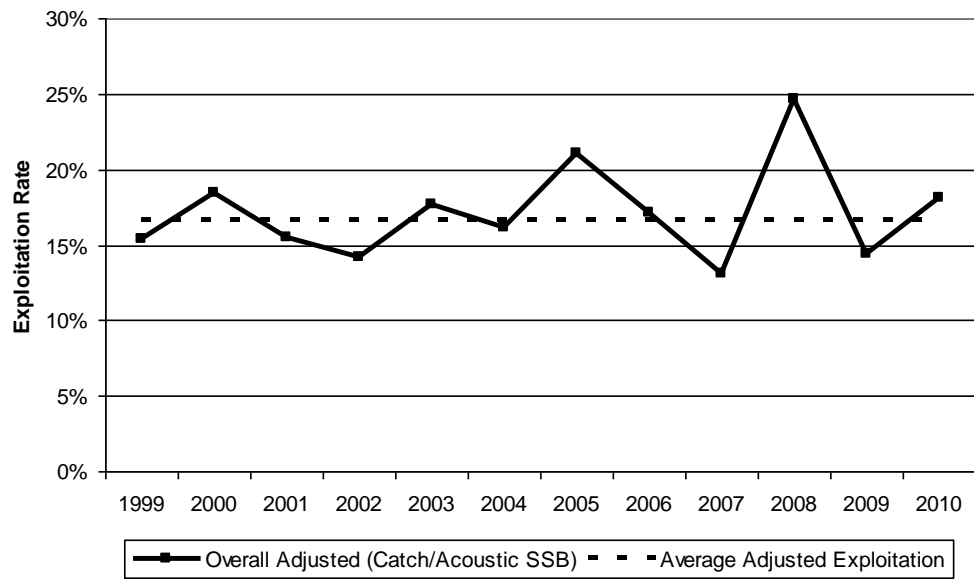


Figure 24. Relative exploitation rate for the SWNS/BoF spawning component using overall catch as a proportion of the overall acoustic SSB.

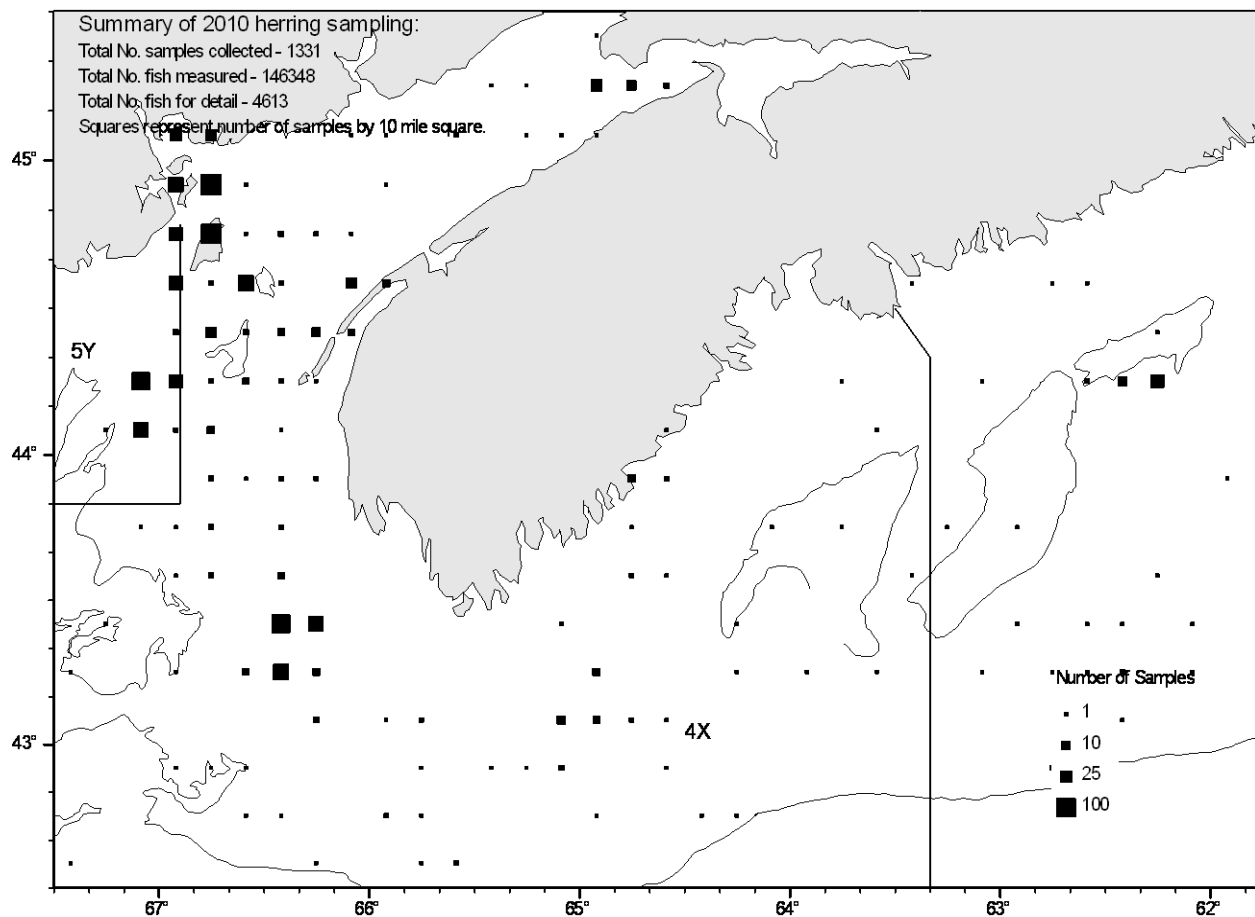


Figure 25. 2010 herring sampling coverage by location from all sources (numbers of length frequency samples grouped by 10 mile squares).

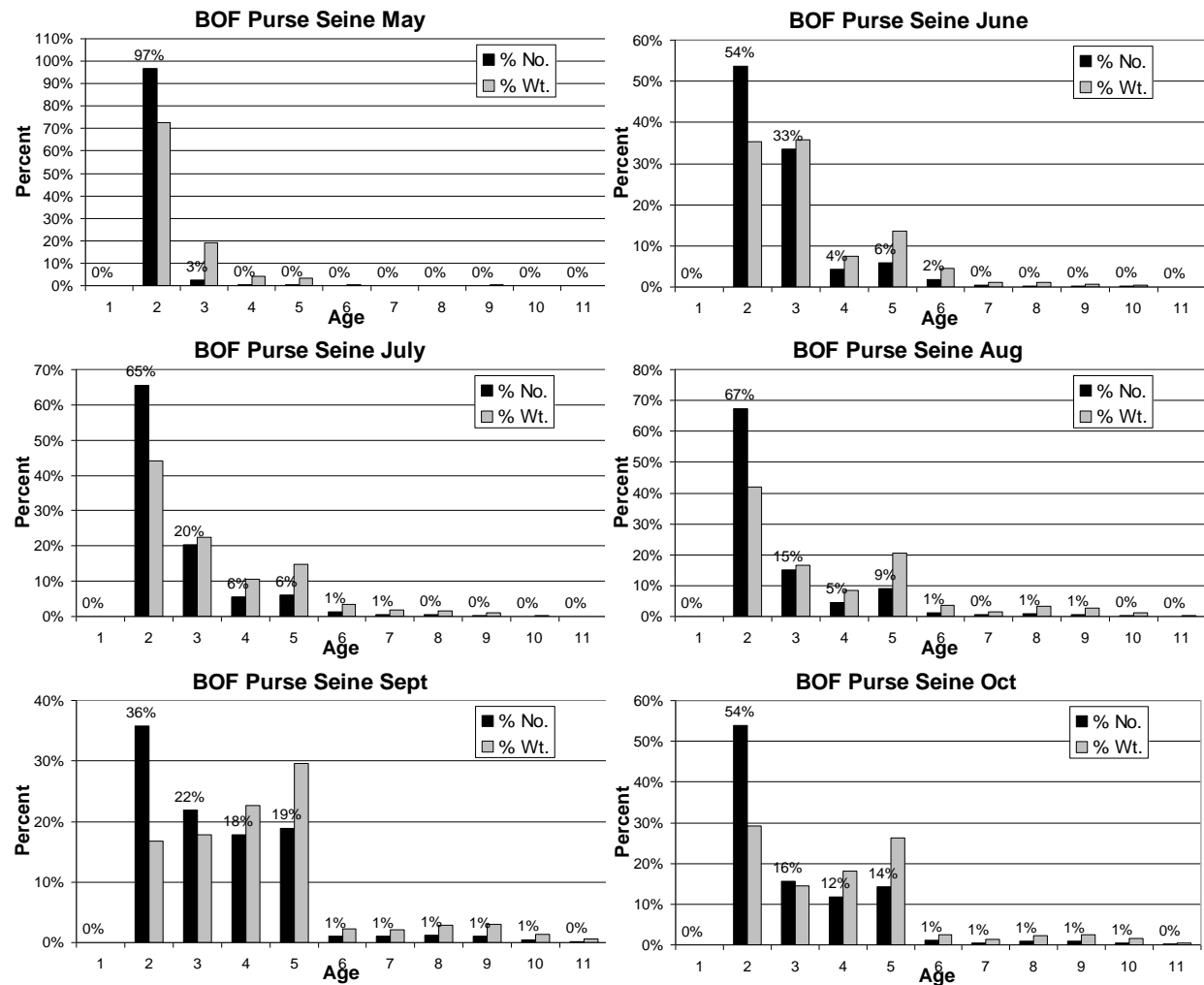


Figure 26. Fishery catch at age by month (% numbers and % weight) from the 2010 SWNS/BoF summer purse seine fishery.

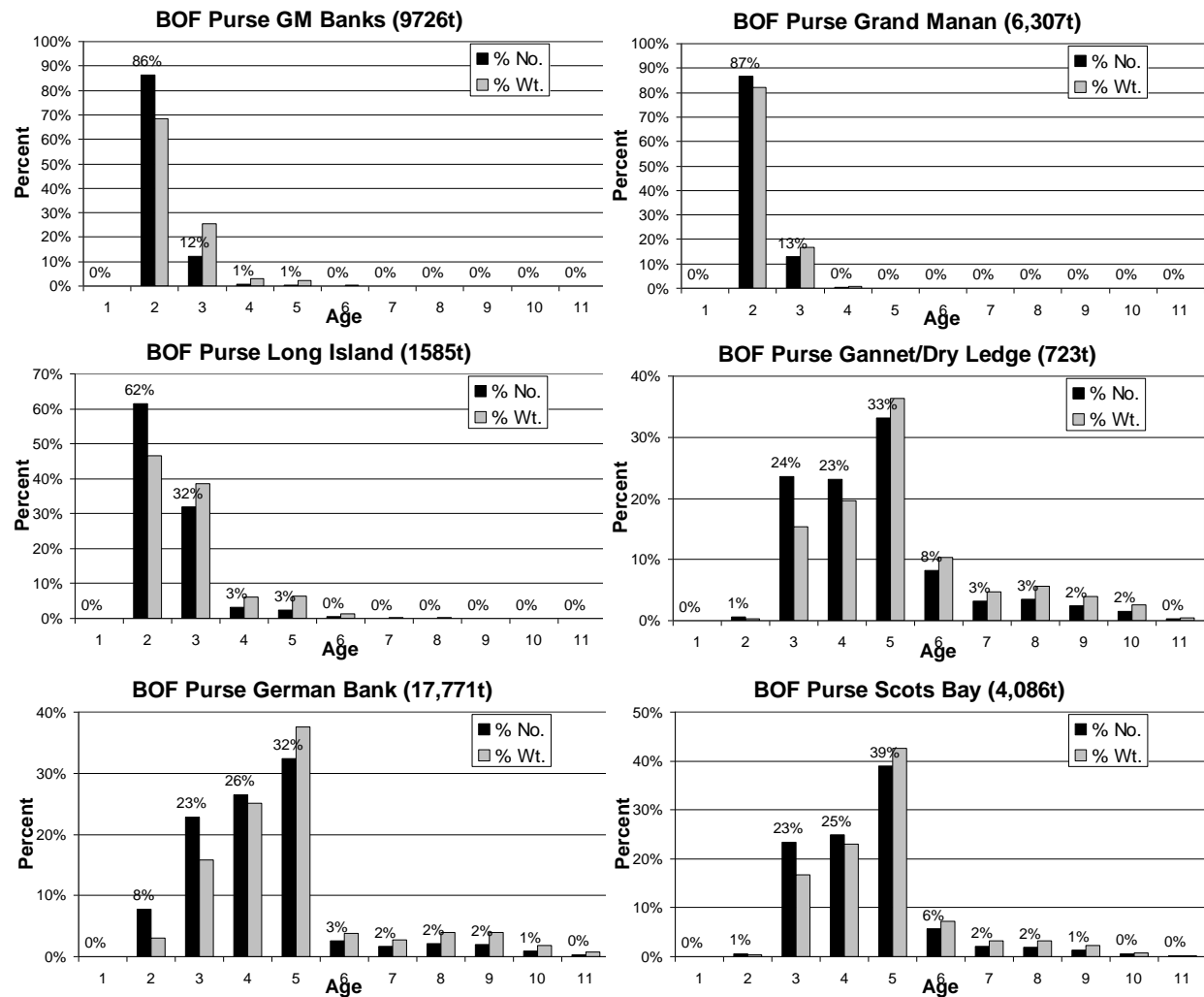


Figure 27. Fishery catch at age by ground (% numbers and % weight) from the 2010 SWNS/BoF summer purse seine fishery.

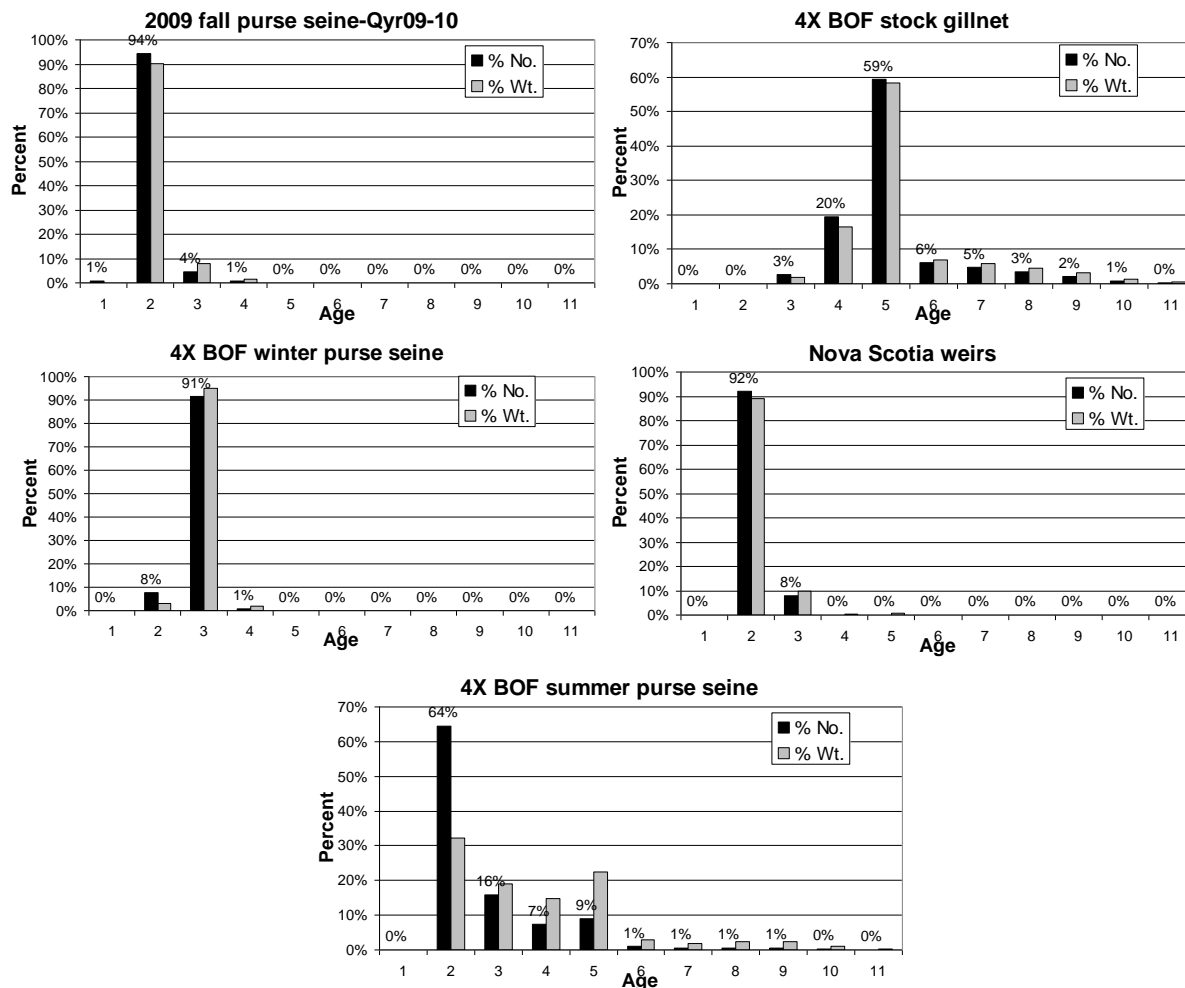


Figure 28. Fishery catch at age by gear component (% numbers and % weight) from the 2010 SWNS/BoF spawning component

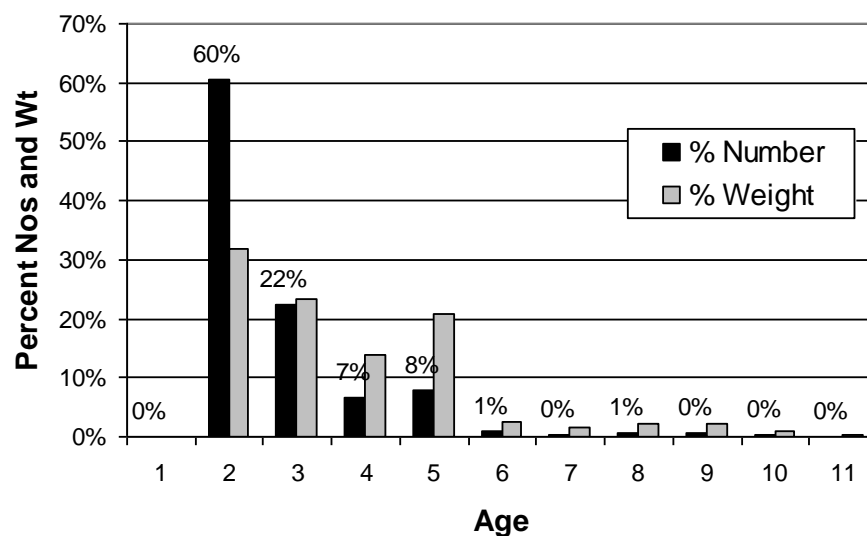


Figure 29. Overall fishery catch at age (% numbers and % weight) from the 2010 SWNS/BoF spawning component.

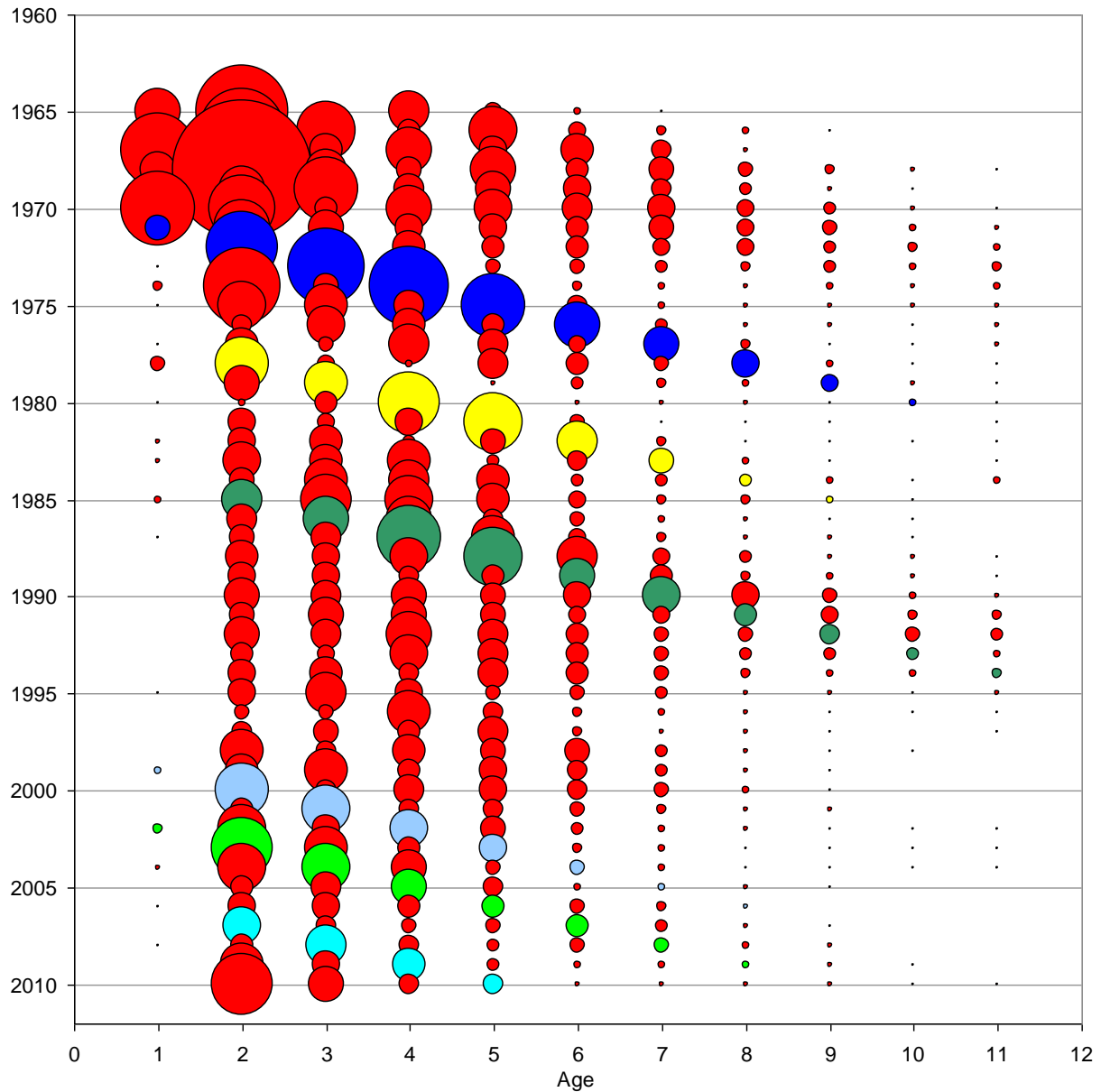


Figure 30. Historical catch at age (bubble size for numbers) for the SWNS/BoF herring spawning component from 1965-2010. Several of the stronger year-classes are highlighted including the 1970, 1978, 1983, 1998, 2001 and 2005 year-classes.

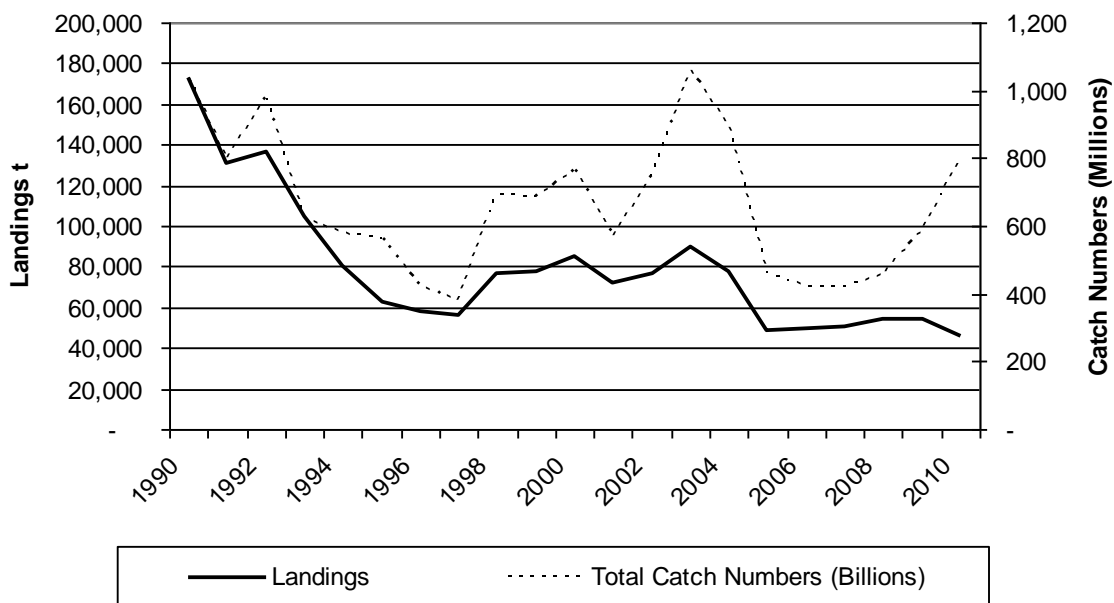


Figure 31. Total landings (t) and total removals (millions) for the combined annual catch from the SWNS spawning component for 1965 to 2010.

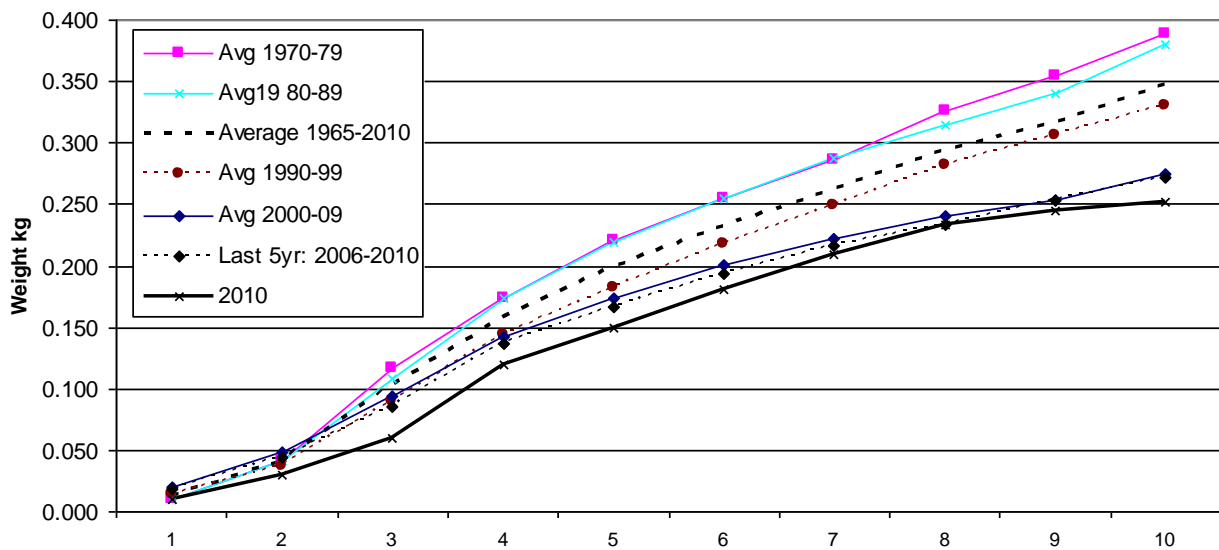


Figure 32. Average weights at age (kg) for the SWNS/BoF component of the 4WX herring fishery (fishery weighted) for the most recent year and by decade for the historical series.

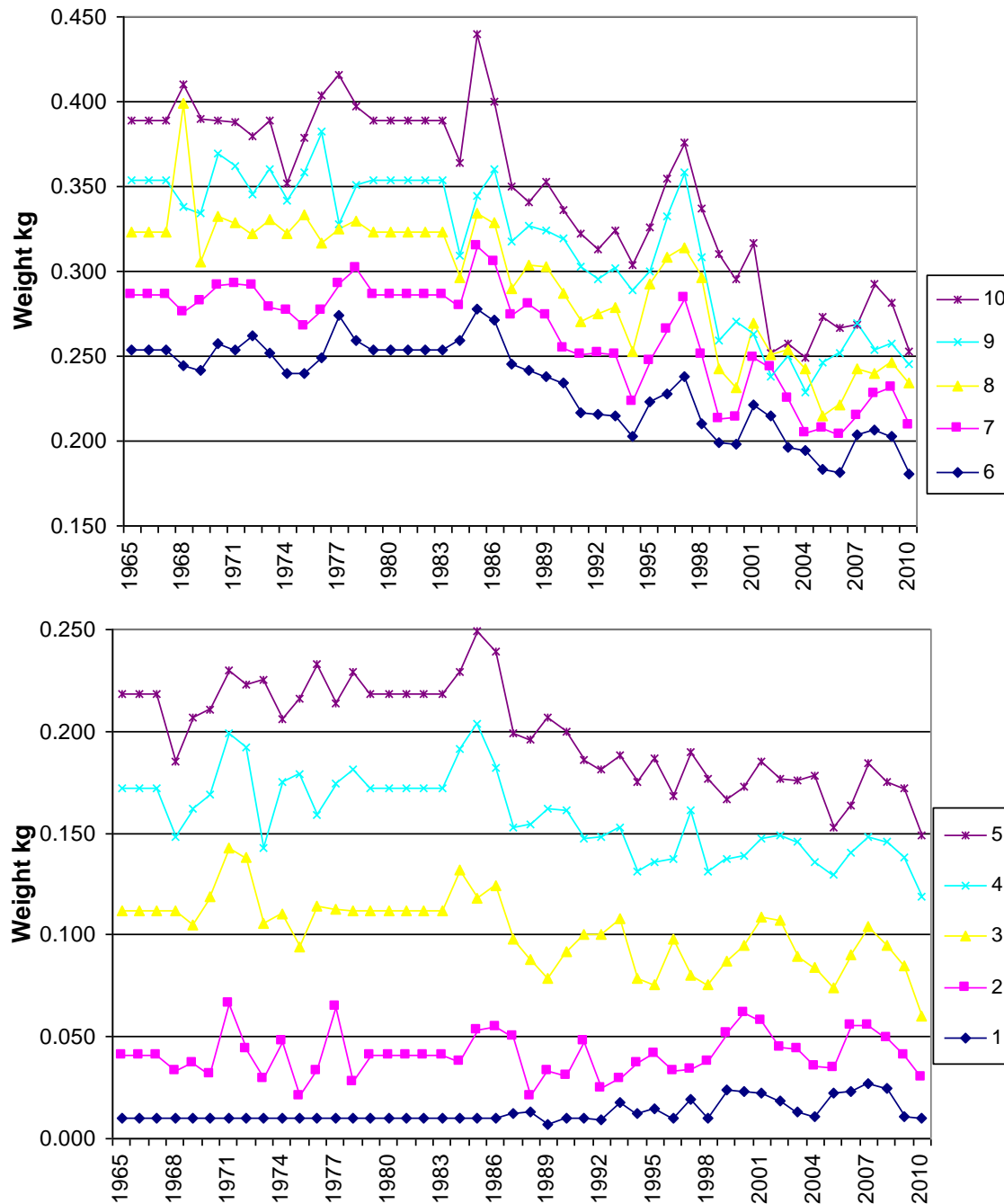


Figure 33. Average weights at age (kg) for the SWNS/BoF component of the 4WX herring fishery (fishery weighted) for 1965-2010.

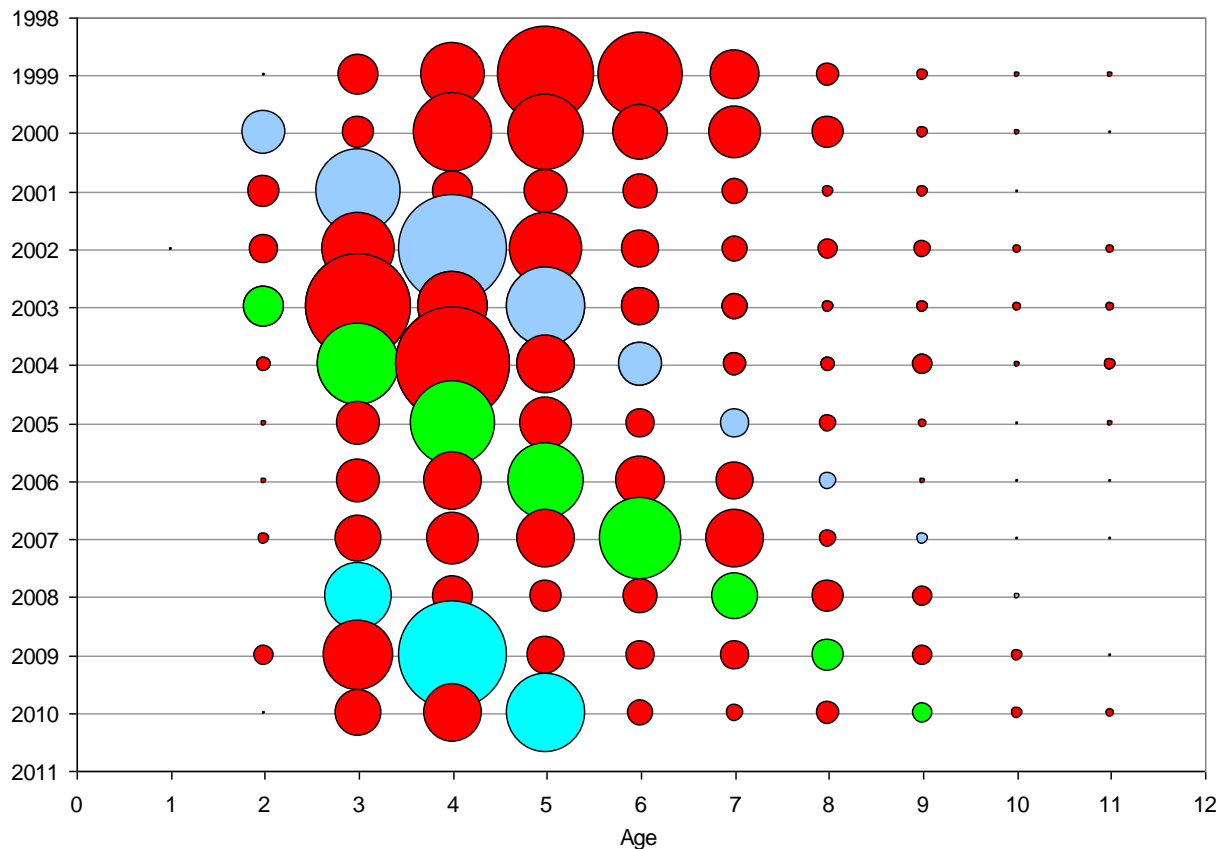


Figure 34. Acoustic survey catch at age (bubble size for numbers) for the German Bank spawning area in the SWNS/BoF component.

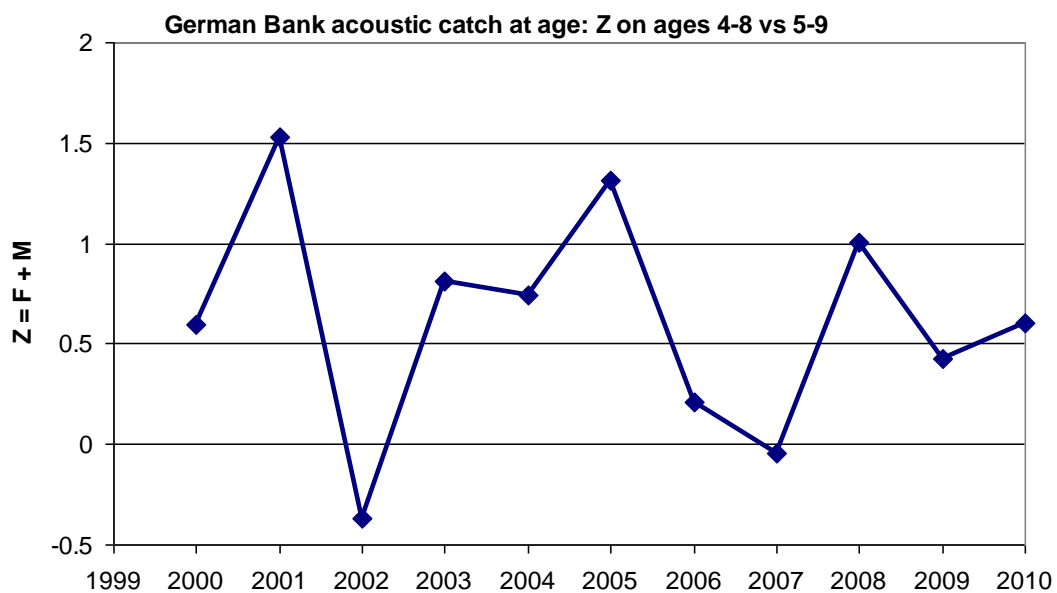


Figure 35. Total mortality estimates ( $Z=F+M$ ) from the overall acoustic catch at age data for ages 4 to 8 combined, compared with ages 5 to 9 in the following year.

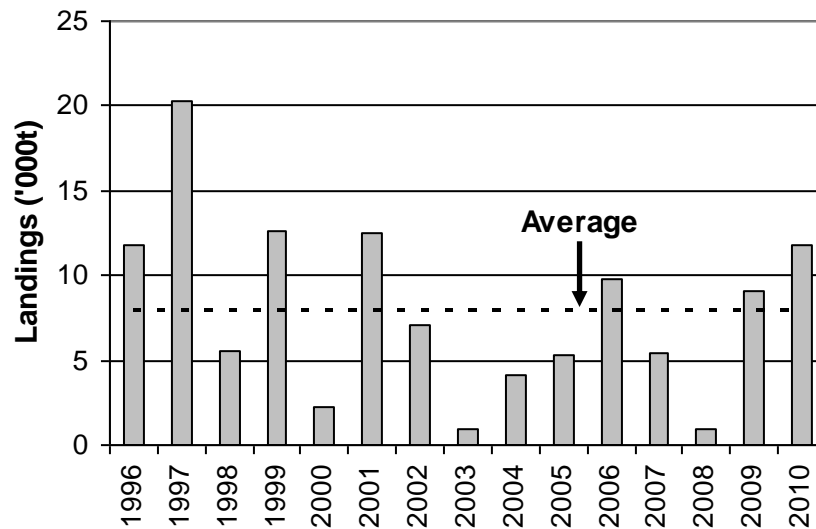


Figure 36. Scotian Shelf Banks herring landings from all gears for 1996-2010 with the overall average for the period.

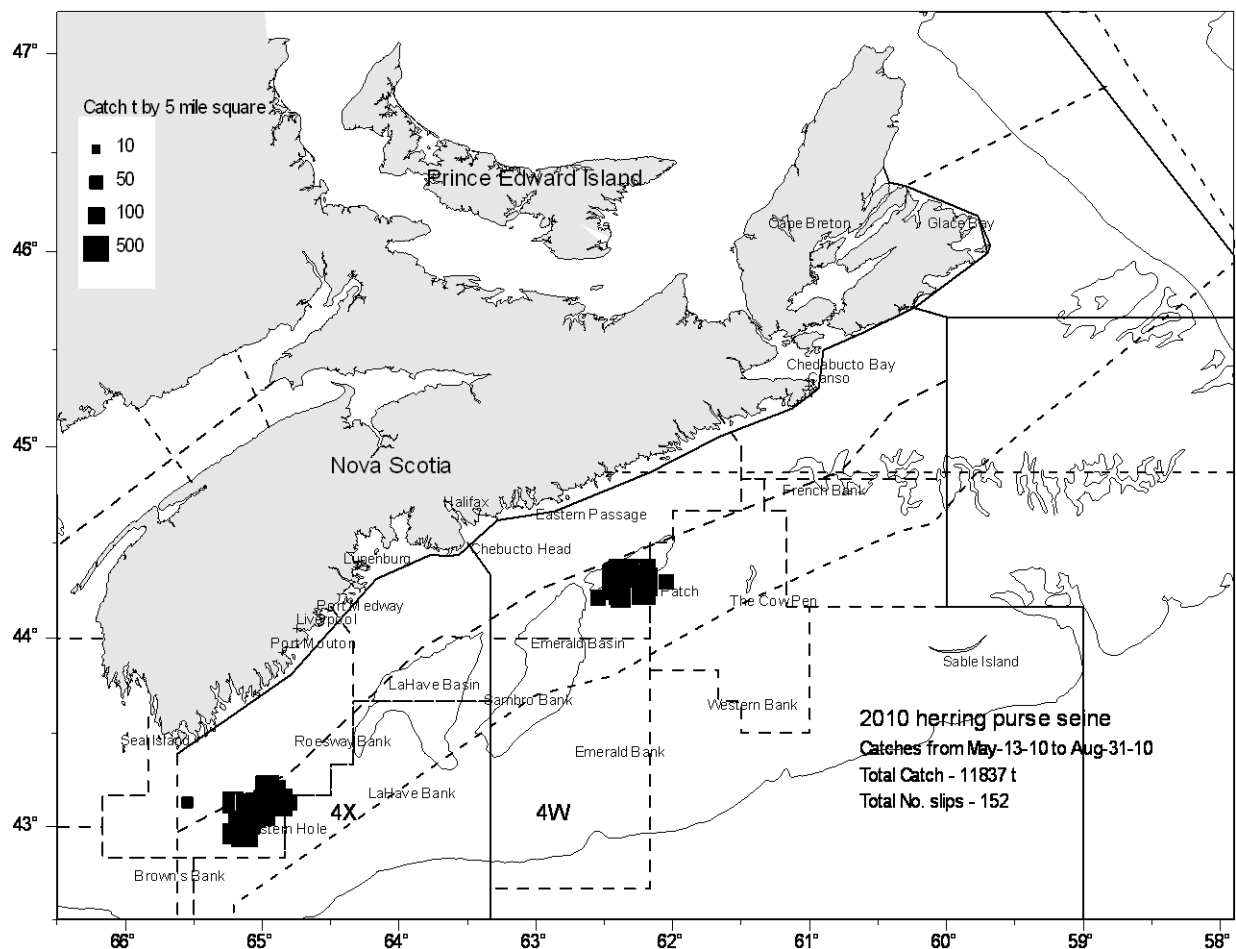


Figure 37. 2010 herring purse seine on the offshore Scotian Shelf banks with embayment and offshore 25 and 50 mile lines shown.

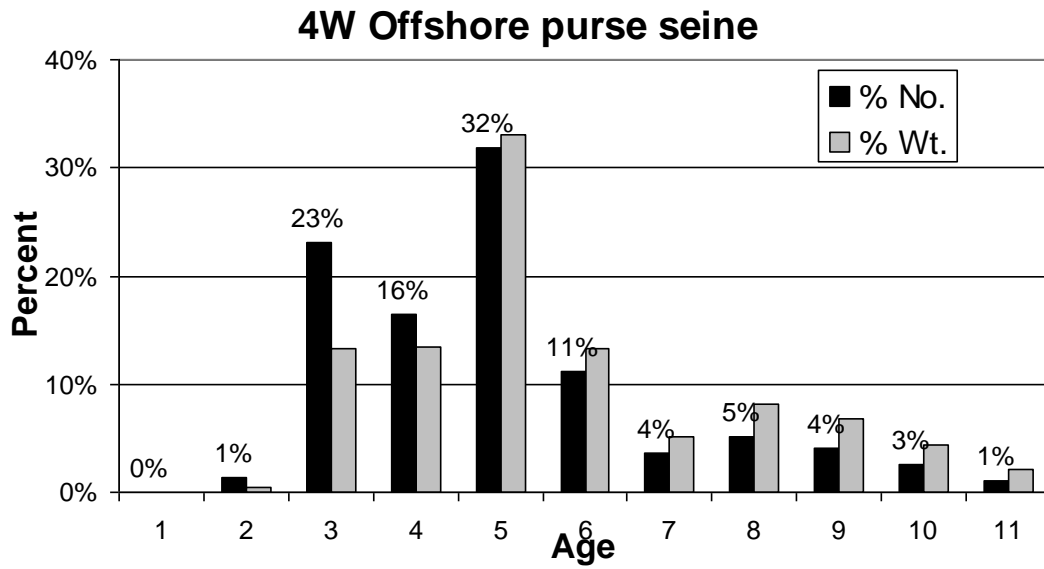


Figure 38. Fishery catch at age (% numbers and % weight) for the 2010 offshore Scotian Shelf herring component.

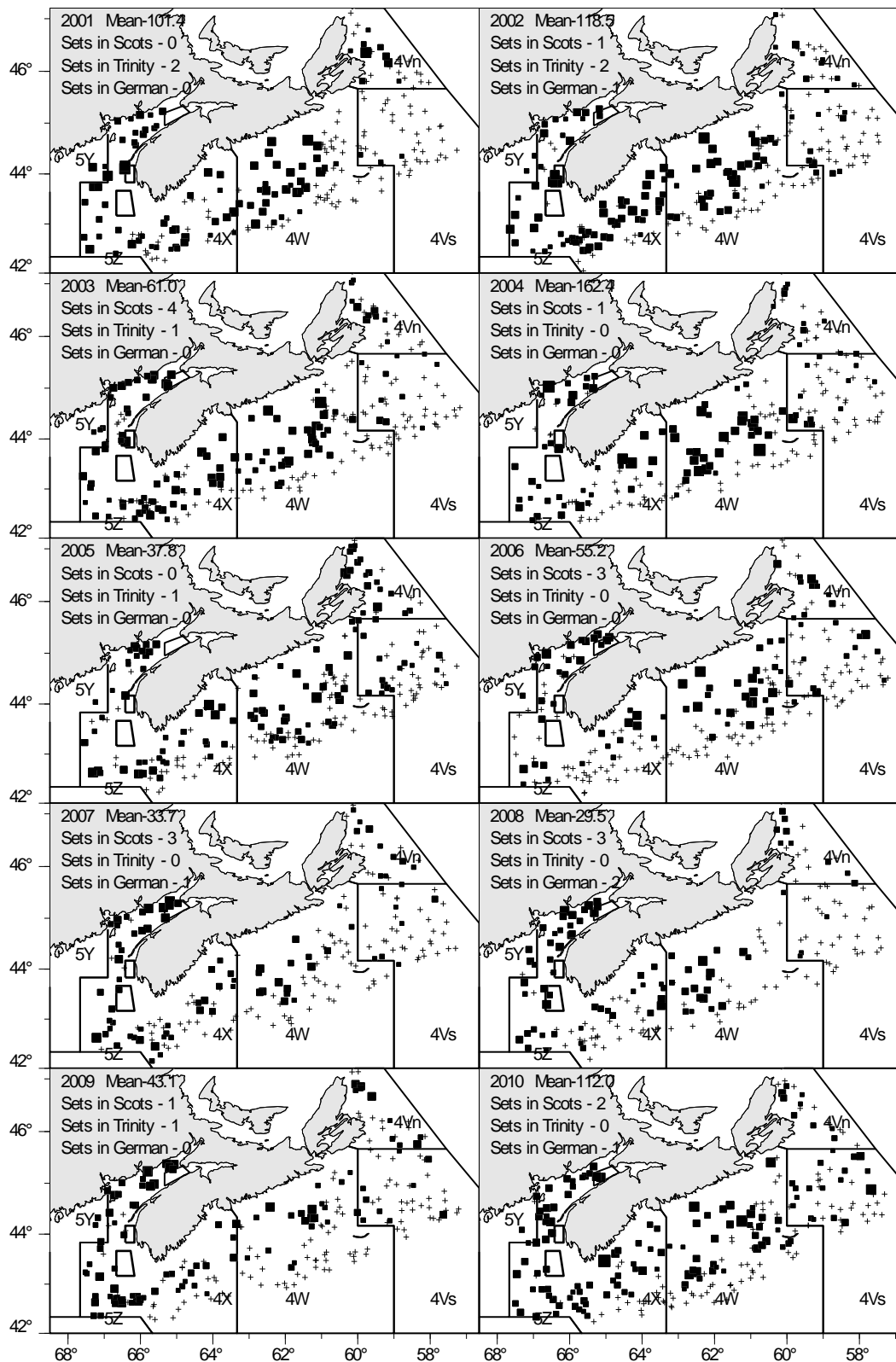


Figure 39. Herring catches from the DFO summer bottom trawl research survey for 2001-2010. Mean numbers per standard tow and count of sets in Scots, Trinity and German spawning areas.

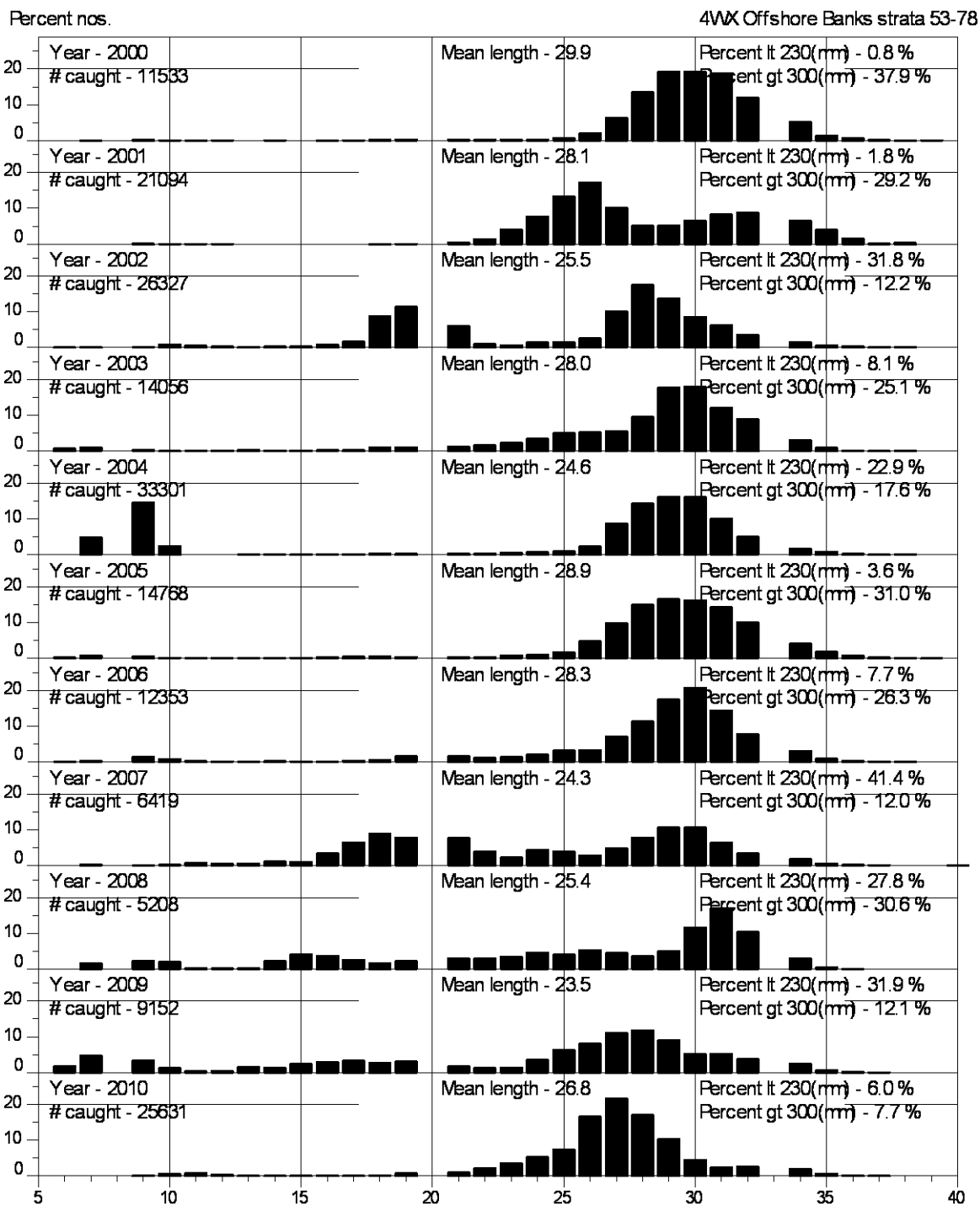


Figure 40. The 2000-2010 herring size distribution (fork length converted to total length cm) from the July bottom trawl research survey for the entire 4VWX area of coverage.

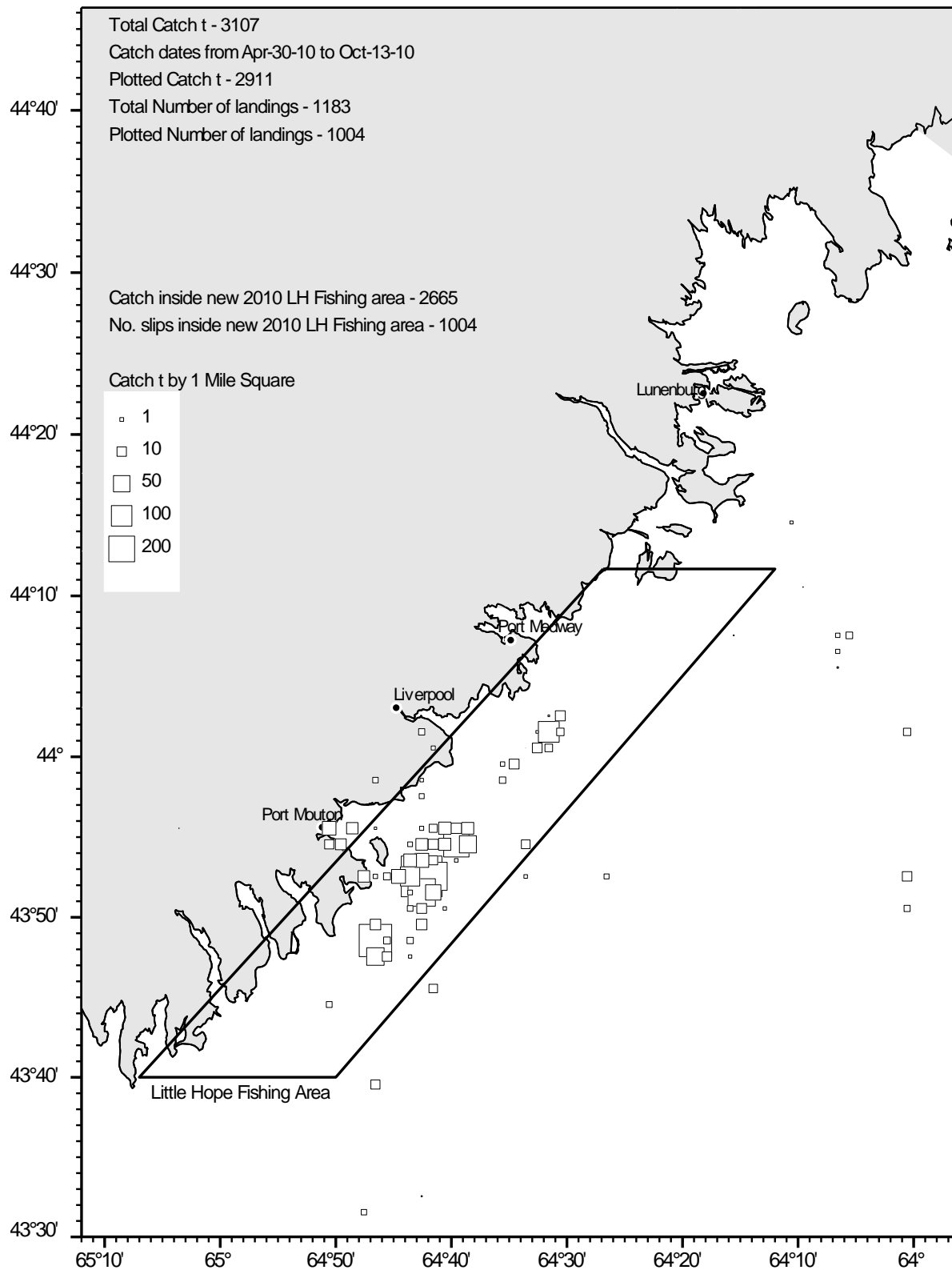


Figure 41. The 2010 herring gillnet catch locations for landings in statistical districts 23-31 with amount caught within the Little Hope Fishing Area.

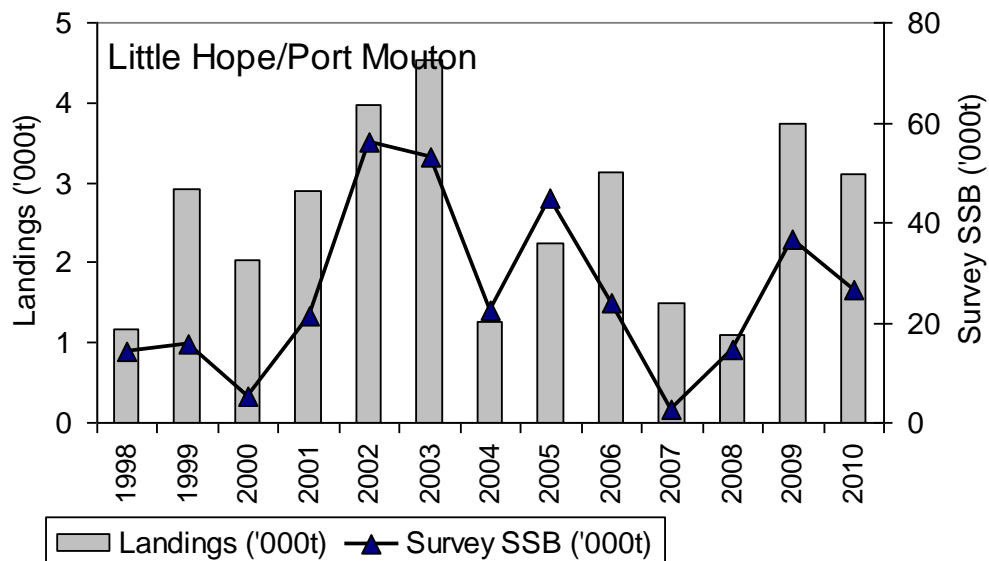


Figure 42. Herring landings and acoustic survey biomass ('000t) for the Little Hope/Port Mouton gillnet fishery from 1997-2010.

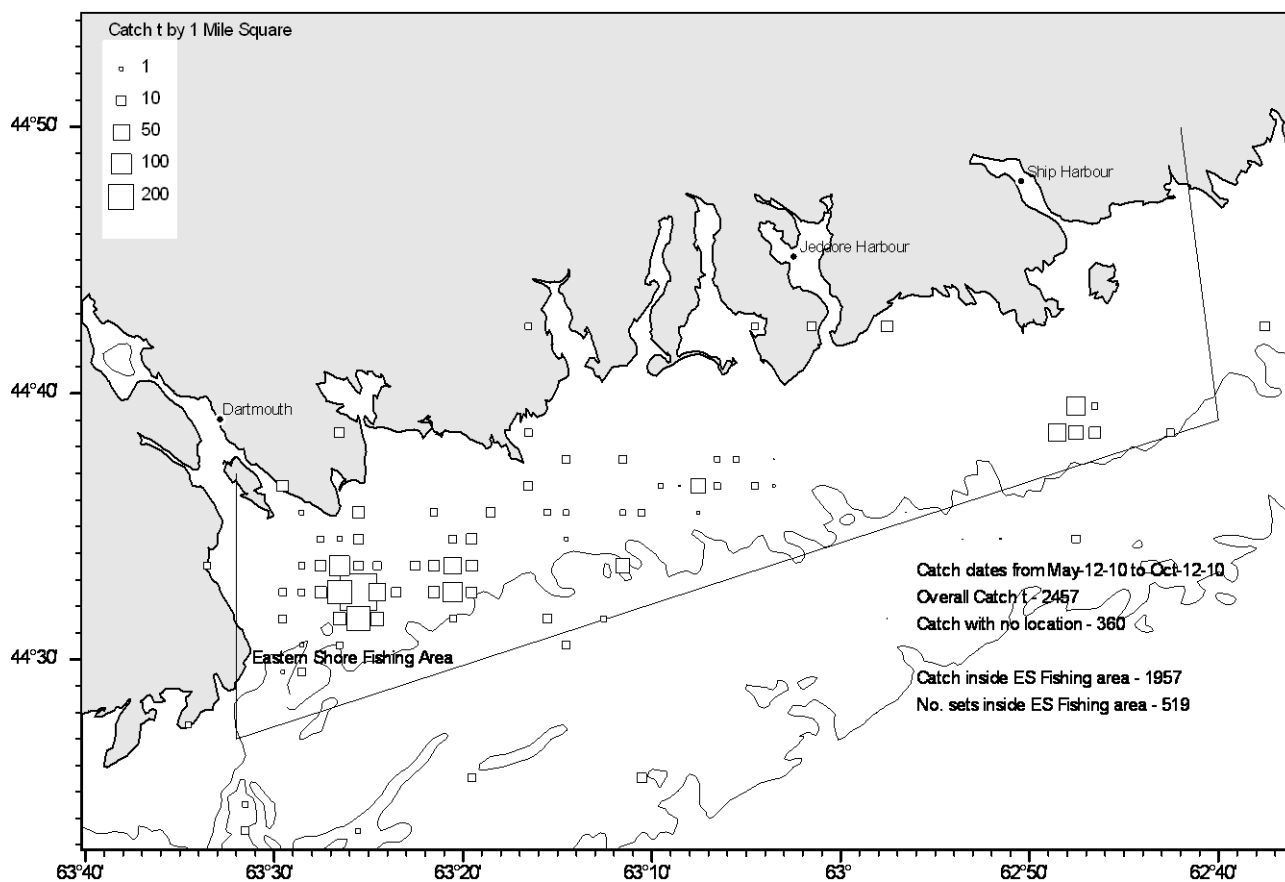


Figure 43. Gillnet herring catches for the 2010 fall fishery along the Eastern Shore Fishing Area (catches by 1 mile squares).

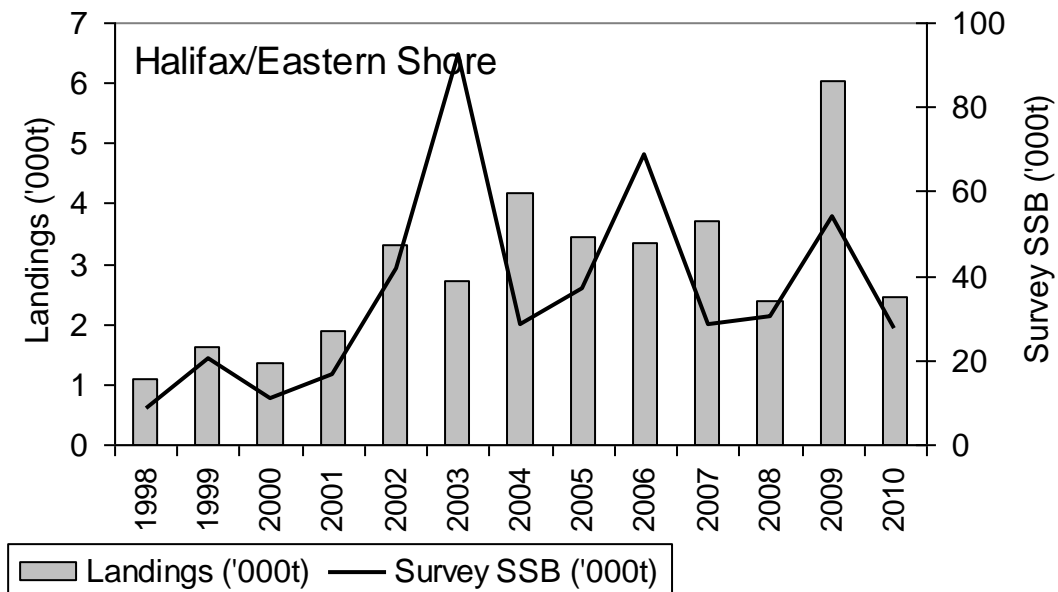


Figure 44. Herring landings and acoustic survey biomass ('000t) for the Halifax/Eastern Shore gillnet fishery from 1997-2010.

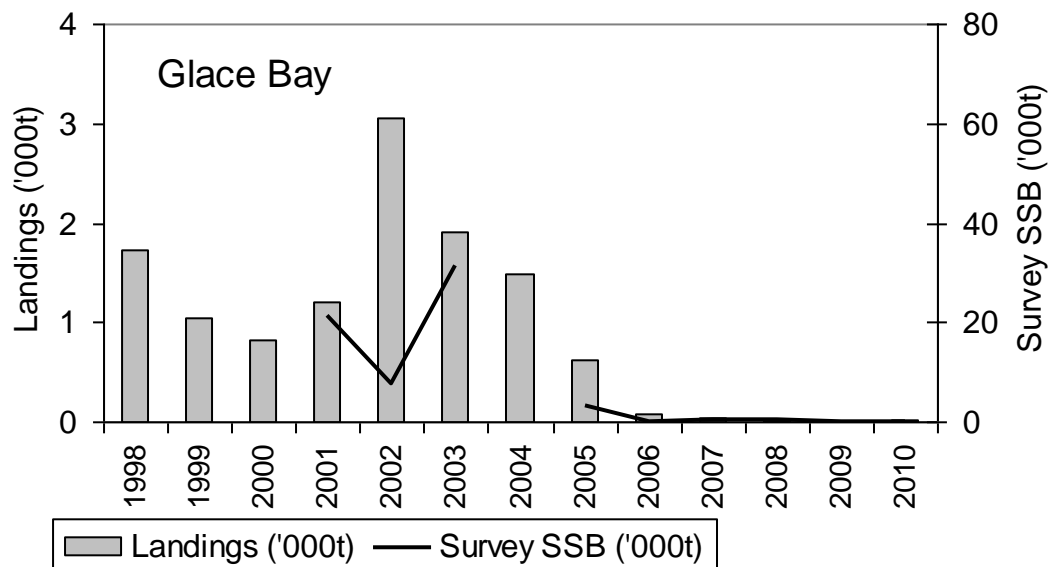


Figure 46. Herring landings and acoustic survey biomass ('000t) for the Glace Bay gillnet fishery from 1997-2010.

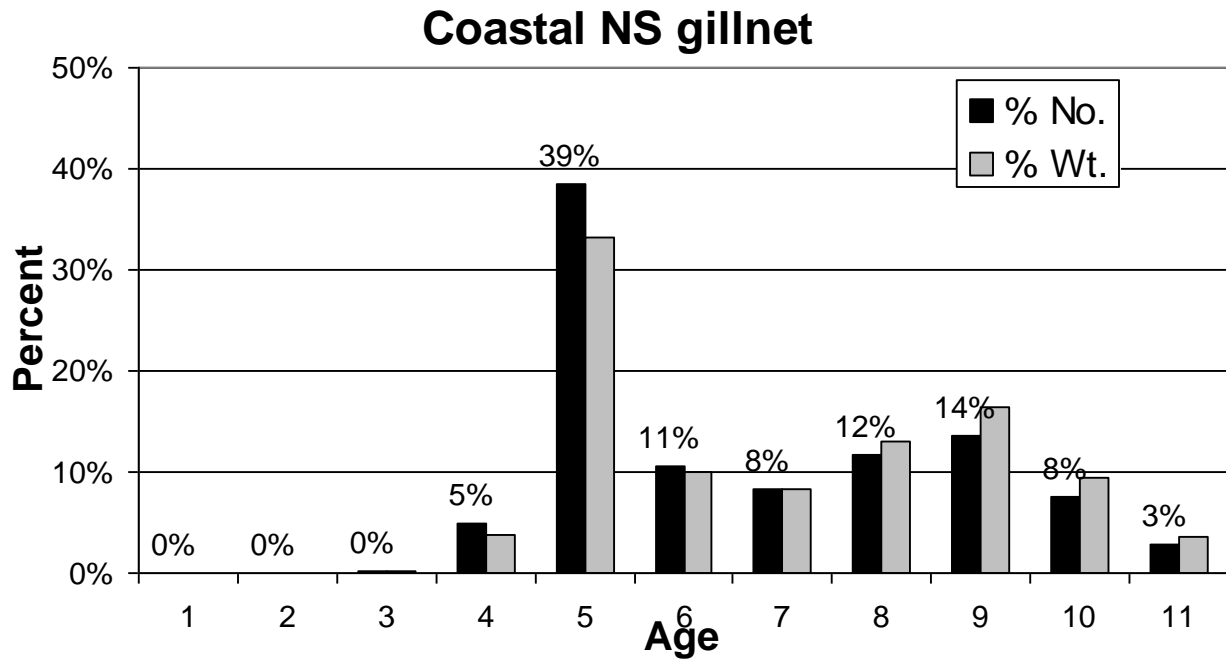


Figure 46. Fishery catch at age (% numbers and % weight) for the 2010 Coastal Nova Scotia herring component.

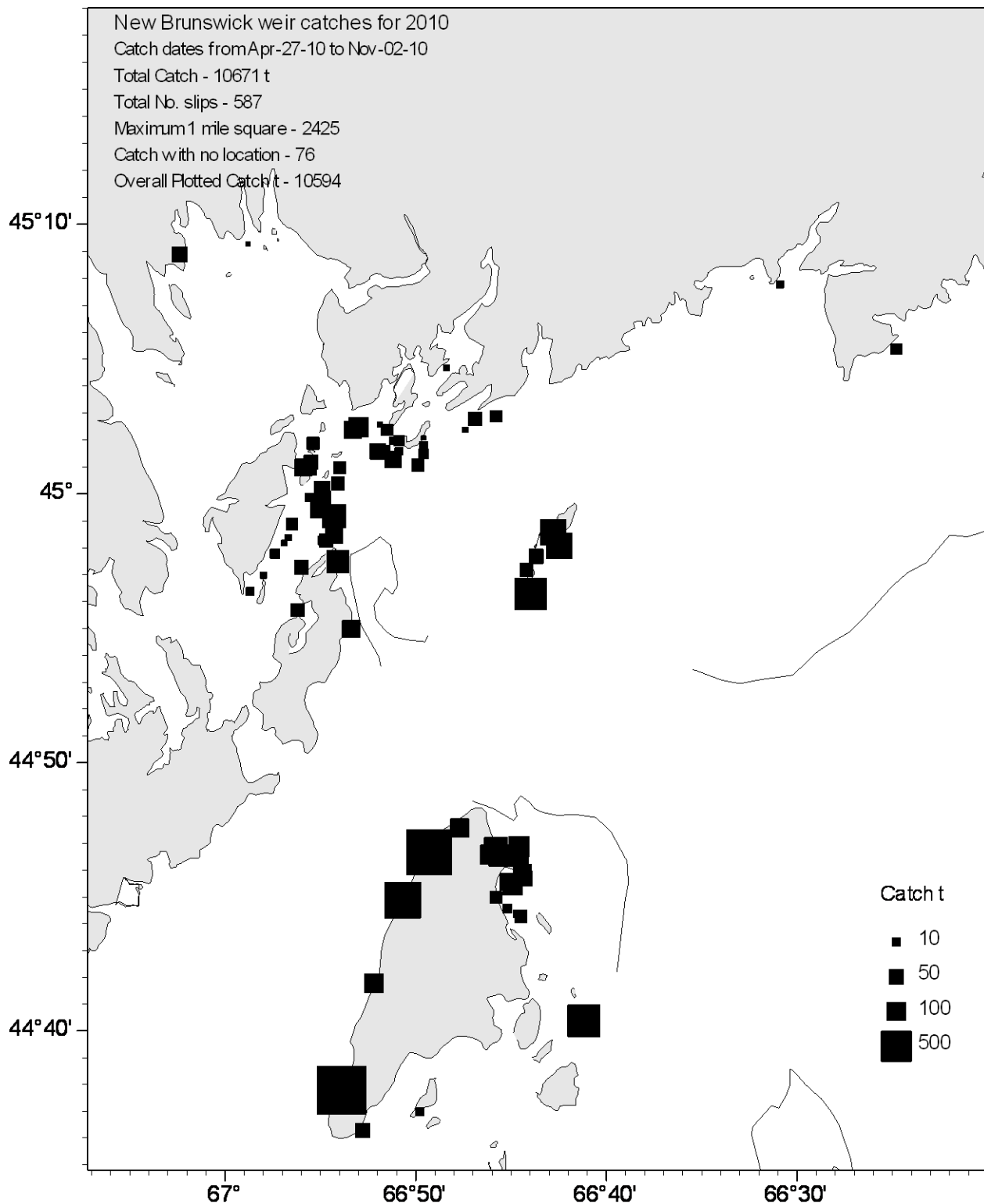


Figure 47. New Brunswick herring weir catches by location for the 2010 fishing season.

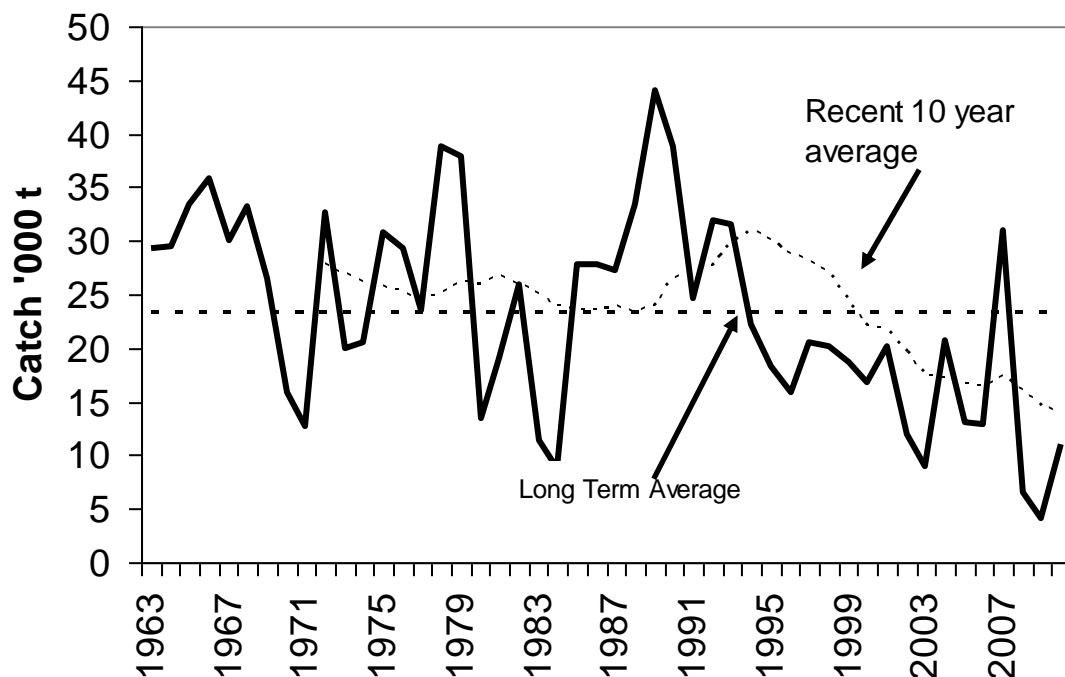


Figure 48. Herring landings from the SWNB weir and shutoff fishery for 1963-2010 with the overall long term average.

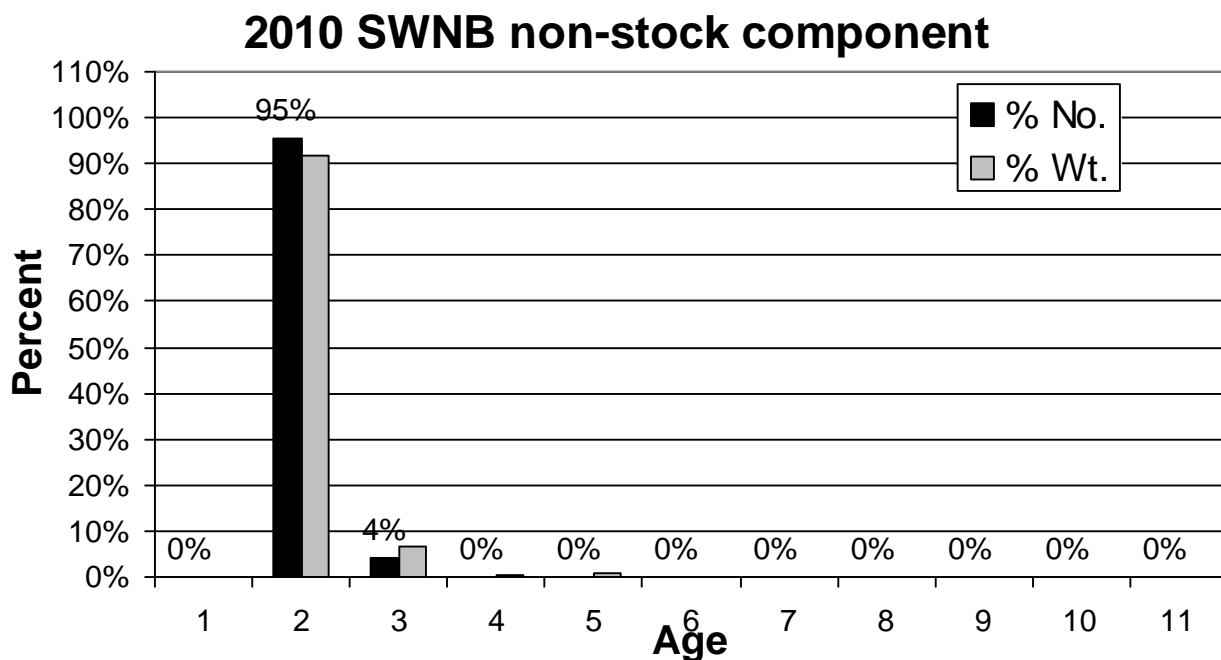
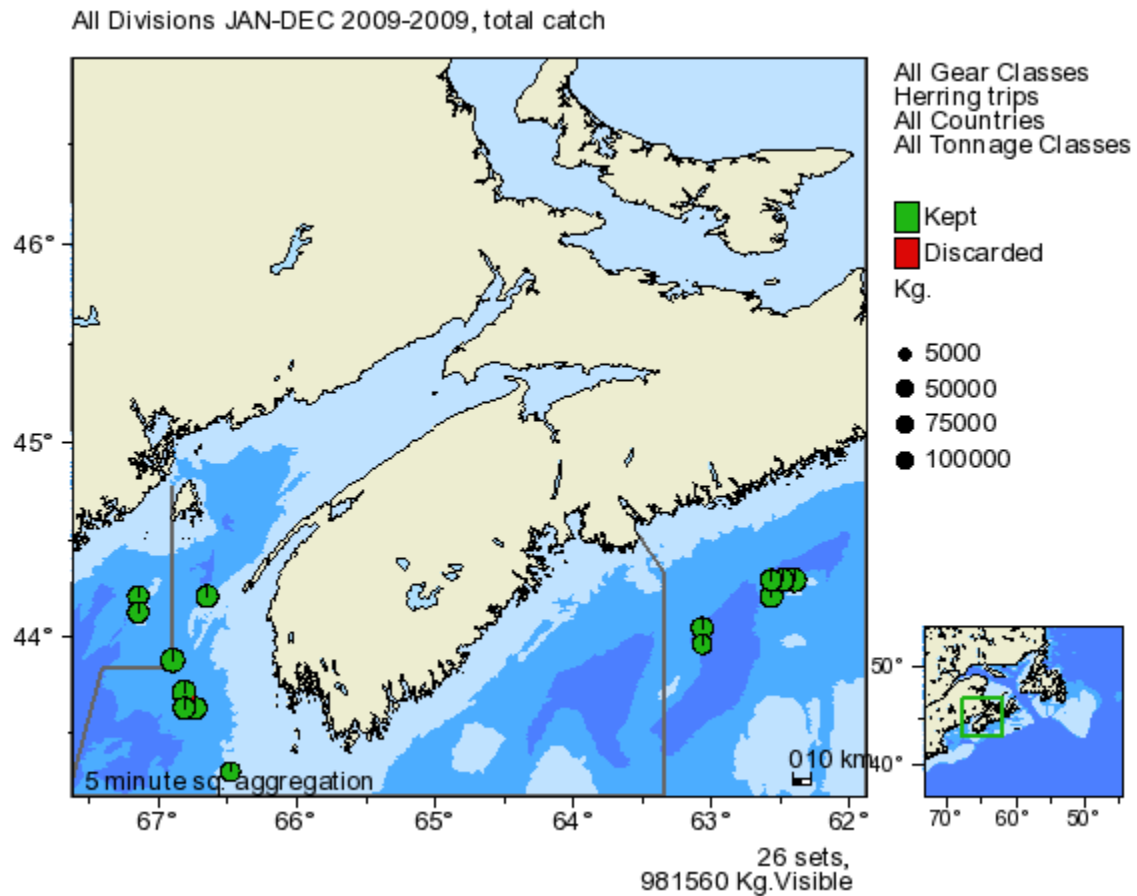


Figure 49. Fishery catch at age (% numbers and % weight) for the 2010 SWNB migrant juvenile herring component.

**APPENDIX A: OBSERVER REPORTS FOR HERRING DIRECTED TRIPS FROM 2009-2010**

2009 observer data:

- Fourteen trips, 28 sets monitored, purse seine gear only.
- Five trips in area 4W ('The Patch' area) in June and rest in 4X/5Y during July and September.
- By-catch of only small amounts of mackerel and dogfish; protocols checked for observers.

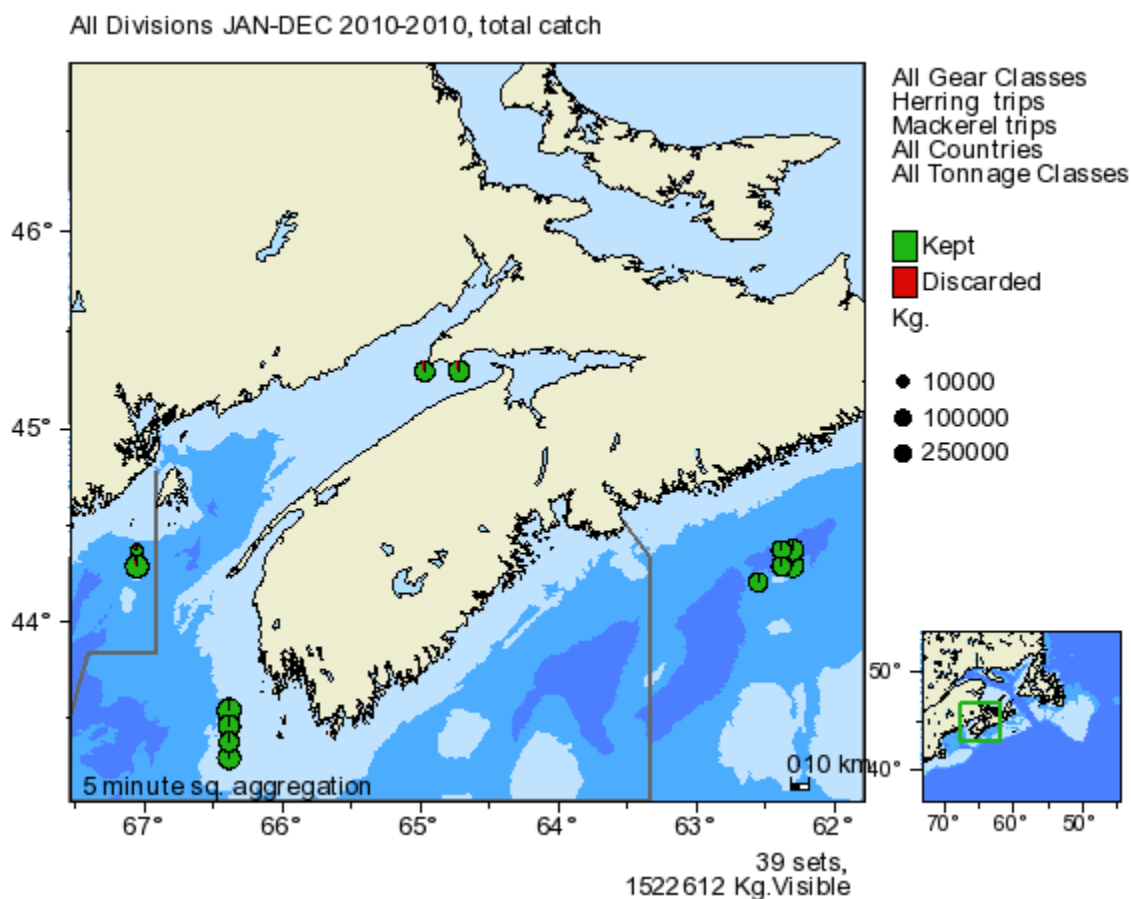


Catch Composition (Metric tonnes)		
Species	Kept 2010	Discarded 2010
HERRING(ATLANTIC)	981.545	0
MACKEREL(ATLANTIC)	0.01	0
SPINY DOGFISH	0	0.005

Figure A1. Species report for 2009 herring trips.

2010 observer data:

- Twenty-two trips, 43 sets monitored, purse seine gear only.
- Five trips in area 4W ('The Patch' area) in June and rest in 4X/5Y during July to September.
- No by-catch with small amounts of several other species released; protocols checked for observers again; additional species appearing for one observer in particular.



Catch Composition (Metric tonnes)		
Species	Kept 2010	Discarded 2010
HERRING(ATLANTIC)	1518.31	0
OCEAN SUNFISH	0	2.81
SEALS (NS)	0	1.228
SOOTY SHEARWATER	0	0.099
THRESHER SHARK	0	0.09
SHORT-FIN SQUID	0	0.041
STRIPED BASS	0	0.025
THORNY SKATE	0	0.003
CEPHALOPODA C.	0	0.002

Figure A2. Species report for 2010 herring and mackerel trips combined.