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An assessment of Newfoundland east and south Coast herring stocks to the spring of 2008

Évaluation des stocks de hareng des côtes est et sud de Terre-Neuve jusqu'au printemps 2008

J. P. Wheeler, B. Squires, and P. Williams

Science Branch
Fisheries and Oceans Canada
P.O. Box 5667
St. John's NL A1C 5X1
wheelerj@dfo-mpo.gc.ca

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ABSTRACT

Results of an assessment to the spring of 2008 are presented for four herring stocks along the east and southeast coasts of Newfoundland. Commercial landings increased from 6400 t in 2006 to 6700 t in 2007; this represented approximately 54% of the 2007 Total Allowable Catch (TAC). Complete landings data were not available for 2008. Spring spawners accounted for 55% of commercial landings in all areas in 2007; this represented an increase from 2006. The 2002 year class was dominant in 2007 research gill net catches in all areas. Five series of abundance indices were available for most of the stock areas: research gill net catch rates, commercial gill net catch rates, gill net fisher observations from logbooks, gill net fisher observations from telephone surveys, and purse seine fisher observations. ADAPT calibrations were completed for spring and fall spawners for each stock area. The results of these calibrations were rejected for all areas based upon large parameter error estimates and residual patterns of indices. The methodology to describe stock status was therefore similar to the last assessment in 2006. Current status and future prospects were summarized for each area in a performance report. These reports were based upon a standardized interpretation of abundance indices and biological characteristics. For White Bay–Notre Dame Bay, stock status improved from 2002 to 2008. For Bonavista Bay– Trinity Bay, stock status improved from 2002 to 2007 but deteriorated in 2008. For St. Mary's Bay–Placentia Bay, stock status deteriorated slightly from 2005 to 2008. For Fortune Bay, stock status deteriorated from 2001 to 2004, improved slightly in 2005, deteriorated again in 2006 and has remained stable from 2006 to 2008. For all areas, current abundance is substantially lower than peak estimates, most of which occurred in the 1970's.

RÉSUMÉ

Le présent document expose les résultats de l'évaluation de quatre stocks de hareng des côtes est et sud-est de Terre-Neuve. Les débarquements commerciaux sont passés de 6400 tonnes en 2006 à 6700 tonnes en 2007; ce qui représente environ 54 % du total autorisé des captures (TAC) pour 2007. Pour l'année 2008, on ne disposait pas de données complètes concernant les débarquements. Les reproducteurs du printemps représentent 55 % des débarquements commerciaux dans toutes les zones en 2007, une augmentation par rapport à 2006. En 2007, la classe d'âge de 2002 était un groupe dominant dans toutes les zones dans les prises au filet maillant effectuées dans le cadre des travaux de recherche. Cinq séries d'indices de l'abondance sont disponibles pour la plupart des zones de stock : les taux de prises au filet maillant enregistrés dans le cadre des travaux de recherche, les taux de prises commerciales au filet maillant, les observations des pêcheurs au filet maillant notées dans les journaux de bord, les observations des pêcheurs au filet maillant obtenues dans le cadre d'enquêtes téléphoniques et les observations des pêcheurs à la senne coulissante. Les étalonnages du modèle ADAPT ont été effectués pour les reproducteurs de printemps et d'automne de chaque zone de stock. Les résultats de ces étalonnages ont été rejetés pour toutes les zones, en raison des importantes erreurs dans les estimations des paramètres et des profils résiduels des indices. La méthodologie utilisée pour décrire l'état des stocks est par conséquent semblable à celle employée pour la dernière évaluation, en 2006. L'état actuel et les perspectives futures sont résumés pour chaque zone dans un rapport sur le rendement. Ces rapports s'appuient sur une méthode normalisée d'interprétation des indices de l'abondance et des caractéristiques biologiques. Pour le secteur de la baie Blanche – baie Notre Dame, l'état des stocks s'est amélioré de 2002 à 2008. Pour le secteur de la baie de Bonavista – baie de la Trinité, l'état des stocks s'est amélioré de 2002 à 2007, mais s'est détérioré en 2008. Pour le secteur de la baie Ste-Marie – baie de Plaisance, l'état des stocks s'est légèrement détérioré de 2005 à 2008. Pour le secteur de la baie de Fortune, l'état des stocks s'est détérioré de 2001 à 2004, s'est légèrement amélioré en 2005, s'est détérioré de nouveau en 2006 et est demeuré stable de 2006 à 2008. Pour toutes les zones, l'abondance actuelle est considérablement inférieure aux estimations maximales, lesquelles ont été enregistrées pour la plupart dans les années 1970.

INTRODUCTION

There are five herring stocks in the coastal waters of east and south Newfoundland (Fig. 1): White Bay-Notre Dame Bay (WB-NDB), Bonavista Bay- Trinity Bay (BB-TB), Conception Bay-Southern Shore (CB-SS), St. Mary's Bay- Placentia Bay (SMB-PB), and Fortune Bay (FB). These stock complexes were defined from tagging experiments conducted in the 1970's and early 1980's (Wheeler and Winters 1984). In addition, herring occur along the south coast from Cape Ray to Pass Island; the affinities of these herring are uncertain. This document provides an assessment of four stocks to the spring of 2008. CB-SS and herring from the south coast were excluded due to a lack of scientific data; landings data only are provided for these areas.

In recent years, these four stocks have been assessed bi-annually, most recently in the fall of 2006 (Wheeler et al. 2006). The same data sources are available for this assessment as in 2006. As in 2006, greater emphasis has been given to autumn spawning herring in this assessment, given their increased numbers in commercial and research gill net catches in most areas in recent years.

In 2006, the RAP review committee identified several analyses to help reduce some of the uncertainties in the assessment of these herring stocks (DFO 2006). Most of these recommendations have been addressed in this assessment.

1. The research gill net catch rates are likely confounded by systematic changes in growth and maturation rates that have occurred since their inception. It is recommended that standardized estimates of year class and year effects be extracted from these data, using statistical models that permit the age-mesh size interaction to be quantified.
   - Progress: Research gill net catch rates were not standardized for this assessment. As this requires a major re-analysis of this series, it was deemed that this should be examined in the assessment framework review which is planned for 2009.

2. The commercial logbook abundance index suffers from very low return rates. It is recommended that return rates could be increased by sending out reminders subsequent to the initial request. It is also recommended that, should this be implemented, secondary and tertiary logbook data be analyzed separately from that of the initial collection to ensure internal consistency of the full data series.
   - Progress: Reminder letters were sent out in June 2007 and in August 2008. Comparisons were made of logbook data received prior to and after the reminder letters.

3. The gill net telephone survey has common respondents to those who submit commercial gill net log books. The consistency between observed (logbook) catch rates and oral statements of annual abundance changes, by common respondents, should be examined by statistical analyses of these two data sets.
   - Progress: Comparisons were made of the opinion-based abundance index of common gill net fishers who returned logbooks and who were also contacted in the phone survey.

4. The gill net telephone survey may be confounded by differing reference periods from which current year estimates are compared. It is recommended that future surveys

include a standard reference period, and include an additional question on the respondents fishing history.

- Progress: A new cumulative (year to year) index was derived to address the issue of differing reference periods. Commencing in 2007, fishers were also asked to provide information on the number of nets that they fished, the number of times the nets were hauled, and the total amount of herring caught.

5. These herring populations have undergone significant changes in growth, maturity and spawning group classifications over the past several decades. It is recommended that a research document be prepared for the next assessment in which changes in these vital rates are analyzed in relation to a variety of potential causative hypotheses.
   - Progress: A manuscript has been prepared and accepted for primary publication. The paper was presented at the ICES herring symposium, in Galway in August 2008.

6. A variety of abundance indices are available for these stocks, some of which are data based and others which are opinion based. It is recommended that the coherence of these various indices be statistically examined so as to clarify interpretative significance and as a guide to index weighting factors.
   - Progress: Comparisons were made to examine the impacts of 1) giving equal weight to data based and opinioned based indices in performance reports, and 2) excluding opinion based indices in performance reports. The impact of removing indices was also examined in an ADAPT calibration.

7. Sequential population analyses (SPA) models provide a useful window through which current abundance and exploitation rates can be compared with retrospective levels. Such models have not been used in recent assessments of these stocks for a variety of reasons, including low catch levels. The Committee felt that it would be useful to re-examine the utility of these models, including variants that may be constrained by earlier acoustic estimates.
   - Progress: A series of ADAPT formulations were run for spring and autumn spawning herring for each of the four stock areas, the results of which are discussed in this document.

This document is divided into several sections. The first section examines commercial fishery data and the biological sampling used to calculate 2006 and 2007 commercial landings at age. The second section examines abundance indices, including research gill net catch rates (spring and fall), acoustic biomass estimates, commercial gill net catch rates, and gill net and purse seine fisher observations. The third section examines biological data, including lengths and weights at age, and recruitment. The fourth section examines several ADAPT formulations for spring and autumn spawning herring for each of the four stock areas. The fifth section includes performance reports on the current status and future prospects of each stock. The methodology is the same as in 2006 and includes standardized retrospective reports back to 1997. The document concludes with a section on sources of uncertainty.

DESCRIPTION OF THE 2006 AND 2007 COMMERCIAL FISHERIES AND LANDINGS AT AGE

COMMERCIAL LANDINGS AND BIOLOGICAL SAMPLING

Policy and Economics Branch provides commercial landings data (t), by bay, month and gear type (Tables 1–6 and Fig. 2). Data for 2006-08 are considered preliminary, as statistics have not yet been finalized. For 2008, landings are available to October 21st only. Not all landings prior to this date are included. Commercial statistics since 1996 do not include landings for bait purposes. These are assumed to be less than 500 t in WB-NDB, 400 t in FB, 300 t in BB-TB and 150 t SMB-PB. Policy and Economics Branch personnel have indicated that bait landings were included in the commercial statistics from approximately 1991 to 1995 only. The exclusion of bait landings from commercial statistics represents a source of uncertainty, especially for those areas and years where bait landings form the bulk of total landings.

Biological samples, collected each year from random samples of the commercial herring fisheries, provide age distributions of the commercial landings. In 2006, 1541 herring were sampled and aged to calculate numbers at age for 6000 t of landings (Tables 7–10). In 2007, 1446 herring were sampled and aged to calculate numbers at age for 6400 t of landings (Tables 7–10). The 2008 commercial fisheries are ongoing in some areas; therefore, 2008 samples have not been processed.

THE 2006 FISHERY

TAC's for the 2006 fishery were unchanged from 2005 for all areas (Tables 1-6). Landings decreased from 7900 t in 2005 to 6500 t in 2006; this represented approximately 57% of the overall TAC (Tables 1-6 and Fig. 2). Allocations for certain gears (purse seines, bar seines and traps) were met and/or exceeded in some areas; allocations for gill nets were not met in any area.

In WB-NDB, landings decreased from 891 t in 2005 to 309 t in 2006; 28% of the TAC was taken in 2006 (Table 1). The 2001 year class accounted for 40% of landing numbers, followed by the 2000 year class at 29% (Table 7 and Fig. 3 and 4). The age distribution was truncated, as only 4 year classes (includes fish age 11+) each accounted for greater than 5% of the landings. Spring spawners accounted for 55% of landings, the same as in 2005.

In BB-TB, landings decreased from 2640 t in 2005 to 1904 t in 2006; 64% of the TAC was taken in 2006 (Table 2). The 2000 year class accounted for 33% of landing numbers, followed by the 2002 year class at 24% (Table 8 and Fig. 3 and 5). The age distribution was extensive, as 5 year classes (includes fish age 11+) each accounted for greater than 5% of the landings. Spring spawners accounted for 43% of landings, a decrease of 32% from 2005.

In SMB-PB, landings increased from 1426 t in 2005 to 1528 t in 2006; 61% of the TAC was taken in 2006 (Table 4). The 2000 year class accounted for 26% of landing numbers, followed by the 1999 year class at 20% (Table 9 and Fig. 3 and 6). The age distribution was extensive, as 5 year classes (includes fish age 11+) each accounted for greater than 5% of the landings. Spring spawners accounted for 48% of landings, a decrease of 23% from 2005.

In FB, landings decreased from 2652 t in 2005 to 2340 t in 2006; 63% of the TAC was taken in 2006 (Table 5). Fish aged 11+ accounted for 49% of landing numbers, followed by the

1996 year class at 21% (Table 10 and Fig. 3 and 7). The age distribution was truncated, as only 3 year classes (includes fish age 11+) each accounted for greater than 5% of the landings. Spring spawners accounted for 95% of landings, an increase of 15% from 2005.

THE 2007 FISHERY

Prior to the 2007 fishery, Fisheries and Aquaculture Management Branch formulated a new two year (2007 and 2008) integrated management plan for east and south coast Newfoundland herring. TAC's increased 55% for WB-NDB and 33% forBB-TB, remained the same for SMB-PB, and decreased 14% for FB (Table 1-6). Landings increased from 6500 t in 2006 to 6600 t in 2007; this represented approximately 53% of the overall TAC (Table 1-6 and Fig. 2). Allocations for certain gears (purse seines, tuck seines, bar seines and traps) were met and/or exceeded in some areas; allocations for gill nets were not met in any area.

In WB-NDB, landings increased from 309 t in 2006 to 362 t in 2007; 21% of the TAC was taken in 2007 (Table 1). The 2002 year class accounted for 39% of landing numbers, followed by the 2001 year class at 32% (Table 7 and Fig. 3 and 4). The age distribution was truncated, as only 4 year classes (includes fish age 11+) each accounted for greater than 5% of the landings. Spring spawners accounted for 77% of landings, an increase of 22% from 2006.

In BB-TB, landings increased from 1904 t in 2006 to 2777 t in 2007; 69% of the TAC was taken in 2007 (Table 2). The 2001 year class accounted for 32% of landing numbers, followed by the 2002 and 2000 year classes, at 23% and 22% respectively (Table 8 and Fig. 3 and 5). The age distribution was truncated as only 4 year classes (includes fish age 11+) each accounted for greater than 5% of the landings. Spring spawners accounted for 65% of landings, an increase of 22% from 2006.

In SMB-PB, landings decreased from 1528 t in 2006 to 759 t in 2007; 30% of the TAC was taken in 2007 (Table 4). The 2000 year class accounted for 42% of landing numbers, followed by fish age 11+ at 23% (Table 9 and Fig. 3 and 6). The age distribution was extensive, as 5 year classes (includes fish age 11+) each accounted for greater than 5% of the landings. Spring spawners accounted for 10% of landings, a decrease of 38% from 2006.

In FB, landings increased from 2340 t in 2006 to 2448 t in 2007; 77% of the TAC was taken in 2007 (Table 5). Fish age 11+ accounted for 61% of landing numbers, followed by the 2002 year class at 23% (Table 10 and Fig. 3 and 7). The age distribution was truncated, as only 3 year classes (includes fish age 11+) each accounted for greater than 5% of the landings. Spring spawners accounted for 92% of landings, a decrease of 2% from 2006.

CONCEPTION BAY–SOUTHERN SHORE AND THE SOUTH COAST

Landings data are available for CB-SS and for the south coast from Cape Ray to Pass Island (Tables 3 and 6). Biological sampling data are not available for these areas.

In CB-SS, 94 t was landed in 2007; this represented approximately 16% of the TAC (Table 3). No landings were reported from 1999 to 2004 and peak landings in the period from 1997 to 2008 occurred in 1997 (177 t).

Along the south coast, 169 t was landed in 2007; this represented 34% of the TAC (Table 6). Landings from 1998 to 2008 averaged 440 t, with a peak of 1200 t in 1999.

SURVEY RESULTS AND ABUNDANCE INDICES

RESEARCH GILL NET PROGRAM

This program, initiated in 1980, provides standardized age disaggregated abundance indices independent of the commercial fishery. In the current program, commercial fishers are contracted each spring to provide catch rate data and biological samples of their catch. Each fisher is provided with a standardized fleet of five herring gill nets; the stretched mesh size of these nets measure 50.8 mm, 57.2 mm, 63.5 mm, 69.9 mm, and 76.2 mm respectively. Each net is 32 m long and 9 m deep, with the exception of the 50.8 mm mesh net, which is 5 m deep. These nets are fished from a fixed location, for a period of one month each spring. This coincides with the spawning season for spring spawning herring, at a time when stock mixing is minimal. Fishers are required to haul the nets once a day (weather permitting) for the duration of the contract, to maintain an accurate daily log record of their catch, and to collect and freeze specified samples of their catch at eight regular intervals during the month. Multiple locations are fished annually in each stock area. Over time, some locations have been changed; however, spatial coverage has been maintained to ensure an adequate distribution of effort throughout each stock area.

A fall research gill net program was conducted in WB-NDB and BB-TB from 1980 to 1991. Catch rates at age are provided (Table11-12 and Fig. 8–9) and were used in ADAPT formulations for these stock areas.

In 2008, 26 fishers participated in the program (Table 13 and Fig. 10), eight in WB-NDB, eight in BB-TB, six in SMB-PB and four in FB. Catch rates (numbers by spawning type per nights fished) are available from 1988 to 2008 for WB-NDB and BB-TB and from 1982 to 2008 for SMB-PB and FB. Catch rates at age are available up to and including 2007 only (Table 14-17 and Fig. 11, 13, 15 and 17), as biological samples for 2008 have not yet been processed. The variance estimates on catch rates are large due to inherent variability and the limited sample size of fishers (Fig. 19).

In WB-NDB, catch rates of spring and autumn spawners combined increased, but not significantly, from 307 (fish per nights fished) in 2006 to 341 in 2007 and then decreased, but not significantly, to 233 in 2008 (Table 14). The 2008 catch rate was below average (Fig. 19), 61% of the long-term mean (1988–2008). Catch rates decreased significantly from 1992 to 2002. In 2007, the 2002 year class accounted for 49% of catch numbers, followed by the 2001 year class at 15% (Fig. 11 and 12). The age distribution was extensive, as 5 year classes (includes fish age 11+) each accounted for greater than 5% of the catch. Spring spawners accounted for 58% of the catch, an increase of 9% from 2006.

In BB-TB, catch rates of spring and autumn spawners combined increased, but not significantly, from 253 (fish per nights fished) in 2006 to 364 in 2007 and then decreased, but not significantly, to 186 in 2008 (Table 15). The 2008 catch rate was above average (Fig. 19), 124% of the long-term mean (1988–2008). Catch rates increased significantly from 2002 to 2007. In 2007, the 2002 year class accounted for 49% of catch numbers, followed by the 2000 year class at 35% (Fig. 13 and 14). The age distribution was extensive, as 5 year classes

(includes fish age 11+) each accounted for greater than 5% of the catch. Spring spawners accounted for 40% of the catch, a decrease of 15% from 2006.

In SMB-PB, catch rates of spring and autumn spawners combined decreased, but not significantly, from 107 (fish per nights fished) in 2006 to 72 in 2007 and again, but not significantly, to 29 in 2008 (Table 16). The substantial decrease in 2008 was attributable to very low catch rates of two fishers in SMB. The 2008 catch rate was below average (Fig. 19), 17% of the long-term mean (1982–2008) and was the second lowest in the time series. In 2007, the 2002 year class accounted for 36% of catch numbers, followed by the 2000 year class at 24% (Fig. 15 and 16). The age distribution was extensive, as 5 year classes (includes fish age 11+) each accounted for greater than 5% of the catch. Spring spawners accounted for 33% of the catch, a decrease of 41% from 2006.

In FB, catch rates of spring and autumn spawners combined decreased, but not significantly, from 348 (fish per nights fished) in 2006 to 218 in 2007, and then increased, but not significantly, to 338 in 2008 (Table 17). The 2008 catch rate was below average (Fig. 19), 56% of the long-term mean (1982–2008). In 2007, the 2002 year class accounted for 49% of catch numbers, followed by fish age 11+ at 30% (Fig. 17 and 18). The age distribution was truncated, as only 4 year classes (includes fish age 11+) each accounted for greater than 5% of the catch. Spring spawners accounted for 83% of the catch, an increase of 7% from 2006.

ACOUSTIC SURVEYS

As part of the assessment process, DFO Science conducted 32 acoustic surveys between 1983 and 2000. These surveys provided empirical estimates of herring abundance by stock area independent of the commercial fishery and were used to calibrate population abundance models. Subsequent to 2000, the surveys were eliminated due to budgetary restrictions within the Department and a re-focusing of research effort in other areas. Acoustic survey methodology and results have been described in previous research documents (see Wheeler et al. 1999 for example). Biomass estimates are provided (Tables 18 and Fig. 20) as they were used in ADAPT formulations.

COMMERCIAL GILL NET LOGBOOK PROGRAM

This program, initiated in 1996, provides a time series of standardized catch per unit effort (CPUE) data from the commercial gill net and bait fisheries. The logbook, described in Wheeler et al. (1999), is designed to be completed by gill net fishers in the spring commercial (food fish) fishery, spring bait (lobster) fishery, and/or fall commercial fishery. Fishers are asked to provide information regarding the number and dimensions of their gill nets, by mesh size. They are also asked to complete a logbook entry for each day that a net or nets are hauled. This entry includes the date, the number of nets hauled by mesh size, the number of nights that the nets had fished, and the approximate catch weight. Fishers are also asked questions to obtain their observations of herring abundance.

Each year, logbooks are sent to approximately 2800 licensed fishers and/or bait permit holders from WB to FB, including CB-SS. The return of logbooks is voluntary and the numbers returned are generally very low. In 2008, 30 logbooks were returned (to October 21st) and, depending upon the area fished, most returns were from winter/spring/early summer fisheries (Table 19). Logbooks from fall fisheries were even more limited in number and were not

included in the analysis. In most areas and years, the number of logbook returns is small, generally less than 10. Given inherent variability and small sample sizes, these data provide very limited information as an abundance index.

In an effort to increase commercial gill net logbook return rates, reminder letters were sent to fishers in 2007 (June) and in 2008 (August). Results are mixed; logbook returns increased in all areas from 2006 to 2007 but decreased in all areas from 2007 to 2008. It was recommended during the 2006 RAP, that data from logbooks returned after the reminder letters were sent should be compared with data from logbooks returned prior to the letters being sent. This was not an issue in 2007 as all logbooks were returned after the reminder was sent in June. This is common throughout the time series as most fishers who return logbooks do so after the completion of the spring bait fishery. In 2008, of the 29 logbooks returned (with catch data), 14 were returned prior to the reminder in August, and 15 were returned subsequently (Table 20). It is difficult to conclude if the reminder impacted results, as catch rates increased in two areas (WB-NDB and BB-TB) and decreased in two areas (SMB-PB and FB) from logbooks returned after the reminder was sent. Similarly, cumulative indices increased in three areas (WB-NDB, SMB-PB and FB) and decreased in the fourth (BB-TB). As indicated above, given inherent variability and small sample sizes, it is unlikely that the impact of a reminder letter could be determined.

During the 2006 RAP, concerns were expressed that opinion-based abundance indices, as derived from fisher's observations of herring abundance, may be confounded by differing reference periods from which current year estimates are compared. To address this concern, a new cumulative index was calculated based upon fisher's observation of abundance from commercial gill net logbooks, from phone surveys, and from purse seine questionnaires. The cumulative index is similar to that calculated for Div. 4T herring (LeBlanc et al. 2007). It is a comparison of the current year observation of abundance with the previous year observation of abundance. The 1 to 10 scale of abundance, where 5.5 is the average (used in previous assessments), is converted to a scale of -4.5 to +4.5, where 0.0 is the average. A fisher's observation of change in abundance from year "n-1" to year "n" is recorded as a "plus" or "minus" on this scale. An average is then derived for all fishers (by stock area); this is added to or subtracted from the previous year's estimate. Comparison of the cumulative indices, as derived from commercial gill net logbooks, with indices used in previous assessments (Fig. 21) indicate similar temporal trends for most stock areas (except SMB-PB).

In WB-NDB, logbook returns increased from 10 in 2006 to 15 in 2007, and then decreased to 8 in 2008 (Table 19). Effort (net nights per fisher) decreased by 64% from 2007 to 2008, and was substantially lower in 2008 than for the research gill net program (Fig. 22). Catch rates (kilograms per standard net per nights fished) decreased, but not significantly, from 65.9 in 2006 to 41.0 in 2007, and then increased, but not significantly, to 86.2 in 2008 (Table 19). The 2008 catch rate was above average (Fig. 23), 261% of the long-term mean (1996–2008) and the highest in the time series. Catch rates increased significantly from 2002 to 2008. Fishers indicated (cumulative index) an increasing trend in abundance in the past five years and abundance in 2008 was higher than in 2007 (Fig. 24).

In BB-TB, logbook returns increased from 12 in 2006 to 13 in 2007, and then decreased to only 3 in 2008 (Table 19). Effort (net nights per fisher) decreased by 83% from 2007 to 2008, and was substantially lower in 2008 than for the research gill net program (Fig. 22). Catch rates (kilograms per standard net per nights fished) increased, but not significantly, from 46.4 in 2006 to 85.6 in 2007, and then decreased, but not significantly, to 16.8 in 2008 (Table 19). The 2008 catch rate was below average (Fig. 23), 55% of the long-term mean (1996-2008). Catch rates

increased significantly from 2002 to 2007. Fishers indicated (cumulative index) an increasing trend in abundance in the past five years and abundance in 2008 was lower than in 2007 (Fig. 24).

In SMB-PB, logbook returns increased from 5 in 2006 to 9 in 2007, and then decreased to 7 in 2008 (Table 19). Effort (net nights per fisher) increased by 72% from 2007 to 2008, and was higher in 2008 than for the research gill net program (Fig. 22). Catch rates (kilograms per standard net per nights fished) increased, but not significantly, from 9.1 in 2006 to 17.4 in 2007, and then to 36.8 in 2008 (Table 19). The 2008 catch rate was above average (Fig. 23), 196% of the long-term mean (1996–2008) and the second highest in the time series. Fishers indicated (cumulative index) a decreasing trend in abundance in the past five years and abundance in 2008 was lower than in 2007 (Fig. 24).

In FB, logbook returns increased from 6 in 2006 to 15 in 2007, and then decreased to 12 in 2008 (Table 19). Effort (net nights per fisher) decreased by 36% from 2007 to 2008, but was higher in 2008 than for the research gill net program (Fig. 22). Catch rates (kilograms per standard net per nights fished) increased, but not significantly, from 11.6 in 2006 to 30.3 in 2007, and then to 50.9 in 2008 (Table 19). The 2008 catch rate was above average (Fig. 23), 129% of the long-term mean (1996–2008). Catch rates decreased significantly from 2002 to 2006. Fishers indicated (cumulative index) a decreasing trend in abundance in the past five years and abundance in 2008 was lower than in 2007 (Fig. 24).

GILL NET TELEPHONE SURVEY

The gill net telephone survey, first conducted in the fall of 2006, was continued in 2007 and 2008. The objectives of the survey were two-fold: 1) to determine how many herring gill net licence and/or bait permit holders fished in the current year, and 2) to obtain observations of herring abundance and other information from those that did fish.

Each year, Policy and Economics Branch provides a list of all herring gill net licence and/or bait permit holders in each of the four assessed stock areas. Sample sizes are determined to provide a 10% margin of error for all areas combined, assuming an 80% response rate (Gower and Kelly 1993). A 10% margin of error is deemed to be acceptable as it indicates that survey results are accurate 90% of the time (for all areas combined). An 80% response rate was chosen as this is comparable with telephone response rates for surveys of capelin fishers in the same area (Nakashima pers. comm.).

The names of fishers to be contacted were chosen randomly. Each fisher was telephoned a maximum of three times (at different times and on different days). If a fisher could not be contacted after three attempts, it was considered a ‘nil’ response.

Based upon recommendations from the 2006 RAP, the 2007 phone survey questions were revised to provide enhanced information. The same questions, updated by “year + 1” were used in 2008. Upon contact, each fisher was asked the following questions:

1. Did you fish herring gill nets for either commercial or bait purposes in 2007? If NO, then thank him/her very much and end the questionnaire.

2. In 2007, did you fish herring for commercial sale or for bait purposes?

3. In 2007, how many nets did you fish?

4. In 2007, approximately how many times did you haul your net(s)?

5. In 2007, approximately how much herring (lbs.) did you catch?

6. Using a scale of 1 to 10, with 1 being the lowest, 5½ being average, and 10 being the highest, how abundant were herring in your fishing area in 2007 compared to the last decade (approximately 1997 to 2007)?

7. Did you fish herring gill nets in 2006? If NO, continue to question # 10.

8. Using a scale of 1 to 10, with 1 being the lowest, 5½ being average, and 10 being the highest, how abundant were herring in your fishing area in 2006 compared to the last decade (approximately 1996 to 2006)?

9. Using a scale of 1 to 10, with 1 being the lowest, 5½ being average, and 10 being the highest, how abundant were herring in your fishing area in 2007 compared to 2006?

10. Do you have any comments regarding the herring stock in your area?

Although catch and effort information was collected in the 2007 and 2008 phone surveys (questions 3–5), it has not been incorporated in this assessment. In assessing observations of abundance, it was assumed that observations of all active fishers were equal, regardless of their level of effort. Cumulative indices, based upon responses to question 9, were calculated for the time series (2006–2008), as described earlier for observation data from commercial gill net logbooks.

There were 2267 licence and/or bait permit holders within the four stock areas in 2008 (Table 21). Attempts were made to contact 415 fishers. Of these, 346 were contacted, representing a 83% response rate. Of those who were contacted, only 142 (41%) fished in 2008. Of those who fished, a large majority (99%) fished for bait purposes only.

In 2008, attempts were made to contact 113 fishers in WB-NDB, 12% of all licence and bait permit holders (Table 21). The response rate was 81%, and of the 92 fishers contacted, 32 fished in 2008, all for bait purposes. All active fishers were in NDB (Fig. 25) and observed abundance appeared to be greater in the eastern part of the bay. Fishers indicated (cumulative index) an increasing trend in abundance since the survey began in 2006 and abundance in 2008 was higher than in 2007 (Fig. 28). This agreed with the cumulative index derived from gill net logbooks (Fig. 28).

In BB-TB, attempts were made to contact 106 fishers, 19% of all licence and bait permit holders (Table 21). The response rate was 87%, and of the 92 fishers contacted, 43 fished in 2008, mostly for bait purposes (95%). Active fishers were widely distributed throughout the stock area (Fig. 26) and observed abundance appeared to be above average in both bays. Fishers indicated (cumulative index) an increasing trend in abundance since the survey began in 2006 and abundance in 2008 was higher than in 2007 (Fig. 28). The cumulative index derived from gill net logbooks indicated that abundance in 2008 was lower than in 2007 (Fig. 28).

In SMB-PB, attempts were made to contact 102 fishers, 23% of all licence and bait permit holders (Table 21). The response rate was 77%, and of the 78 fishers contacted, only 17 fished in 2006, all for bait purposes. The majority of active fishers were in PB (Fig. 27) where observed abundance appeared to be above average. Fishers indicated (cumulative index) an increasing trend in abundance since the survey began in 2006 and abundance in 2008 was higher than in 2007 (Fig. 28). This differed substantially from the cumulative index derived from gill net logbooks which indicated a decreasing trend over the same period and abundance in 2008 was lower than in 2007 (Fig. 28).

In FB, attempts were made to contact 94 fishers, 31% of all licence and bait permit holders (Table 21). The response rate was 89%, and of the 84 fishers contacted, 50 fished in 2008, all for bait purposes. Active fishers were widely distributed throughout the stock area (Fig. 27) and observed levels of abundance were mixed across the area. Fishers indicated (cumulative index) a decreasing trend in abundance since the survey began in 2006 and abundance in 2008 was lower than in 2007 (Fig. 28). This agreed with the cumulative index derived from gill net logbooks (Fig. 28).

In the 2006 assessment (Wheeler et al. 2006), observations of abundance from gill net logbooks were used as an index of abundance in evaluating stock status from 1996 to 2004. Observations of abundance from the 2006 telephone survey were used to evaluate stock status in 2005 and 2006 as sample sizes were much larger and spatial survey coverage was much better than for logbooks. In this assessment, cumulative indices from gill net logbooks (1996-2008) and from telephone surveys (2006–2008) were used independently to evaluate stock status.

As indicated earlier, official statistics do not include landings for bait purposes for most years. Consequently, based upon results of the 2006-2008 telephone surveys, landings of 95% or more of active gill net fishers are not included in annual landings data. Estimates of bait landings can be calculated for 2007 and 2008 as estimates of catch were provided by active fishers in the telephone survey (Table 22). These estimates (averaged for 2007 and 2008) are as follows:

	WB-NDB	BB-TB	SMB-PB	FB
Average annual estimated bait landings (t)	600	550	150	450
Bait landings estimate (t) used by FAM	500	300	150	400

For all stock areas, annual estimated bait landings from the telephone survey were equal to or greater than those used by Fisheries and Aquaculture Management Branch in the 2007–2008 integrated herring management plan. The calculation of bait landings from telephone survey results provides an important method for correcting catch at age data, critical for analytical models of population estimation.

As recommended during the 2006 RAP, comparisons were made of the observations of abundance of common gill net fishers who returned gill net logbooks and who were also contacted in the telephone survey (Fig. 29). In total, from 2006 to 2008, there were 17 common fishers across all stock areas. Due to the limited sample size, results were pooled. Current year and previous year observations of abundance were evaluated. Abundance observations of common fishers from gill net logbooks and from phone surveys should be linearly related;

however, this was not the case. Although the sample size is very small and the results are combined for all areas and years, this suggests that annual observations of abundance given by gill net fishers can differ substantially dependent upon when observations are provided. It has been suggested by some fishers that observations provided during the fall (i.e. telephone survey) may be more appropriate as they would include observations over a longer period during the fishing season.

COMMERCIAL PURSE SEINE QUESTIONNAIRE

This program, initiated in 1996, provides a quantitative evaluation of biological and fishery related information from herring purse seine fishers. Each year, attempts are made to contact all active fishers by telephone after the purse seine fishery and each fisher is asked a series of standardized questions (Wheeler et. al. 1999). Response rates are high for most areas and years; in 2007, 20 of 23 fishers (87%) responded to the survey (Table 23). For WB-NDB and BB-TB, where there is a fall fishery only, survey results are available to 2007. For SMB-PB, where there is a winter/spring fishery, survey results are available to 2008. There is no purse seine fishery in FB.

A cumulative index was also calculated based upon purse seine fisher observations of abundance. A comparison between the cumulative index and the index used in previous assessments is provided in Fig. 31.

For WB-NDB, two of two active fishers responded to the questionnaire in 2007. Both fished in NDB only (Fig. 30). Their estimate of landings represented 98% of reported purse seine landings in 2007 (Fig. 30). They indicated (cumulative index) a decreasing trend in abundance in the past five years and abundance in the fall of 2007 was slightly lower than in 2006 (Table 23 and Fig. 31).

For BB-TB, fifteen of eighteen active fishers responded to the questionnaire in 2007. The majority fished in TB (Fig. 30). Their estimate of landings represented 118% of reported purse seine landings in 2007 (Fig. 30). They indicated (cumulative index) an increasing trend in abundance in the past five years and abundance in the fall of 2007 was higher than in 2006 (Table 23 and Fig. 31).

For SMB-PB, two of two active fishers responded to the questionnaire in 2008. One fished in SMB and one in PB (Fig.30). Their estimate of landings represented 137% of reported purse seine landings in 2008 (Fig. 30). They indicated (cumulative index) an increasing trend in abundance in the past five years and abundance in the spring of 2008 was lower than in 2007 (Table 23 and Fig. 31).

Information from the purse seine questionnaires provides another source of uncertainty regarding commercial landings statistics. For approximately 38% of the records (area x year), estimated landings from the purse seine questionnaire were greater than the official reported purse seine landings. The differences were variable and ranged from 5% to greater than 200%. This is further exacerbated as the estimate of removals (landings plus dead discards) from the questionnaire was greater than the estimated landings from the questionnaire for 73% of the records. These differences were also variable and ranged from 1% to over 200%.

SUMMARY OF ABUNDANCE INDICES

Seven abundance indices have been documented for east and southeast Newfoundland herring in this document:

1) spring research gill net catch rates
2) fall research gill net catch rates
3) acoustic biomass estimates
4) gill net logbook catch rates
5) gill net fisher index (from logbooks)
6) gill net logbook index (from phone surveys)
7) purse seine fisher index

Before attempting to determine stock status, all indices were examined together for the entire time period of the indices, 1980–2008 (Fig. 32) and for the more recent time period, 1996–2008, of the current indices (Fig. 33). To compare trends, each index was standardized to its mean. Spring and fall research gill net catch rates of spring and autumn spawners were combined. For the most recent period (Fig. 33), indices exhibit a fair degree of coherence for WB-NDB, BB-TB and FB. For WB-NDB, most indices showed an upward trend from approximately 2002 to 2008. For BB-TB, the upward trend peaked in 2007 and indices were lower in 2008. For FB, most indices showed a downward trend from the late 1990s to 2006 or 2007. Since then, observation indices show a continued downward trend whereas catch rate indices show upward movement. For SMB-PB it is not as clear as there is little coherence between indices.

BIOLOGICAL DATA

GROWTH

Mean lengths and weights at age of spring and autumn spawning herring from 1970 to 2007 were calculated (Tables 24–27 and Fig. 34–35). Lengths and weights at age were calculated from samples collected from January to June to minimize the impact of seasonal growth. The mean lengths and weights at age of herring decreased in all areas during the 1980's and 1990's. In recent years, growth rates have increased and/or stabilized. However, the mean weights of both spring and autumn spawners in 2007 were still below the long term mean (1970 –2007) in all areas. The implications of these changes in growth on fisheries management are described in Wheeler et al. (2008).

RECRUITMENT

Good survival of young herring (i.e. recruitment) through the 1960's to 1980's was largely influenced by suitable environmental conditions, principally warm over-wintering water temperatures and high salinities prior to spawning (Winters and Wheeler 1987). Ocean temperatures and salinities in the early to mid 1990's were below average. However, since the late 1990's ocean temperatures in coastal Newfoundland waters have been warmer and above the long-term mean. More recently, salinities have also increased and are above the long-term mean. Recent higher temperatures and salinities may enhance recruitment.

Estimation of recruiting year class strength is important in evaluating the future prospects of these herring stocks. Estimates of relative year class size of spring and autumn spawners were available from the research gill net data set and in particular from mean research gill net catch rates at ages four, five, and six (Fig. 36). It should be noted that these estimates may be biased due to: systematic changes in growth due to changes in weight and presumably girth over time, the possible change in selection pattern of ages 4-6 over time, the selection of these age groups by the fishery in some years, and variable exploitation rates. For SMB-PB and FB, the time series included the 1976-2003 year classes. For WB-NDB and BB-TB, it included the 1982-2003 year classes. For each area and spawning type, there are seven mature year classes (1997-2003) that can be estimated. Based upon age at maturity analysis (Wheeler et al. 2008), fish age 4+ are considered to be fully mature. The 2003 year class (at age 4 in 2007) is the most recent recruiting year class that can be estimated. It was below average in all stock areas.

STOCK STATUS

VIRTUAL POPULATION ANALYSIS

The most recent analytical assessment of population size for these herring stocks was conducted in 2000 (Wheeler et al. 2001). At that time, an integrated catch at age analysis (ICA) was used to estimate population sizes for three of the four stock areas. The ICA model could not be fitted for the FB stock as catches and fishing mortalities were very low through much of the time series. Therefore, a research gill net catchability analysis was used to estimate the population size for FB at that time.

It was recommended during the 2006 RAP that an analytical analysis of population size be attempted for this assessment. Initially, the thought was to use ICA as it had been used successfully in the past and would have provided direct comparisons with earlier assessments. However, this was not possible as ICA has not been updated to work with current Windows software. Its successor, FLICA, was available but requires the use of software (R) that was not available. As an alternative, ADAPT (Gavaris 1988) was available and has been used successfully for estimating herring population sizes in Div. 4T (LeBlanc et al. 2007). The outputs of this model are also familiar to most assessment scientists and provide excellent visual representation of residual patterns for abundance indices.

In 2000, population sizes of spring spawners only were estimated as spring spawners were the dominant spawning component in all areas at the time. However, given the current importance of autumn spawners in some areas, it was felt that estimation of spring and autumn spawners should be attempted for all four stock areas.

The following data sources were used as input to the ADAPT model for each of the four stock areas and for each spawning type:

- Catch at ages 3 to 11+, 1970–2007 (Table 7–10)
- Weights at ages 3 to 11+, 1970–2007 (Table 24–27)
- Spring research gill net catch rates at ages, 1982–2007 (Tables 14–17)
- Fall research gill net catch rates at age, 1980–1991 (Table 11–12)
- Acoustic biomass estimates, 1983–2000 (Table 18)
- Gill net logbook catch rates, 1996-2007 (Table 19)
- Gill net fisher cumulative index (from logbooks), 1996–2007 (Table 19)
- Purse seine fisher cumulative index, 1996–2007 (Table 23)

The spring and fall research gill net catch rates were age disaggregated and catch rates at ages 3 to 11+ were available for spring and autumn spawners. They were considered in the model to estimate population numbers. The remaining indices (acoustic biomass estimates, gill net logbook catch rates, gill net fisher index and purse seine fisher index) were age aggregated and were for spring and autumn spawners combined. They were considered in the model to estimate population biomass. All indices were considered to be proportionally related to population abundance, except acoustic biomass estimates, which were considered to be absolute. The gill net fisher cumulative index (from phone surveys) was not included due to its short time series of three years.

For all model formulations, the following 2008 population numbers (‘000) were used:

Stock Area	Spawning Type	Age 3 (assigned)	Age 4+ (estimated)
WB-NDB	Spring	500	500
	Autumn	200	200
BB-TB	Spring	3000	3000
	Autumn	2000	2000
SMB-PB	Spring	100	100
	Autumn	1500	1500
FB	Spring	6000	6000
	Autumn	200	200

Age 3 in 2008 had to be assigned a starting value as this cohort was not represented in any of the indices. These starting values were chosen as they were greater than the catch number for any cohort in 2007 (Rivard and Gavaris 2003).

A fixed maturity ogive was used for all areas and both spawning types (Wheeler et al. 1989):

	Age 3	Age 4	Age 5+
Maturity Ogive	0.35	0.60	1.00

This was the same maturity ogive used in the 2000 ICA model. Similarly, natural mortality was assumed to be 0.20 for all ages and years, as in 2000.

The ADAPT model allows the fishing mortality for the oldest age group (in this case age 11+) to constrained in two ways: 1) the F on the oldest age group is either assigned or estimated to be a fixed ratio of the F on the next youngest age group, or 2) the F on the oldest age group is calculated to be the average fishing mortality of an assigned group of ages. For all of the formulations in this assessment, the F on age 11+ was assigned to be equal to the F on age 10.

Unfortunately, there is no formula to determine if an ADAPT calibration provides an accurate estimate of current and historical population sizes. Rivard and Gavaris (2003) indicate that special attention should be given to the relative error of the parameter estimates and to their bias estimates. Large values of the relative error (greater than 50%) indicate poor precision. They also indicate that for the proportional catchability model (as in this assessment), the catchability coefficients at age are assumed to be constant over time. When this assumption is violated for a given index, the residuals aggregated for all ages in any given year will usually show trends or patterns over time. Although these are parameters that can be examined, each ADAPT calibration must be evaluated on its own merits. In evaluating ADAPT calibrations in this assessment, the results of two recent assessments have been considered. In the 2006 assessment of Div. 3Ps cod, the parameter estimates had a mean square residual of approximately 0.65. This calibration was rejected due to poor fit and other reasons (Healey, pers. comm.). In the 2007 assessment of Div. 4T herring, results indicated a model fit with a mean square residual of 0.38. The residual plots for age disaggregated indices showed distinct patterns with strong year effects and some cohort effects. The model fit was considered unreliable and the residual patterns put into doubt its use as a true indicator of current biomass levels (LeBlanc et al. 2007).

ADAPT calibrations by stock area and spawning type were prepared for this assessment. Diagnostics, including mean square residuals, relative errors and biases are presented in Table 28–31. Examples of residual plots for WB-NDB spring and autumn spawners are presented in Fig. 37 and 38; residuals for BB-TB, SMB-PB, and FB were not plotted but exhibited patterns to those for WB-NDB. Diagnostics, illustrating the impacts of removing indices from an ADAPT calibration, are presented in Table 32–35. Comparison of spring spawner biomass estimates (ages 5+) from the illustrative ADAPT calibrations in this assessment with ICA age 5+ biomass estimates from the 2000 assessment (Wheeler et al. 2001) are presented in Fig. 39.

For WB-NDB spring spawners, the mean square residual was 2.42 and relative errors for ages 4 to 11+ in 2008 ranged from 0.618 to 1.719 (Table 28). For autumn spawners, the mean square residual was 3.19 and relative errors for ages 4 to 11+ in 2008 ranged from 0.473 to 1.813 (Table 28). Large relative errors indicated a lack of precision in the estimation of current population numbers. Residual plots indicated strong year effects and some cohort effects for spring research gill net catch rates, and strong year effects for acoustic survey estimates, and for gill net and purse seine fisher indices (Fig. 37 and 38). Mean square residuals increased with the removal of indices from the ADAPT calibration (Table 32). Comparison of ADAPT and ICA spring spawner biomass estimates indicated similar downward trends (Fig. 39). However, the historical biomass estimated by ADAPT was approximately half that estimated by ICA.

For BB-TB spring spawners, the mean square residual was 1.92 and relative errors for ages 4 to 11+ in 2008 ranged from 0.392 to 1.404 (Table 29). For autumn spawners, the mean square residual was 3.01 and relative errors for ages 4 to 11+ in 2008 ranged from 0.484 to 1.785 (Table 29). Large relative errors indicated a lack of precision in the estimation of current

population numbers. Residuals indicated strong year effects and some cohort effects for spring and fall research gill net catch rates, and strong year effects for acoustic survey estimates, for gill net and purse seine fisher indices, and lesser year effects for gill net logbook catch rates. Mean square residuals increased with the removal of indices from the ADAPT calibration (Table 33). Comparison of ADAPT and ICA spring spawner biomass estimates indicated similar historical estimates and subsequent downward trends (Fig. 39).

For SMB-PB spring spawners, the mean square residual was 1.51 and relative errors for ages 4 to 11+ in 2008 ranged from 0.435 to 1.468 (Table 30). For autumn spawners, the mean square residual was 2.37 and relative errors for ages 4 to 11+ in 2008 ranged from 0.902 to 5.049 (Table 30). Large relative errors indicated a lack of precision in the estimation of current population numbers. Residuals indicated strong cohort effects and some year effects (1996 to 2002) for spring research gill net catch rates, and strong year effects for acoustic survey estimates, and purse seine fisher indices, and lesser year effects for gill net logbook catch rates and gill net fisher indices. Mean square residuals increased with the removal of indices from the ADAPT calibration (Table 34). Comparison of ADAPT and ICA spring spawner biomass estimates indicated similar historical estimates and subsequent downward trends (Fig. 39).

For FB spring spawners, the mean square residual was 5.52 and relative errors for ages 4 to 11+ in 2008 ranged from 1.403 to 5.600 (Table 31). For autumn spawners, the mean square residual was 4.88 and relative errors for ages 4 to 11+ in 2008 ranged from 1.078 to 4.457 (Table 31). Large relative errors indicated a lack of precision in the estimation of current population numbers. Residuals indicated strong year and cohort effects for spring research gill net catch rates, and strong year effects for acoustic survey estimates, and gill net fisher indices, and lesser year effects for gill net logbook catch rates. Mean square residuals increased with the removal of indices from the ADAPT calibration (Table 35). Comparison of ADAPT and ICA spring spawner biomass estimates indicated very little similarity (Fig. 39).

The combination of large mean square residuals, large relative errors of parameter estimates, and strong year and/or cohort residual patterns indicate that the model fits of these ADAPT calibrations, by stock area and spawning type, are unreliable and do not provide a true indicator of current population levels. It is also not surprising that the estimates for autumn spawners are less reliable than for spring spawners as the spring research gill net catch rates, which are the dominant indicator in the ADAPT calibrations, are designed to estimate spring spawner abundance.

PERFORMANCE REPORT METHODOLOGY

As in the last three assessments (Wheeler et al. 2003, Wheeler et. al. 2004, Wheeler et al. 2006), performance reports were used to summarize current status and prospects of each stock (Tables 37-40). Observations on abundance indices and biological characteristics were interpreted and then evaluated using the traffic light method (Caddy 1998). This method uses a system of red (-), yellow (?), and green (+) lights to categorize indicators as ‘cause for concern’, ‘uncertain’, or ‘positive’. In this assessment, ‘uncertain’ was defined as ‘uncertainty of an interpretation’ rather than precautionary uncertainty.

In the past, four series of abundance indices were evaluated for each stock including: research gill net catch rates (spring and autumn spawners combined), commercial and/or bait gill net catch rates (from logbooks), gill net fisher observations (from logbooks and telephone survey), and purse seine fisher observations (from questionnaires). Purse seine fisher

observations were not available for FB, as there is no purse seine fishery in the area. In this assessment, gill net fisher observations from telephone surveys were considered separately from gill net observations from logbooks and cumulative indices were used to describe gill net and purse seine fisher observations. Biological characteristics, including research gill net age compositions and year class sizes were also evaluated.

Current stock status was described based upon a standardized (but arbitrary) evaluation of all abundance indices and age composition of mature age groups (Table 36). Abundance indices and age composition data were weighted based upon their perceived importance and reliability in assessing current status. Research gill net catch rates were given the most weight, followed by research gill net age compositions, and then commercial gill net catch rates, gill net fisher observations and purse seine fisher observations. Weightings were unchanged from the last assessment (Wheeler et al. 2006). New rankings were formulated for the cumulative indices (gill net fisher from logbooks, gill net fisher from telephone surveys, and purse seine fisher).

Future prospects were described by evaluating the strengths of fishery dependent year classes (2001 and 2002) and other mature year classes (1998-2000) and of the 2003 recruiting year class, as estimated from research gill net catch rates at age (Table 36). The strengths of fishery dependent year classes were given the most weight, followed by the strengths of other mature year classes and of the 2003 recruiting year class.

The calculation of standardized composite performance report indices (Fig. 40) allows for inter-annual comparisons from 1997 to 2008. Research gill net catch rates were compared to historical population estimates (Wheeler et al. 2001) to evaluate current vs. historical status (Fig. 41).

Current performance indices were compared to those from the last assessment (Fig. 42) to assess the impacts of considering gill net indices from logbooks and telephone surveys separately, and using cumulative indices for gill net and purse seine fisher observations. Changes made for this assessment had no impact on historical perspectives.

During the 2006 RAP it was recommended that the coherence of data-based and opinion-based indices be examined to clarify interpretative significance and as a guide to index weighting factors. This was evaluated by: 1) comparing current performance report indices, where individual indices are weighted, with report indices where all individual indices are unweighted (Fig. 43), and 2) comparing current performance report indices with report indices where all opinion-based indices were removed (Fig. 44). In the first analysis, trends were very similar for all stocks except SMB-PB. In the second analysis, trends were similar for all stocks except for divergence in recent years in SMB-PB and FB.

WHITE BAY–NOTRE DAME BAY

The fishery

Reported landings increased from 309 t in 2006 to 362 t in 2007; 21% of the TAC was taken in 2007 (Table 1). In addition to reported landings, approximately 600 t was estimated (from gill net telephone survey) to have been taken for bait purposes. Fishers reported no discard mortality in the 2007 fall purse seine fishery (Table 23).

Documented effort has declined since the 1980's. Purse seine effort in the fall fishery (sets per fisher) decreased by 83% from 1997 to 2007 (Table 23). Gill net effort (net nights fished per fisher) in the spring fishery decreased by 82% from 1996 to 2008 (Table 19).

The 2007 purse seine fishery, in November and December, was mostly in the Fogo Island area. The 2008 gill net fishery, from early May to early July, was mostly in NDB (Fig. 25).

Abundance indices

Research gill net catch rates (number of fish per nights fished) of spring and autumn spawners combined decreased, but not significantly, from 307 in 2006 to 233 in 2008 (Table 14). The 2008 catch rate was below average, 61% of the long-term mean (Fig. 19). Catch rates decreased significantly from 1992 to 2002.

Eight commercial gill net logbooks were returned in 2008. Catch rates (kilograms per standard net per nights fished) increased, but not significantly, from 65.9 in 2006 to 86.2 in 2008. The 2008 catch rate was above average, 261% of the long-term mean (Fig. 23) and the highest in the time series. Fishers indicated (cumulative index) an increasing trend in abundance in the past five years and abundance in 2008 was higher than in 2007 (Fig. 24).

There were 32 active gill net fishers contacted in the 2008 telephone survey. They indicated (cumulative index) an increasing trend in abundance since the survey began in 2006 and abundance in 2008 was higher than in 2007 (Fig. 28).

Two of two active purse seine fishers responded to the purse seine questionnaire in 2007. They indicated (cumulative index) a decreasing trend in abundance in the past five years and abundance in the fall of 2007 was slightly lower than in 2006 (Fig. 31).

Biological characteristics

The 2002 and 2001 year classes accounted for 49% and 15% respectively of the 2007 research gill net catch numbers (Table 14 and Fig. 12). The age distribution was extensive as 5 year classes (including age 11+ fish) each accounted for greater than 5% of the catch.

Based on research gill net catch rates of year classes since 1982, three of seven current mature year classes (1997-2003) are above average, three are below average, and one is average (Fig. 36). The 2003 recruiting year class is below. The strength of the 2004 year class cannot yet be quantified. However, all year classes in this time series (with the exception of the 1982 year class) are considered to be weak in relation to the strong year classes of the late 1960's (Wheeler et al. 2001).

Current stock status

Biomass estimates are available to 2001 from an integrated catch at age analysis (Wheeler et al. 2001). A visual comparison with research gill net catch rates suggests that current abundance is substantially lower than in the 1970's (Fig. 41).

A standardized performance index is available for 1997-2008 (Fig. 40). The composite index indicates that stock status has improved from 2002 to 2008.

Stock outlook

Short term prospects are uncertain; the 2003 year class is below average and equal numbers of mature year classes are above and below average but are weak compared to year classes since 1982 (Fig. 36). All year classes in the time series (except 1982) are weak compared to historical levels.

BONAVISTA BAY-TRINITY BAY

The fishery

Reported landings increased from 1904 t in 2006 to 2777 t in 2007; 69% of the TAC was taken in 2007 (Table 2). In addition to reported landings, approximately 550 t was estimated (from gill net telephone survey) to have been taken for bait purposes. Fishers reported no discard mortality in the 2007 fall purse seine fishery (Table 23).

Documented effort (sets per fisher) in the purse seine fishery has increased in recent years and peaked in 2007 (Table 23). Gill net effort (net nights fished per fisher) in the spring fishery decreased by 93% from 1996 to 2008 (Table 19).

The 2007 purse seine fishery, in November and December, was in the northern part of BB and in Northwest Arm and the southern part of TB. The 2008 gill net fishery, from late April to late June, was distributed widely throughout the stock area (Fig. 26).

Abundance indices

Research gill net catch rates (number of fish per nights fished) of spring and autumn spawners combined decreased, but not significantly, from 253 in 2006 to 186 in 2008 (Table 15). The 2008 catch rate was above average, 124% of the long-term mean (Fig. 19). Catch rates increased significantly from 2002 to 2007.

Three commercial gill net logbooks were returned in 2008. Catch rates (kilograms per standard net per nights fished) decreased, but not significantly, from 46.4 in 2006 to 16.8 in 2008. The 2008 catch rate was below average, 55% of the long-term mean (Fig. 23). Fishers indicated (cumulative index) an increasing trend in abundance in the past five years and abundance in 2008 was lower than in 2007 (Fig. 24).

There were 43 active gill net fishers contacted in the 2008 telephone survey. They indicated (cumulative index) an increasing trend in abundance since the survey began in 2006 and abundance in 2008 was higher than in 2007 (Fig. 28).

Fifteen of eighteen active purse seine fishers responded to the purse seine questionnaire in 2007. They indicated (cumulative index) an increasing trend in abundance in the past five years and abundance in the fall of 2007 was higher than in 2006 (Fig. 31).

Biological characteristics

The 2002 and 2000 year classes accounted for 49% and 35% respectively of the 2007 research gill net catch numbers (Table 15 and Fig. 14). The age distribution was extensive as 5 year classes (including age 11+ fish) each accounted for greater than 5% of the catch.

Based on research gill net catch rates of year classes since 1982, five of seven current mature year classes (1997-2003) are above average (Fig. 36). The 2003 recruiting year class is below. The strength of the 2004 year class cannot yet be quantified. However, all year classes in this time series (with the exception of the 1982 year class) are considered to be weak in relation to the strong year classes of the late 1960's (Wheeler et al. 2001).

Current stock status

Biomass estimates are available to 2001 from an integrated catch at age analysis (Wheeler et al. 2001). A visual comparison with research gill net catch rates suggests that current abundance is substantially lower than in the 1970's (Fig. 41).

A standardized performance index is available for 1997-2008 (Fig. 40). The composite index indicates that stock status improved from 2002 to 2007 and deteriorated in 2008.

Stock outlook

Short term prospects are uncertain; the 2003 year class is below average but most mature year classes are above average compared to year classes since 1982 (Fig. 36). All year classes in the time series (except 1982) are weak compared to historical levels.

ST. MARY'S BAY-PLACENTIA BAY

The fishery

Reported landings decreased from 1528 t in 2006 to 759 t in 2007; 30% of the TAC was taken in 2007 (Table 4). In addition to reported landings, approximately 150 t was estimated (from gill net telephone survey) to have been taken for bait purposes. Fishers reported no discard mortality in the 2008 spring purse seine fishery (Table 23).

Documented effort increased from the 1980's to the 1990's. Purse seine effort (sets per fisher) peaked in 2000 and has since decreased by 79% from 2001 to 2008 (Table 23). Gill net

effort (net nights fished per fisher) peaked in 1998 and has since decreased by 73% from 1998 to 2008 (Table 19).

The 2008 purse seine fishery, from April to June, was on the eastern sides of PB and SMB. The 2008 gill net fishery, from early April to early June, was mostly in PB (Fig. 27).

Abundance indices

Research gill net catch rates (number of fish per nights fished) of spring and autumn spawners combined decreased, but not significantly, from 107 in 2006 to 29 in 2008 (Table 16). The 2008 catch rate was below average, 17% of the long-term mean (Fig. 19) and the second lowest in the time series.

Seven commercial gill net logbooks were returned in 2008. Catch rates (kilograms per standard net per nights fished) increased, but not significantly, from 9.1 in 2006 to 36.8 in 2008. The 2008 catch rate was above average, 196% of the long-term mean (Fig. 23) and the second highest in the time series. Fishers indicated (cumulative index) a decreasing trend in abundance in the past five years and abundance in 2008 was lower than in 2007 (Fig. 24).

There were 17 active gill net fishers contacted in the 2008 telephone survey. They indicated (cumulative index) an increasing trend in abundance since the survey began in 2006 and abundance in 2008 was higher than in 2007 (Fig. 28).

Two of two active purse seine fishers responded to the purse seine questionnaire in 2008. They indicated (cumulative index) an increasing trend in abundance in the past five years and abundance in the spring of 2008 was lower than in 2007 (Fig. 31).

Biological characteristics

The 2002 and 2000 year classes accounted for 36% and 24% respectively of the 2007 research gill net catch numbers (Table 16 and Fig. 16). The age distribution was extensive as 5 year classes (including age 11+ fish) each accounted for greater than 5% of the catch.

Based on research gill net catch rates of year classes since 1976, five of seven current mature year classes (1997-2003) are below average (Fig. 39). The 2003 recruiting year class is below. The strength of the 2004 year class cannot yet be quantified. However, all year classes in this time series are considered to be weak in relation to the strong year classes of the late 1960's (Wheeler et al. 2001).

Current stock status

Biomass estimates are available to 2000 from an integrated catch at age analysis (Wheeler et al. 2001). A visual comparison with research gill net catch rates suggests that current abundance is substantially lower than historical estimates in the 1970's (Fig. 41).

A standardized performance index is available for 1997-2008 (Fig. 40). The composite index indicates that stock status has deteriorated slightly from 2005 to 2008.

Stock outlook

Short term prospects are negative; the 2003 year class is below average but most mature year classes are also below average compared to year classes since 1976 (Fig. 36). All year classes in the time series are weak compared to historical levels.

FORTUNE BAY

The fishery

Reported landings increased from 2340 t in 2006 to 2448 t in 2007; 77% of the TAC was taken in 2007 (Table 5). In addition to reported landings, approximately 450 t was estimated (from gill net telephone survey) to have been taken for bait purposes.

Documented effort in the 1980's and 1990's was very low. There is no purse seine fishery in FB. However, bar seine and trap effort, which is not measured, has increased since 1999. In 1998, combined bar seine and trap landings were 0 t. From 1999 to 2008, combined bar seine and trap landings averaged 2135 t. Gill net effort (net nights fished per fisher) peaked in 1997 and has since decreased by 81% from 1997 to 2008 (Table 19).

In recent years, most landings have been taken by bar seines and traps in the spring, primarily in the Long Harbour area. The 2008 gill net fishery, from early April to mid June, was distributed widely throughout the stock area (Fig. 27).

Abundance indices

Research gill net catch rates (number of fish per nights fished) of spring and autumn spawners combined decreased, but not significantly, from 348 in 2006 to 338 in 2008 (Table 17). The 2008 catch rate was below average, 56% of the long-term mean (Fig. 19).

Twelve commercial gill net logbooks were returned in 2008. Catch rates (kilograms per standard net per nights fished) increased, but not significantly, from 11.6 in 2006 to 50.9 in 2008. The 2008 catch rate was above average, 129% of the long-term mean (Fig. 22). Fishers indicated (cumulative index) a decreasing trend in abundance in the past five years and abundance in 2008 was lower than in 2007 (Fig. 24).

There were 50 active gill net fishers contacted in the 2008 telephone survey. They indicated (cumulative index) a decreasing trend in abundance since the survey began in 2006 and abundance in 2008 was lower than in 2007 (Fig. 28).

Biological characteristics

The 2002 year class and fish age 11+ accounted for 49% and 30% respectively of the 2007 research gill net catch numbers (Table 17 and Fig. 18). The age distribution was truncated as 4 year classes (including age 11+ fish) each accounted for greater than 5% of the catch.

Based on research gill net catch rates of year classes since 1976, five of seven current mature year classes (1997-2003) are either average or below average (Fig. 39). The 2003 recruiting year class is below. The strength of the 2004 year class cannot yet be quantified.

Current stock status

Biomass estimates are available to 2001 from a research gill net catchability analysis (Wheeler et al. 2001). A visual comparison with research gill net catch rates suggests that current abundance is substantially lower than peak estimates in the late 1990's (Fig. 41).

A standardized performance index is available for 1997-2008 (Fig. 40). The composite index indicates that stock status deteriorated from 2001 to 2006 but has remained stable from 2006 to 2008.

Stock outlook

Short term prospects are negative; the 2003 year class is below average but most mature year classes are average or below average compared to year classes since 1976.

SOURCES OF UNCERTAINTY

The major uncertainty in this assessment continues to be the inability to estimate current stock sizes and exploitation rates, and to place these estimates within an historical context. Models which depend upon catch at age are difficult to calibrate due to low catch levels in some areas and years. Such models are further complicated due to uncertainties in the catch at age. Bait landings, which account for a large portion of the catch in some areas and years, are not included in official catch statistics for most years. Estimates of landings by purse seine fishers are higher than official statistics in some areas and years. Dead discards from the purse seine fishery are also not included in estimates of total removals.

The evaluation of trends within abundance indices is dependent, among other things, upon the uncertainties associated with each index. Due to the limited fishery and research data, sample sizes for most indices in these assessments, with the exception of the gill net fisher index from telephone surveys, are generally small resulting in higher uncertainties. This becomes particularly evident in their resulting residual patterns in ADAPT calibrations.

There continues to be concerns regarding how to quantify the observations of abundance of gill net and purse seine fishers in estimating current abundance.

Estimation of recruiting year class strength is important in evaluating the future prospects of these stocks. Recruitment data are available from the research gill net data set, and may be biased by systematic changes in growth. Strong year classes are normally seen across stock areas and quickly become dominant in most data sources. However, it is more difficult to predict the future prospects of weak and moderately strong year classes.

Standardization of performance reports requires the combination of several indices. In this assessment, as in the past, indices were weighted subjectively based upon the perceived degree to which each data source provides an index of abundance.

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Table 1. White Bay (WB)–Notre Dame Bay (NDB) herring landings and TAC's (t), by gear, 1997–2008.

Year	Area	Purse Seine	Bar Seine	Tuck Seine	Gill Net	Trap	Total	TAC
1997	WB	11	0	-	10	57	78	
	NDB	2364	0	-	11	7	2382	
	Combined	2375	0	-	21	64	2460	4900
1998	WB	106	0	-	6	27	139	
	NDB	484	7	-	30	1	522	
	Combined	606	7	-	36	28	661	2500
1999	WB	0	0	-	4	30	34	
	NDB	931	0	-	53	0	984	
	Combined	931	0	-	57	30	1018	2500
2000	WB	74	0	-	3	2	79	
	NDB	997	0	-	16	1	1014	
	Combined	1071	0	-	19	3	1093	2500
2001	WB	13	0	-	7	5	25	
	NDB	0	0	-	0	1	1	
	Combined	13	0	-	7	6	26	1100
2002	WB	0	13	-	6	5	23	
	NDB	303	0	-	7	23	333	
	Combined	300	13	-	13	28	357	1100
2003	WB	0	0	-	22	0	22	
	NDB	195	87	-	24	4	310	
	Combined	195	87	-	46	4	332	1100
2004	WB	11	2	-	4	28	45	
	NDB	152	48	-	8	13	220	
	Combined	163	50	-	12	40	265	1100
2005	WB	39	174	115	2	174	505	
	NDB	97	259	2	10	17	386	
	Combined	136	433	117	12	190	891	1100
2006*	WB	56	16	21	8	49	150	
	NDB	83	58	0	19	0	159	
	Combined	139	74	21	27	49	309	1100
2007*	WB	13	8	0	0	9	31	
	NDB	320	7	0	0	4	331	
	Combined	333	15	0	0	13	362	1700
2008*	WB	23	0	3	0	2	28	
	NDB	0	246	19	2	0	267	
	Combined	23	246	22	2	2	295	1700

* provisional

Table 2. Bonavista Bay (BB)–Trinity Bay (TB) herring landings and TAC's (t), by gear, 1997–2008.

Year	Area	Purse Seine	Bar Seine	Tuck Seine	Gill Net	Trap	Total	TAC
1997	BB	321	0	-	72	1	394	
	TB	329	211	-	129	41	710	
	Combined	650	211	-	201	42	1104	1600
1998	BB	352	62	-	148	0	562	
	TB	356	10	-	22	22	410	
	Combined	708	72	-	170	22	972	2500
1999	BB	563	222	-	94	0	879	
	TB	245	208	-	100	0	553	
	Combined	808	430	-	194	0	1432	2500
2000	BB	493	195	-	135	8	831	
	TB	2	190	-	67	0	259	
	Combined	495	385	-	202	0	1090	2500
2001	BB	241	16	-	37	0	294	
	TB	18	155	-	19	0	192	
	Combined	259	171	-	56	0	486	3500
2002	BB	0	297	-	25	7	329	
	TB	200	4	-	13	20	237	
	Combined	200	301	-	38	27	566	3500
2003	BB	343	1	-	48	90	482	
	TB	0	0	-	8	0	8	
	Combined	343		-	56	90	490	3000
2004	BB	188	139	-	3	2	322	
	TB	134	19	-	21	2	177	
	Combined	322	158	-	24	5	509	3000
2005	BB	910	456	21	154	82	1623	
	TB	604	103	142	163	5	1017	
	Combined	1515	559	162	317	87	2640	3000
2006*	BB	703	474	56	33	3	1268	
	TB	340	129	62	103	0	636	
	Combined	1043	603	118	136	3	1904	3000
2007*	BB	465	381	301	22	0	1169	
	TB	784	197	473	132	23	1608	
	Combined	1249	578	774	154	23	2777	4000
2008*	BB	110	197	405	12	7	731	
	TB	0	11	0	15	0	26	
	Combined	110	208	405	27	7	757	4000

* provisional

Table 3. Conception Bay (CB)–Southern Shore (SS) herring landings and TAC's (t), by gear, 1997–2008.

Year	Area	Purse Seine	Bar Seine	Tuck Seine	Gill Net	Trap	Total	TAC
1997	CB	177	0	-	0	0	177	
	SS	0	0	-	0	0	0	
	Combined	177	0	-	0	0	177	600
1998	CB	32	0	-	5	2	40	
	SS	0	0	-	0	0	0	
	Combined	32	0	-	5	2	40	600
1999	CB	0	0	-	0	0	0	
	SS	0	0	-	0	0	0	
	Combined	0	0	-	0	0	0	600
2000	CB	0	0	-	0	0	0	
	SS	0	0	-	0	0	0	
	Combined	0	0	-	0	0	0	600
2001	CB	0	0	-	0	0	0	
	SS	0	0	-	0	0	0	
	Combined	0	0	-	0	0	0	600
2002	CB	0	0	-	0	0	0	
	SS	0	0	-	0	0	0	
	Combined	0	0	-	0	0	0	600
2003	CB	0	0	-	0	0	0	
	SS	0	0	-	0	0	0	
	Combined	0	0	-	0	0	0	600
2004	CB	0	0	-	0	0	0	
	SS	0	0	-	0	0	0	
	Combined	0	0	-	0	0	0	600
2005	CB	1	3	0	3	1	8	
	SS	0	0	0	0	3	3	
	Combined	1	3	0	3	4	11	600
2006*	CB	0	0	0	7	0	7	
	SS	0	0	0	0	0	0	
	Combined	0	0	0	7	0	7	600
2007*	CB	94	0	0	0	0	94	
	SS	0	0	0	0	0	0	
	Combined	94	0	0	0	0	94	600
2008*	CB	0	0	0	0	0	0	
	SS	0	0	0	0	0	0	
	Combined	0	0	0	0	0	0	600

* provisional

Table 4. St. Mary's Bay (SMB)–Placentia Bay (PB) herring landings and TAC's (t), by gear, 1997–2008.

Year	Area	Purse Seine	Bar Seine	Tuck Seine	Gill Net	Trap	Total	TAC
1997	SMB	1650	0	-	1	0	1651	
	PB	2186	100	-	20	0	2306	
	Combined	3836	100	-	21	0	3957	6600
1998	SMB	707	0	-	14	0	721	
	PB	1574	0	-	4	0	1578	
	Combined	2281	0	-	18	0	2299	2000
1999	SMB	0	0	-	0	0	0	
	PB	330	0	-	1	0	331	
	Combined	330	0	-	1	0	331	2000
2000	SMB	0	0	-	0	0	0	
	PB	447	41	-	4	0	492	
	Combined	447	41	-	4	0	492	2000
2001	SMB	57	0	-	0	0	57	
	PB	394	213	-	38	0	645	
	Combined	451	213	-	38	0	702	2000
2002	SMB	100	0	-	0	0	100	
	PB	1297	0	-	135	36	1468	
	Combined	1398	0	-	135	36	1568	2000
2003	SMB	0	0	-	11	0	11	
	PB	925	19	-	74	0	1018	
	Combined	925	19	-	84	0	1029	2500
2004	SMB	342	0	-	79	0	421	
	PB	897	71	-	1	0	968	
	Combined	1240	71	-	179	0	1389	2500
2005	SMB	1101	43	0	0	2	1146	
	PB	146	0	0	134	0	280	
	Combined	1247	43	0	134	2	1426	2500
2006*	SMB	729	0	0	0	0	729	
	PB	649	0	0	150	0	799	
	Combined	1378	0	0	150	0	1528	2500
2007*	SMB	528	0	34	0	0	562	
	PB	30	0	0	167	0	197	
	Combined	558	0	34	167	0	759	2500
2008*	SMB	236	0	0	0	0	236	
	PB	0	0	0	79	7	86	
	Combined	236	0	0	79	7	322	2500

* provisional

Table 5. Fortune Bay (FB) herring landings and TAC's (t), by gear, 1997–2008.

Year	Purse Seine	Bar Seine	Tuck Seine	Gill Net	Trap	Total	TAC
1997	0	92	-	28	23	143	5400
1998	0	0	-	0	0	0	5400
1999	0	337	-	30	88	455	5400
2000	0	791	-	16	35	842	5400
2001	0	1592	-	0	190	1782	2700
2002	0	1895	-	0	364	2259	2700
2003	0	2427	-	0	880	3307	3700
2004	0	1655	-	54	1221	2930	3700
2005	0	2084	0	4	564	2652	3700
2006*	0	2026	0	4	310	2340	3700
2007*	0	1987	0	2	459	2448	3200
2008*	0	1816	28	2	626	2471	3200

* provisional

Table 6. South coast Newfoundland (Cape Ray to Pass Island) herring landings and TAC's (t) (Cinq Cerf Bay to Pass Island), by gear, 1998–2008.

Year	Purse Seine	Bar Seine	Tuck Seine	Gill Net	Trap	Total	TAC
1998	178	0	-	67	0	245	350
1999	1161	0	-	43	0	1205	350
2000	77	0	-	108	12	197	350
2001	843	0	-	127	66	1036	350
2002	261	28	-	170	50	510	350
2003	102	108	-	172	102	485	500
2004	0	0	-	29	213	243	500
2005	0	0	0	102	152	254	500
2006*	111	0	0	90	187	388	500
2007*	0	0	0	53	116	169	500
2008*	0	0	0	0	94	94	500

* provisional

Table 7. Commercial catch at age of spring and autumn spawning herring for White Bay–Notre Dame Bay, 1970–2007.

Spring Spawners

Age	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	195	26	3113
2	10	0	5	0	0	2	56	50	0	0	115	445	76	0	6	3	29	1105	407
3	0	129	290	727	4	128	24	1671	55	60	46	152	371	38	12	187	975	324	1044
4	12	88	2396	1411	123	215	506	107	2034	50	1240	41	332	46	124	350	2945	7201	291
5	24	161	353	2825	3142	453	237	468	317	2928	92	1231	59	23	1218	240	308	25843	2984
6	24	64	69	761	5446	5438	868	184	1034	323	1080	63	268	14	73	1486	667	1651	11819
7	972	425	122	719	1193	7069	10893	793	517	1410	17	805	34	93	114	108	1258	1067	1036
8	11	10184	403	654	697	1123	17145	7363	2509	767	496	64	258	0	157	275	198	2088	1137
9	83	233	1363	416	1506	838	1328	12675	10807	2222	179	344	19	26	37	94	162	399	1454
10	159	254	205	1685	858	810	3364	1055	11756	14413	1450	194	192	4	122	81	179	442	315
11+	275	3105	808	794	2378	3999	8535	15707	14379	27508	14653	10908	4059	805	1938	2110	1973	4566	2943
Total	1570	14643	6014	9992	15347	20075	42956	40073	43408	49681	19368	14247	5668	1049	3801	4934	8889	44712	26543

Age	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006*	2007*
1	0	0	2273	0	0	0	0	0	0	0	0	0	0	0	0	0	83	0	0
2	23	0	29	940	0	0	0	159	2	0	0	0	121	0	0	376	89	0	0
3	128	1936	386	207	96	0	96	0	698	796	75	404	11	511	145	283	1048	38	3
4	613	285	16183	942	31	1054	609	3	2	921	1619	175	20	238	602	182	909	278	218
5	124	637	1542	8940	263	121	2747	484	63	20	1355	1747	3	89	102	172	147	380	472
6	3106	240	553	483	3614	1674	129	1194	3420	16	0	946	23	89	11	0	130	27	368
7	10566	2451	103	371	75	2199	701	23	2939	351	5	2	0	312	0	20	2	34	30
8	370	7360	2145	211	199	108	1513	162	51	224	108	0	0	29	0	0	4	0	27
9	1081	532	4432	722	70	192	183	474	209	213	208	57	0	0	0	0	0	0	0
10	844	1132	537	2796	544	49	127	0	359	41	5	28	0	0	0	0	6	7	27
11+	2178	1148	2201	3509	861	441	337	91	427	90	14	62	0	81	0	3	9	0	0
Total	19033	15721	30384	19121	5753	5838	6442	2590	8170	2672	3389	3421	178	1349	860	1036	2427	764	1145

Autumn Spawners

Age	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	53	0	0	6	0	0	0	0	71	0	72	0	0	0	10	2	0
4	0	0	17	7	11	64	31	45	6	0	13	13	26	74	60	29	67	297	92
5	26	6	74	22	124	3	35	35	24	10	13	86	62	25	409	94	69	469	115
6	10	14	79	25	10	25	51	85	155	267	23	11	16	23	66	333	79	156	45
7	39	11	67	60	48	16	20	54	171	172	272	0	12	0	30	137	373	112	20
8	60	26	0	25	2	21	40	0	24	160	4	100	9	0	8	32	68	630	7
9	20	17	164	13	46	3	46	94	2	133	19	0	42	6	7	23	6	152	560
10	11	19	81	97	7	2	4	0	130	0	0	4	0	0	3	10	0	10	6
11+	172	291	562	298	346	302	329	182	238	298	450	65	23		24	74	42	108	306
Total	338	384	1097	547	594	442	556	495	750	1040	865	279	262	128	607	732	714	1936	1151

Age	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006*	2007*
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	11	0	0	0	0	0	0	0	0	0	9	0	0
3	0	0	0	0	0	0	0	19	0	0	0	28	7	0	0	37	3	0	0
4	65	130	188	109	0	7	11	0	56	106	187	176	0	134	108	269	328	7	55
5	12	65	450	187	48	70	37	0	72	26	113	613	0	31	363	37	1546	180	112
6	5	52	98	172	78	80	2	80	20	0	150	169	2	14	26	25	46	372	116
7	574	84	36	48	113	137	120	16	233	0	38	139	0	137	102	15	13	44	66
8	70	37	128	46	79	25	3	3	0	13	0	2	0	26	26	11	4	0	0
9	0	0	249	80	42	4	24	3	69	20	0	28	0	0	26	0	37	6	0
10	533	4	120	19	21	0	0	3	0	0	0	0	0	2	0	0	8	6	0
11+	29	577	2733	613	349	14	204	0	34	0	113	28	0	54	0	0	4	7	0
Total	1288	949	4002	1274	730	337	412	124	484	165	601	1183	9	398	651	394	1998	622	349

Spring and Autumn Spawners

	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
Total	1908	15027	7111	10539	15941	20517	43512	40568	44158	50721	20233	14526	5930	1177	4408	5666	9603	46648	27694
%SS	82.3	97.4	84.6	94.8	96.3	97.8	98.7	98.8	98.3	97.9	95.7	98.1	95.6	89.1	86.2	87.1	92.6	95.8	95.8
%AS	17.7	2.6	15.4	5.2	3.7	2.2	1.3	1.2	1.7	2.1	4.3	1.9	4.4	10.9	13.8	12.9	7.4	4.2	4.2

	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006*	2007*
Total	20321	16670	34386	20395	6483	6175	6854	2714	8654	2837	3990	4604	187	1747	1511	1430	4425	1386	1494
%SS	93.7	94.3	88.4	93.8	88.7	94.5	94.0	95.4	94.4	94.2	84.9	74.3	95.2	77.2	56.9	72.4	54.8	55.1	76.6
%AS	6.3	5.7	11.6	6.2	11.3	5.5	6.0	4.6	5.6	5.8	15.1	25.7	4.8	22.8	43.1	27.6	45.2	44.9	23.4

* Preliminary

Table 8. Commercial catch at age of spring and autumn spawning herring for Bonavista Bay–Trinity Bay, 1970–2007.

Spring Spawners

Age	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
1	0	0	0	0	0	0	5	10	0	0	0	0	0	0	0	0	151	296	717
2	0	0	0	0	0	0	14	16	22	6	15	136	0	0	4	13	207	1352	6612
3	0	690	10	0	0	392	77	248	26	286	13	246	8	4	22	175	443	413	9910
4	0	311	1347	60	2	134	493	135	357	167	195	53	11	34	35	70	4445	2845	267
5	9	102	389	4887	235	163	123	759	122	765	43	256	2	7	210	87	261	16208	3674
6	55	64	91	126	4795	2564	166	227	251	19	293	26	30	2	9	351	161	334	21739
7	808	361	75	96	424	14330	4897	50	112	436	52	288	5	15	5	37	262	359	782
8	35	1373	88	0	151	455	20697	6209	598	101	264	23	35	0	12	27	38	126	713
9	126	151	480	48	294	995	909	23206	4412	530	75	321	5	8	2	13	10	33	8
10	69	126	14	271	69	727	854	774	13394	5575	967	88	65	2	2	22	31	6	55
11+	212	522	213	0	1849	1679	4306	5890	5956	19994	12259	11762	1186	159	154	797	657	956	1247
Total	1314	3700	2707	5488	7819	21439	32541	37524	25250	27879	14176	13199	1347	231	455	1592	6666	22928	45724

Age	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006*	2007*
1	0	0	115	0	0	0	4	0	0	0	0	48	0	0	0	0	0	0	0
2	563	58	689	499	354	0	0	0	75	57	50	355	197	0	0	260	46	0	0
3	1043	3094	210	1056	621	394	107	23	302	533	49	204	252	596	384	406	3097	337	37
4	3323	422	13551	271	160	819	2645	63	13	507	805	215	188	412	877	237	2200	1992	530
5	264	2350	2586	12612	344	303	349	2638	96	93	566	756	33	170	119	447	526	418	2298
6	1428	94	3859	2422	3779	1072	64	345	3230	135	11	383	54	59	24	65	2321	215	1948
7	8639	629	347	579	422	3878	152	46	182	1388	14	48	139	117	0	26	253	809	508
8	13	4439	1550	194	385	479	978	157	7	98	1557	23	39	2	0	26	27	134	1127
9	216	235	7505	1394	132	471	172	430	0	4	920	898	0	2	0	9	63	45	256
10	100	325	447	2054	657	530	163	11	29	4	62	110	5	0	0	8	39	0	42
11+	508	466	891	653	1092	2614	649	300	94	88	105	218	137	155	7	9	137	101	204
Total	16097	12112	31750	21734	7946	10560	5283	4013	4028	2907	4139	3258	1044	1513	1411	1493	8709	4051	6950

Autumn Spawners

Age	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	19	0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	253
3	0	0	0	0	0	0	10	0	0	0	14	6	3	0	0	0	0	0	54
4	9	0	0	0	0	26	22	55	16	0	11	115	0	10	3	5	51	2	22
5	0	10	0	0	0	30	77	16	14	27	17	106	8	2	84	18	80	391	88
6	0	0	0	0	0	0	23	176	61	114	83	33	10	5	14	203	59	237	357
7	4	4	2	0	16	22	66	86	58	30	188	83	3	2	17	96	292	87	216
8	17	23	2	48	2	41	34	112	28	175	45	283	8	0	3	54	149	360	202
9	18	3	5	0	0	6	62	30	23	13	112	36	25	0	5	22	24	138	818
10	17	21	0	0	0	19	8	73	82	16	3	4	0	0	0	10	0	2	2
11+	738	406	33	0	1216	259	1069	1069	417	800	463	230	37	3	9	29	30	156	237
Total	803	467	42	48	1234	403	1371	1617	699	1175	936	896	94	22	135	437	685	1392	2249

Age	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006*	2007*
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	13	0	0	0	22	0	0	0	0	0	0	0	0
3	0	5	6	0	11	0	6	0	33	0	58	41	74	0	64	140	35	127	0
4	55	139	140	10	0	0	39	0	63	239	64	75	28	159	120	427	731	239	76
5	76	55	837	219	146	53	90	119	26	324	184	136	57	153	205	123	1428	1678	146
6	136	9	152	205	205	168	4	126	88	121	258	110	224	316	103	116	216	2889	1434
7	237	61	17	118	163	27	0	16	39	138	42	172	116	246	120	46	193	96	1864
8	18	50	99	0	121	114	48	29	3	76	56	130	165	179	5	29	121	138	105
9	83	58	104	5	39	0	24	11	6	2	61	9	64	0	0	10	44	42	34
10	697	19	125	0	14	0	0	0	19	35	59	36	13	0	0	13	38	0	13
11+	193	89	481	167	376	79	206	20	4	16	20	164	177	70	94	29	80	114	60
Total	1495	485	1961	724	1075	440	430	321	281	951	824	873	918	1123	711	933	2886	5323	3732

Spring and Autumn Spawners

	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
Total	2117	4167	2749	5536	9053	21842	33912	39141	25949	29054	15112	14095	1441	253	590	2029	7351	24320	47973
%SS	62.1	88.8	98.5	99.1	86.4	98.2	96.0	95.9	97.3	96.0	93.8	93.6	93.5	91.3	77.1	78.5	90.7	94.3	95.3
%AS	37.9	11.2	1.5	0.9	13.6	1.8	4.0	4.1	2.7	4.0	6.2	6.4	6.5	8.7	22.9	21.5	9.3	5.7	4.7

	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006*	2007*
Total	17592	12597	33711	22458	9021	11000	5713	4334	4309	3858	4963	4131	1962	2636	2122	2426	11595	9374	10682
%SS	91.5	96.1	94.2	96.8	88.1	96.0	92.5	92.6	93.5	75.3	83.4	78.9	53.2	57.4	66.5	61.5	75.1	43.2	65.1
%AS	8.5	3.9	5.8	3.2	11.9	4.0	7.5	7.4	6.5	24.7	16.6	21.1	46.8	42.6	33.5	38.5	24.9	56.8	34.9

* Preliminary

Table 9. Commercial catch at age of spring and autumn spawning herring for St. Mary's Bay-Placentia Bay, 1970–2007.

Spring Spawners

Age	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
1	3	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	476	0	0	76	995	74	365	52	30	87	133	0	0	0	8	0	0	34	0
3	109	557	207	326	280	2234	391	1423	175	663	332	193	0	5	9	7	0	19	0
4	4434	116	20375	77	234	471	1906	140	1817	279	133	42	2	2	24	18	143	2	22
5	59	2111	725	15470	126	147	208	736	123	2263	153	111	3	3	36	27	19	502	163
6	76	80	5154	566	14328	1591	267	87	596	96	1270	51	8	2	6	21	28	29	2457
7	645	251	365	6757	436	13858	862	50	64	614	57	338	3	4	3	15	9	47	119
8	66	45	650	93	6049	146	5622	1039	106	85	470	28	14	0	24	3	4	9	213
9	72	13	352	224	138	3391	201	3830	512	66	38	80	4	9	0	25	0	3	16
10	37	22	73	193	238	350	2256	134	3827	501	237	6	4	0	10	5	5	0	36
11+	107	96	403	315	624	1323	1361	2448	2185	4785	2971	466	69	39	44	125	30	11	147
Total	6084	3291	28304	24097	23451	23585	13439	9939	9435	9439	5794	1315	107	64	164	246	238	656	3173

Age	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006*	2007*
1	0	0	0	0	0	13	0	0	0	0	0	0	0	0	0	0	0	0	0
2	22	0	37	68	5	24	0	19	235	151	0	0	0	0	0	6	375	136	0
3	48	115	0	47	62	137	333	19	125	487	21	11	0	190	73	72	582	31	2
4	9	189	222	7	34	5	1418	224	0	205	21	579	28	18	539	67	4	911	0
5	0	64	160	363	11	36	37	1187	1656	61	0	156	329	124	20	2731	42	153	73
6	24	15	170	231	187	6	0	94	8237	873	0	63	392	1183	74	943	3090	161	96
7	463	30	12	55	118	225	0	43	465	3222	84	60	168	236	1091	386	50	1174	23
8	34	494	110	53	74	60	63	32	134	299	292	291	39	89	40	320	4	73	30
9	100	45	493	74	63	98	0	51	76	186	42	127	268	19	0	198	4	14	2
10	5	172	88	383	56	172	16	16	50	43	21	35	153	202	44	73	59	128	16
11+	34	128	948	965	1174	1042	416	177	280	109	63	392	440	1216	449	225	68	297	49
Total	739	1252	2240	2246	1784	1818	2283	1862	11258	5636	544	1714	1817	3277	2330	5021	4278	3078	291

Autumn Spawners

Age	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0
3	0	0	24	5	2	0	11	0	0	0	0	0	0	0	0	0	0	4	0
4	0	9	61	150	2	7	4	47	23	11	96	139	0	18	17	9	16	12	20
5	2	2	175	52	96	68	214	52	435	143	35	116	7	6	101	20	24	32	30
6	0	53	15	71	146	182	67	209	92	598	52	10	0	12	32	86	15	80	239
7	71	31	61	10	80	89	32	81	244	73	419	11	0	4	21	46	97	30	90
8	112	43	37	54	95	206	17	69	122	216	79	50	0	0	5	36	28	82	35
9	19	84	101	17	93	6	94	26	38	21	126	7	0	0	3	10	16	24	270
10	28	35	71	68	51	37	11	22	52	2	25	0	0	0	0	3	4	3	5
11+	202	314	539	737	970	677	329	526	561	348	492	29	2	4	8	24	15	12	53
Total	434	571	1084	1164	1535	1272	779	1032	1567	1412	1324	362	9	44	187	234	215	281	742

Age	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006*	2007*
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	5	7	0	0	0	7	0	19	76	61	0	12	0	0	0	0	0	92	2
4	5	37	14	7	2	7	105	40	295	231	0	16	20	113	36	54	480	193	2
5	18	61	87	8	208	62	112	82	188	445	0	73	118	18	412	209	732	959	29
6	8	54	40	50	239	116	35	102	1231	273	42	46	209	239	90	1164	174	1507	232
7	56	24	23	33	173	182	106	10	1361	764	63	98	185	534	617	398	261	91	1269
8	43	47	65	27	41	231	99	19	229	694	104	30	243	343	273	369	7	133	270
9	67	58	98	64	41	182	87	9	306	376	63	26	2	85	8	271	57	131	122
10	178	17	40	0	3	0	78	0	50	23	104	9	7	76	83	106	26	98	180
11+	164	173	495	479	863	411	282	74	730	255	125	90	155	247	211	294	71	197	648
Total	544	478	862	668	1570	1198	904	355	4466	3122	501	400	939	1655	1730	2865	1808	3401	2754

Spring and Autumn Spawners

	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
Total	6518	3862	29388	25261	24986	24857	14218	10971	11002	10851	7118	1677	116	108	351	480	453	937	3915
%SS	93.3	85.2	96.3	95.4	93.9	94.9	94.5	90.6	85.8	87.0	81.4	78.4	92.2	59.3	46.7	51.2	52.5	70.0	81.0
%AS	6.7	14.8	3.7	4.6	6.1	5.1	5.5	9.4	14.2	13.0	18.6	21.6	7.8	40.7	53.3	48.8	47.5	30.0	19.0

	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006*	2007*
Total	1283	1730	3102	2914	3354	3016	3187	2217	15724	8758	1045	2114	2756	4932	4060	7886	6086	6479	3045
%SS	57.6	72.4	72.2	77.1	53.2	60.3	71.6	84.0	71.6	64.4	52.1	81.1	65.9	66.4	57.4	63.7	70.3	47.5	9.6
%AS	42.4	27.6	27.8	22.9	46.8	39.7	28.4	16.0	28.4	35.6	47.9	18.9	34.1	33.6	42.6	36.3	29.7	52.5	90.4

* Preliminary

Table 10. Commercial catch at age of spring and autumn spawning herring for Fortune Bay, 1970–2007.

Spring Spawners

Age	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
1	0	0	617	23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	29475	167	1515	2210	389	2	82	27	0	0	25	0	0	0	2	0	0	0	0
3	5988	23223	256	925	1314	277	15	2103	42	0	16	144	0	2	0	54	0	0	0
4	11953	6086	19690	67	552	581	318	25	2677	183	3	16	3	2	4	3	145	0	0
5	133	23525	2896	5694	130	112	228	327	62	3833	69	4	3	0	3	39	4	304	0
6	281	1165	10767	475	4435	87	129	166	237	15	1122	3	0	0	2	12	69	11	219
7	7894	5747	351	1712	250	1490	11	26	43	165	7	21	2	0	0	2	20	49	7
8	233	3514	4432	73	1094	16	338	43	139	5	183	2	36	0	2	0	6	18	26
9	16	132	991	282	36	142	36	188	52	24	0	23	0	10	0	0	0	4	6
10	225	148	34	558	117	22	188	4	326	0	11	0	5	0	2	0	2	0	0
11+	257	537	366	173	255	201	140	244	302	167	50	12	5	18	23	15	14	38	10
Total	56455	64244	41915	12192	8572	2930	1485	3153	3880	4392	1486	225	54	32	38	125	260	424	268

Age	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006*	2007*
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0	513	0	0	0	0	0	0
3	0	0	0	0	2	6	0	0	0	0	108	0	114	0	0	0	877	0	0
4	0	0	23	0	0	0	0	201	0	0	27	156	144	0	775	0	0	1631	51
5	0	2	8	3	0	2	14	12	0	0	0	10	3651	0	0	750	2	22	2024
6	18	2	0	0	327	0	14	17	0	0	49	23	257	3831	64	20	1173	22	17
7	274	12	0	0	2	24	24	0	0	0	817	99	172	100	6321	152	6	485	43
8	0	155	6	0	3	9	569	0	0	0	153	1184	314	144	266	6506	22	199	155
9	17	17	274	2	8	23	36	47	0	0	120	201	742	122	3	264	4712	0	44
10	11	20	0	75	10	8	36	6	15	0	0	191	344	632	67	243	328	1785	717
11+	24	0	72	266	217	647	728	38	355	0	479	830	1259	3408	3089	2516	1207	4040	5329
Total	344	208	383	346	569	719	1421	321	370	0	1753	2694	7510	8237	10585	10451	8327	8184	8380

Autumn Spawners

Age	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	7	0	7	0	0	0	0	5	0	0	0	0	0	0	0
4	0	598	0	48	9	22	9	23	0	7	4	64	0	0	0	17	3	0	2
5	334	0	84	50	87	12	38	19	36	5	3	16	7	0	9	4	8	4	0
6	0	136	25	79	65	39	26	19	6	50	3	0	2	2	4	26	16	7	5
7	443	175	185	8	12	19	13	0	25	0	3	0	0	0	6	12	38	11	5
8	816	769	44	32	27	20	0	0	12	17	0	0	0	0	0	7	12	25	0
9	412	626	310	15	5	11	27	0	6	12	0	0	0	0	0	4	5	10	13
10	0	470	125	27	0	7	0	0	0	0	0	0	0	0	0	0	0	5	0
11+	2201	1956	793	97	85	45	9	2	18	12	0	0	0	0	0	2	5	14	10
Total	4206	4730	1566	356	297	175	129	63	103	103	13	85	9	2	19	72	87	76	35

Age	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006*	2007*
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0	29	0	0	0	0	0	0
4	3	10	0	0	0	0	0	0	0	0	0	10	0	0	32	0	249	0	77
5	6	5	0	4	0	0	0	0	0	0	0	26	86	0	1283	0	416	66	78
6	0	12	8	5	3	0	0	0	0	0	0	26	286	0	192	30	267	66	52
7	6	17	0	3	11	0	25	0	0	0	27	46	114	11	228	81	373	22	182
8	31	7	3	0	0	0	31	0	0	0	0	36	86	11	257	30	6	89	122
9	3	54	0	0	0	0	10	2	0	0	0	8	0	0	96	81	172	0	17
10	17	0	3	0	0	0	0	0	0	0	0	17	143	0	128	20	22	44	0
11+	5	5	0	5	26	14	0	0	0	0	2	148	314	79	164	101	611	179	164
Total	71	110	14	17	40	14	66	2	0	0	29	317	1058	101	2380	343	2116	466	692

Spring and Autumn Spawners

	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
Total	60661	68974	43481	12548	8869	3105	1614	3216	3983	4495	1499	310	63	34	57	197	347	500	303
%SS	93.1	93.1	96.4	97.2	96.7	94.4	92.0	98.0	97.4	97.7	99.1	72.6	85.7	94.1	66.7	63.5	74.9	84.8	88.4
%AS	6.9	6.9	3.6	2.8	3.3	5.6	8.0	2.0	2.6	2.3	0.9	27.4	14.3	5.9	33.3	36.5	25.1	15.2	11.6

	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006*	2007*
Total	415	318	397	363	609	733	1487	323	370	0	1782	3011	8568	8338	12965	10794	10443	8650	9072
%SS	82.9	65.4	96.5	95.3	93.4	98.1	95.6	99.4	100.0	ERR	98.4	89.5	87.7	98.8	81.6	96.8	79.7	94.6	92.4
%AS	17.1	34.6	3.5	4.7	6.6	1.9	4.4	0.6	0.0	ERR	1.6	10.5	12.3	1.2	18.4	3.2	20.3	5.4	7.6

* Preliminary

Table 11. Fall research gill net catch rates at age (numbers per nights fished), of spring and autumn spawning herring, for White Bay–Notre Dame Bay, 1980 to 1991.

Spring Spawners

Age	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0
2	9.8	4.5	8.5	0.5	23.3	2.6	0.2	1.2	5.7	5.2	3.2	0.3
3	8.1	5.2	29.1	50.1	6.4	134.5	9.0	0.6	3.9	10.8	120.9	5.2
4	204.1	1.2	5.6	81.4	19.1	19.0	107.3	38.8	3.6	20.1	21.1	262.1
5	7.2	25.2	3.5	7.3	84.0	11.6	12.5	352.0	18.0	7.6	7.0	15.8
6	92.2	1.0	1.9	14.1	4.2	60.1	9.0	35.1	90.4	39.2	3.5	2.4
7	2.7	5.3	0.8	19.8	8.5	7.1	38.2	16.0	7.8	123.8	12.1	3.1
8	29.5	0.5	9.3	2.6	14.0	6.7	3.8	57.3	6.6	4.1	51.8	10.3
9	4.5	1.9	0.0	22.4	0.8	7.5	2.6	8.6	13.3	12.2	7.3	32.3
10	34.0	0.8	15.5	5.2	8.5	5.2	3.1	5.5	1.2	25.6	10.8	1.7
11+	503.9	83.7	192.6	318.7	254.8	119.5	50.2	102.3	27.0	41.9	33.5	10.3
Total	895.9	129.4	266.8	522.1	423.6	373.9	235.9	617.6	177.9	290.4	271.3	343.5

Autumn Spawners

Age	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0
3	3.3	0.3	7.0	0.0	14.0	0.0	0.0	0.0	0.1	0.0	1.3	0.0
4	0.4	1.0	3.4	14.2	2.1	1.5	2.9	15.7	2.2	0.7	4.5	3.0
5	1.5	0.0	3.8	1.6	40.9	1.5	3.9	20.3	3.2	0.4	1.6	7.3
6	1.8	0.4	3.3	4.2	10.2	13.9	3.3	15.1	1.5	0.1	0.4	0.6
7	1.8	0.0	0.0	1.4	1.3	7.6	10.2	2.8	0.8	2.6	0.3	0.2
8	0.1	0.3	0.0	0.2	1.1	0.0	2.6	8.5	0.4	0.7	0.4	0.0
9	0.2	0.0	1.5	0.3	0.3	0.0	0.4	2.9	1.7	0.0	0.5	0.4
10	0.0	0.0	0.0	0.9	0.2	0.0	0.0	2.1	0.4	2.2	0.3	0.2
11+	4.3	0.3	0.4	1.9	3.3	2.3	1.3	1.1	1.0	1.7	1.9	1.5
Total	13.3	2.2	19.5	24.7	73.5	26.8	24.6	68.5	11.6	8.4	11.2	13.2

Spring and Autumn Spawners Combined

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
Total	909.2	131.6	286.3	546.8	497.0	400.7	260.5	686.2	189.5	298.8	282.5	356.7
%SS	98.5	98.3	93.2	95.5	85.2	93.3	90.5	90.0	93.9	97.2	96.0	96.3
%AS	1.5	1.7	6.8	4.5	14.8	6.7	9.5	10.0	6.1	2.8	4.0	3.7

Table 12. Fall research gill net catch rates at age (numbers per nights fished), of spring and autumn spawning herring, for Bonavista Bay–Trinity Bay, 1980-91.

Spring Spawners

Age	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7	0.1	0.0	0.0
2	20.6	1.3	4.6	1.0	18.3	2.2	2.4	3.7	4.9	9.7	1.8	0.9
3	1.3	1.9	73.0	8.1	7.6	50.3	5.8	0.3	14.7	3.0	39.9	2.2
4	12.8	0.2	19.8	101.9	7.4	4.0	109.9	4.4	1.5	10.3	10.2	56.4
5	0.9	0.8	5.0	11.0	57.3	1.8	2.1	43.9	6.3	1.1	8.3	8.1
6	4.3	0.2	14.6	4.3	2.3	8.0	2.2	1.9	50.9	4.2	0.5	14.0
7	0.3	1.6	0.1	11.5	1.3	5.1	4.6	1.7	1.9	20.8	2.9	1.1
8	0.9	0.0	3.0	0.2	2.0	0.1	0.6	1.6	1.6	0.5	13.4	7.5
9	0.1	1.2	0.0	4.5	0.0	0.6	0.1	0.5	1.1	1.0	1.3	33.2
10	1.9	0.1	0.6	1.0	1.9	0.0	0.8	0.2	0.2	1.0	1.2	2.1
11+	101.2	61.8	64.8	95.9	44.6	17.6	10.4	6.3	3.9	2.4	4.4	6.9
Total	144.2	69.0	185.5	239.4	142.6	89.7	138.8	64.5	87.6	54.0	83.9	132.5

Autumn Spawners

Age	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.1	0.0
3	0.8	0.0	20.3	0.2	0.4	0.4	0.2	0.0	0.1	0.2	0.4	0.0
4	1.2	1.3	3.3	33.6	1.2	0.9	0.7	0.3	0.5	0.2	1.6	1.6
5	0.5	0.2	10.9	8.5	23.3	0.8	2.4	0.7	0.9	0.4	0.5	2.5
6	1.2	0.2	0.4	10.0	5.0	8.8	2.8	0.7	1.1	0.9	0.2	0.4
7	2.5	0.2	1.8	2.3	4.9	3.8	7.7	0.5	0.6	0.8	0.4	0.4
8	0.6	2.4	0.1	1.5	0.5	0.8	2.0	2.8	0.1	0.5	0.2	0.3
9	0.3	0.0	5.3	0.6	1.9	0.3	1.3	0.7	1.3	0.1	0.4	0.4
10	0.0	0.0	0.0	4.4	0.0	0.0	0.1	0.1	0.4	0.8	0.0	0.9
11+	2.0	1.2	5.6	4.5	4.4	1.2	1.0	0.6	1.7	0.5	0.5	1.9
Total	9.0	5.5	47.7	65.6	41.6	17.0	18.2	6.5	7.0	4.2	4.2	8.4

Spring and Autumn Spawners Combined

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
Total	153.3	74.5	233.2	305.0	184.2	106.7	157.1	71.0	94.6	58.2	88.1	140.9
%SS	94.1	92.6	79.5	78.5	77.4	84.0	88.4	90.8	92.6	92.8	95.2	94.0
%AS	5.9	7.4	20.5	21.5	22.6	16.0	11.6	9.2	7.4	7.2	4.8	6.0

Table 13. Parameters, catch data, catch rates, and effort, by stock area and year, for spring research gill net data.

Stock Area	Year	Number of Fishers	Fishing Dates Start	Fishing Dates End	Total Catch (numbers)	Catch Rate (numbers per nights fished) AS	Catch Rate (numbers per nights fished) SS	Catch Rate (numbers per nights fished) Comb.	Effort (net nights per fisher)
WBNDB	1988	5	14 May	17 June	17759	9	146	156	570
	1989	7	25 April	24 June	99614	61	486	547	910
	1990	7	25 April	22 June	121218	27	679	706	859
	1991	7	8 May	31 July	117333	25	685	709	827
	1992	6	6 May	7 July	139253	28	859	887	785
	1993	6	3 May	9 July	104251	67	607	674	773
	1994	7	2 May	18 July	110697	72	586	658	841
	1995	7	15 May	27 July	103011	53	560	613	840
	1996	7	7 May	11 July	114465	71	470	541	1058
	1997	7	13 May	11 July	70338	32	320	352	998
	1998	7	5 May	10 July	53055	26	246	272	975
	1999	7	5 May	16 July	46465	14	202	216	1075
	2000	6	25 April	22 July	10681	9	49	58	920
	2001	7	8 May	20 July	29934	29	107	136	1100
	2002	9	21 April	31 July	10768	10	29	39	1372
	2003	9	19 April	31 July	31444	20	91	111	1412
	2004	8	23 April	31 July	30881	45	76	121	1278
	2005	8	22 April	31 July	76674	95	207	301	1273
	2006	8	24 April	31 July	75281	96	210	307	1227
	2007	7	14 May	25 July	37949	143	198	341	1033
	2008	8	5 May	31 July	23187	98	135	233	1229
BBTB	1988	7	9 May	17 June	6554	1	51	53	622
	1989	8	18 April	12 June	25250	10	96	106	1189
	1990	7	10 April	6 June	28748	11	135	146	982
	1991	8	30 April	26 June	40320	20	188	209	966
	1992	8	20 April	18 June	35196	15	138	153	1152
	1993	8	23 April	15 June	28373	17	113	130	1090
	1994	8	18 April	21 June	45863	19	168	187	1227
	1995	7	9 May	27 June	20836	10	99	110	950
	1996	7	11 April	18 June	58278	29	229	259	1127
	1997	8	16 April	26 June	73135	33	279	312	1172
	1998	8	21 April	29 June	25564	19	83	102	1257
	1999	8	15 April	26 June	23290	21	60	81	1440
	2000	8	3 April	26 June	15579	16	41	57	1373
	2001	8	4 May	20 July	14303	18	32	50	1436
	2002	10	15 April	18 July	9859	4	23	27	1814
	2003	10	9 April	12 July	37597	36	72	108	1747
	2004	9	14 April	17 July	54260	82	99	181	1499
	2005	9	14 April	17 July	46422	87	75	162	1430
	2006	9	5 April	15 July	78838	136	117	253	1557
	2007	9	13 April	23 July	85282	218	147	364	1387
	2008	8	18 April	14 July	42380	111	75	186	1411

Table 13 (cont'd).

Stock Area	Year	Number of Fishers	Fishing Dates Start	Fishing Dates End	Total Catch (numbers)	Catch Rate (numbers per nights fished) AS	Catch Rate (numbers per nights fished) SS	Catch Rate (numbers per nights fished) Comb.	Effort (net nights
SMBPB	1982	4	17 April	15 May	1905	4	12	16	595
	1983	5	6 April	3 June	9174	21	44	65	708
	1984	4	5 April	14 June	34405	129	116	246	700
	1985	4	10 April	6 June	35835	133	143	276	650
	1986	5	10 April	13 June	37840	98	172	270	700
	1987	5	1 April	31 May	43693	72	211	282	774
	1988	5	2 April	29 May	23140	29	141	170	681
	1989	5	4 April	7 June	21634	25	123	148	730
	1990	5	9 April	6 June	28591	53	139	192	743
	1991	5	3 April	12 June	9971	25	42	67	745
	1992	5	8 April	10 June	13264	32	55	87	765
	1993	5	5 April	11 June	10727	25	46	72	750
	1994	5	7 April	7 June	22350	36	106	142	785
	1995	5	5 April	3 June	12861	14	70	84	765
	1996	5	2 April	12 June	54047	61	266	328	825
	1997	5	4 April	4 June	30290	55	136	191	795
	1998	5	1 April	5 June	19392	41	80	121	803
	1999	5	1 April	27 May	38665	82	164	246	785
	2000	5	4 April	3 June	36152	107	125	232	780
	2001	5	5 April	8 June	37536	63	168	232	810
	2002	6	1 April	14 June	85521	145	262	407	1050
	2003	6	4 April	12 June	37122	45	147	192	965
	2004	6	5 April	18 June	22115	33	77	110	1009
	2005	6	5 April	14 June	24036	70	84	154	780
	2006	6	1 April	2 June	22020	49	58	107	1030
	2007	6	2 April	13 June	12332	48	24	72	1000
	2008	6	8 April	7 June	9322	7	22	29	965
FB	1982	2	16 April	22 May	799	2	10	12	325
	1983	2	11 April	16 May	10653	49	129	178	300
	1984	1	19 April	18 May	5908	71	156	227	130
	1985	2	16 April	17 May	38301	175	462	636	301
	1986	3	15 April	6 June	44175	65	399	464	476
	1987	3	8 April	22 May	63850	70	690	760	420
	1988	3	13 April	23 May	46435	37	517	554	419
	1989	3	11 April	23 May	84066	81	927	1008	417
	1990	3	17 April	24 May	48466	47	479	527	460
	1991	3	9 April	28 May	50778	36	561	597	425
	1992	3	16 April	12 June	30235	51	331	383	395
	1993	3	13 April	5 June	39774	49	413	462	430
	1994	3	13 April	10 June	62870	46	668	714	440
	1995	3	18 April	23 June	56079	74	684	758	370
	1996	3	3 April	27 May	93868	58	862	920	510
	1997	3	7 April	31 May	96821	91	980	1071	452
	1998	3	7 April	30 May	111464	51	1224	1275	437
	1999	3	1 April	26 May	90685	213	854	1067	425
	2000	3	1 April	30 May	76734	159	727	886	433
	2001	3	6 April	1 June	110487	97	1131	1228	450
	2002	4	3 April	31 May	60195	93	447	540	557
	2003	4	23 April	31 May	61701	78	463	541	570
	2004	4	3 April	31 May	40159	97	194	291	690
	2005	4	3 April	31 May	50777	105	349	453	560
	2006	4	1 April	6 June	38232	80	267	348	550
	2007	4	2 April	11 June	11330	37	181	218	622
	2008	4	13 April	16 June	14153	58	282	338	625

Table 14. Spring research gill net catch rates at age (numbers per nights fished), of spring and autumn spawning herring, for White Bay–Notre Dame Bay, 1988-2007, catch rates only in 2008.

Spring Spawners

Age	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
1							0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2							0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3							4.7	16.0	83.5	11.0	0.0	1.2	0.6	0.0
4							1.9	43.3	51.6	247.1	21.5	10.9	232.0	18.5
5							22.2	11.2	52.9	28.8	493.7	51.0	14.6	300.1
6							59.6	126.9	16.3	13.7	33.5	359.9	52.1	20.2
7							5.6	182.9	144.6	7.5	13.7	18.8	182.7	45.9
8							4.7	9.7	195.5	84.2	10.3	6.7	14.1	104.1
9							12.0	16.0	11.5	164.3	47.2	13.4	7.6	8.4
10							1.8	24.3	26.5	21.9	127.9	29.7	12.9	9.5
11+							34.1	56.4	97.1	106.1	110.8	115.9	69.1	52.1
Total							146.4	486.4	678.8	684.6	858.6	606.9	585.7	559.8

Age	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
2	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.1	0.0	0.0	0.8	
3	0.0	3.2	7.9	6.5	0.3	0.5	11.0	3.6	5.5	7.0	0.3	0.2	
4	0.9	0.6	117.6	70.3	2.6	44.2	3.0	65.9	11.3	30.6	69.4	6.9	
5	47.9	3.2	0.2	85.1	14.8	8.1	4.7	2.7	43.9	41.5	10.0	137.1	
6	286.0	77.1	1.2	1.0	16.8	37.5	3.6	9.5	2.8	85.3	8.3	17.0	
7	12.7	139.5	10.3	0.4	0.2	15.5	2.1	1.3	2.0	1.4	36.5	7.3	
8	21.6	8.6	43.3	9.5	0.9	0.1	0.7	4.6	1.7	0.8	2.3	17.4	
9	74.2	17.6	1.7	15.0	0.4	0.2	0.2	1.5	1.5	6.8	0.0	0.0	
10	5.2	31.0	6.9	2.8	0.6	0.6	0.5	1.2	0.6	3.3	1.1	5.3	
11+	21.1	39.4	56.8	18.0	12.1	0.1	3.0	0.7	6.1	29.7	23.3	5.7	
Total	469.5	320.0	246.0	202.1	48.7	106.8	28.9	91.1	75.6	206.6	151.5	197.6	135.2

Autumn Spawners

Age	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
1							0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2							0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3							0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0
4							0.0	0.0	2.3	1.6	0.0	0.0	0.6	2.3
5							0.7	6.8	2.5	2.7	1.7	6.8	1.8	13.1
6							1.3	1.8	2.3	1.4	14.2	17.9	9.1	6.9
7							0.7	4.4	0.9	1.6	2.2	13.8	12.0	7.9
8							0.6	4.4	1.4	1.0	0.2	2.4	11.1	4.3
9							4.5	6.3	1.9	2.9	1.2	1.3	4.0	3.9
10							0.1	19.9	0.2	0.0	0.3	0.3	0.1	4.1
11+							1.4	17.1	16.0	13.6	8.6	25.0	33.8	10.9
Total							9.4	61.0	26.8	24.8	28.4	67.4	72.4	53.3

Age	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
3	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
4	0.0	0.6	1.2	0.2	0.0	1.5	2.0	2.4	13.6	5.3	1.4	9.3	
5	3.4	0.9	5.0	3.2	2.0	12.8	1.7	6.1	4.6	52.6	17.9	30.2	
6	29.6	2.6	2.4	5.5	2.7	10.3	2.1	0.7	10.4	4.8	88.5	34.1	
7	3.4	14.5	0.7	0.4	1.5	1.8	2.7	7.2	2.7	5.6	5.7	37.8	
8	10.4	2.0	8.9	0.2	1.3	1.8	1.3	1.5	3.5	2.4	8.1	6.2	
9	8.8	2.6	1.7	2.8	0.4	0.3	0.1	1.0	1.9	0.5	0.2	0.1	
10	4.1	1.2	1.7	0.6	0.6	0.1	0.1	0.7	5.3	4.1	4.2	10.4	
11+	11.7	8.1	4.5	1.1	0.8	0.6	0.4	0.6	3.3	19.5	29.2	14.7	
Total	71.4	32.4	26.1	14.0	9.3	29.3	10.4	20.3	45.2	94.6	155.2	143.1	97.9

Spring and Autumn Spawners

	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
Total							155.8	547.3	705.6	709.4	887.0	674.3	658.1	613.2
% SS							94.0	88.9	96.2	96.5	96.8	90.0	89.0	91.3
% AS							6.0	11.1	3.8	3.5	3.2	10.0	11.0	8.7

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Total	541.0	352.4	272.1	216.1	58.1	136.1	39.2	111.4	120.8	301.2	306.8	340.7	233.1
% SS	86.8	90.8	90.4	93.5	83.9	78.5	73.6	81.8	62.6	68.6	49.4	58.0	58.0
% AS	13.2	9.2	9.6	6.5	16.1	21.5	26.4	18.2	37.4	31.4	50.6	42.0	42.0

Table 15. Spring research gill net catch rates at age (numbers per nights fished), of spring and autumn spawning herring, for Bonavista Bay–Trinity Bay, 1988-2007, catch rates only in 2008.

Spring Spawners

Age	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
1							0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2							0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0
3							5.6	2.3	8.8	0.9	0.3	2.6	0.7	0.0
4							0.3	21.8	8.2	50.1	1.2	1.7	16.6	34.3
5							2.3	0.9	27.7	12.0	46.2	8.2	9.6	8.2
6							29.2	5.5	4.5	27.9	8.1	50.6	12.6	1.7
7							0.5	57.7	12.2	3.2	10.3	6.4	65.0	4.6
8							0.4	0.9	60.8	19.8	2.3	7.0	6.5	19.9
9							0.6	0.6	0.8	62.3	17.6	3.7	8.9	2.6
10							0.0	0.7	3.2	3.8	34.8	13.1	7.5	3.0
11+							12.2	5.5	8.9	8.3	16.8	20.2	40.1	25.0
Total							51.2	96.1	135.1	188.2	137.6	113.5	167.6	99.2

Age	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
2	0.0	0.0	0.0	0.0	0.1	0.2	0.0	0.0	0.1	0.0	0.0	0.0	
3	0.0	2.8	1.2	0.1	0.1	3.4	11.0	2.5	1.1	11.6	1.1	2.2	
4	0.9	0.0	5.7	17.6	2.6	3.3	5.8	47.3	9.3	4.6	53.5	6.8	
5	140.9	3.3	0.2	7.2	11.9	2.0	2.3	12.2	68.3	6.3	11.1	69.6	
6	20.8	181.9	1.7	0.4	5.8	10.0	0.6	2.9	13.1	40.6	8.0	14.1	
7	5.3	23.7	62.3	0.8	0.4	3.0	1.5	0.4	2.5	5.1	52.4	9.5	
8	5.5	5.6	4.6	29.8	0.2	0.5	0.5	1.5	0.8	2.5	2.8	38.9	
9	20.8	7.0	2.1	1.4	12.7	0.9	0.1	0.6	0.3	0.1	1.7	1.5	
10	3.7	16.7	1.3	0.3	4.1	3.8	0.0	0.9	0.8	1.5	1.9	0.9	
11+	31.4	38.2	5.9	2.3	2.6	5.1	1.2	3.7	2.6	2.9	5.9	3.7	
Total	229.1	278.9	83.0	59.9	40.5	32.1	23.0	72.1	98.6	75.1	138.2	146.9	75.0

Autumn Spawners

Age	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
1							0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2							0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3							0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4							0.0	0.1	0.0	0.1	0.0	0.1	0.2	0.6
5							0.3	0.3	0.4	3.8	0.5	1.7	1.9	2.1
6							0.2	0.3	0.2	2.1	2.5	5.0	3.7	1.3
7							0.2	1.9	0.9	1.1	1.0	3.9	5.4	1.6
8							0.0	1.3	1.2	0.7	0.5	0.8	3.2	2.0
9							0.5	0.5	1.2	2.2	0.7	0.4	0.8	0.2
10							0.0	3.3	0.1	0.7	0.4	0.1	0.4	0.1
11+							0.3	2.4	7.3	9.8	9.5	4.6	3.7	2.6
Total							1.5	10.1	11.3	20.5	15.1	16.7	19.2	10.4

Age	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.2	0.0	
4	0.0	0.7	0.8	0.6	0.2	0.1	0.7	1.6	7.9	19.2	1.3	0.0	
5	2.7	0.2	3.6	4.0	2.4	3.7	0.9	7.3	11.5	31.9	21.6	5.9	
6	12.3	5.1	0.7	5.9	2.9	5.5	0.8	3.3	28.9	8.7	51.6	71.8	
7	1.7	13.3	2.9	1.4	4.3	2.1	1.0	8.6	12.4	12.0	8.6	105.1	
8	3.6	2.7	7.1	2.5	2.7	1.5	0.3	5.3	6.3	2.9	13.9	10.4	
9	3.0	2.2	0.7	4.3	0.5	0.6	0.3	2.4	3.0	3.9	2.5	7.8	
10	1.9	2.0	0.8	1.0	1.3	1.5	0.1	1.6	3.3	2.1	2.5	7.6	
11+	4.2	6.9	2.2	1.3	2.0	2.7	0.1	5.3	8.9	6.4	12.8	8.7	
Total	29.5	33.1	18.7	20.9	16.2	17.7	4.2	35.5	82.4	87.2	114.9	217.6	111.1

Spring and Autumn Spawners

	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
Total							52.7	106.2	146.4	208.7	152.8	130.2	186.9	109.7
% SS							97.2	90.5	92.3	90.2	90.1	87.2	89.7	90.5
% AS							2.8	9.5	7.7	9.8	9.9	12.8	10.3	9.5

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Total	258.6	312.0	101.7	80.9	56.7	49.8	27.2	107.6	181.0	162.3	253.2	364.4	186.2
% SS	88.6	89.4	81.6	74.1	71.4	64.4	84.5	67.0	54.5	46.3	54.6	40.3	40.3
% AS	11.4	10.6	18.4	25.9	28.6	35.6	15.5	33.0	45.5	53.7	45.4	59.7	59.7

Table 16. Spring research gill net catch rates at age (numbers per nights fished), of spring and autumn spawning herring, for St. Mary's Bay-Placentia Bay, 1982-2007,catch rates only in 2008.

Spring Spawners

Age	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0.2	1.6	0.7	0.0	0.0	0.0	0.4	0.2	0.1	0.1	0.0	0.2	0.0	0.0
3	0.2	10.2	18.6	59.3	0.3	13.7	2.3	23.5	11.2	0.9	2.7	3.5	15.6	11.3
4	0.6	1.8	21.9	5.9	125.6	1.7	4.2	6.0	19.5	16.5	0.7	3.3	25.4	49.2
5	0.4	0.9	7.0	9.9	8.5	152.1	2.7	1.8	5.7	7.1	21.8	1.5	2.9	1.8
6	1.4	1.0	2.7	6.9	17.4	11.6	100.2	3.5	2.4	1.9	3.8	12.1	0.4	0.4
7	0.2	3.2	0.9	2.4	3.4	17.7	6.2	64.3	5.0	0.5	2.4	2.4	6.9	0.8
8	1.7	0.4	7.3	2.1	2.6	4.0	14.4	3.3	69.9	1.1	1.0	2.7	2.1	1.8
9	0.4	4.7	0.2	8.6	0.1	2.1	3.0	12.6	2.4	8.3	1.6	1.1	3.8	1.2
10	0.4	0.5	10.1	2.7	2.4	0.6	0.1	3.1	16.7	1.1	7.5	2.1	3.2	0.3
11+	6.5	19.4	47.0	45.4	12.1	7.4	7.2	4.9	6.8	4.8	13.1	17.2	45.6	3.5
Total	11.9	43.8	116.3	143.1	172.5	210.7	140.7	123.2	139.5	42.3	54.8	46.2	105.9	70.3

Age	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
2	0.0	0.0	0.6	1.1	0.2	0.3	0.8	1.2	0.9	0.4	0.4	0.0	
3	0.0	4.1	22.6	67.7	11.6	5.4	106.3	1.0	1.3	14.8	0.5	0.2	
4	54.9	0.3	5.5	21.4	74.2	5.9	1.8	117.4	3.0	0.3	41.2	1.2	
5	159.8	20.4	0.3	8.0	13.8	98.2	6.0	3.1	60.5	2.0	0.2	17.4	
6	9.3	66.7	10.1	0.0	6.1	21.4	46.1	0.3	3.4	36.0	2.4	0.6	
7	5.9	12.6	26.2	13.0	0.1	9.8	7.9	10.9	0.8	1.4	21.5	1.9	
8	1.9	2.4	4.4	31.2	2.2	6.6	1.8	2.6	2.5	3.8	0.2	1.9	
9	5.9	2.2	1.3	4.4	3.2	8.6	0.8	3.5	2.7	19.3	2.7	0.2	
10	0.8	0.5	1.0	2.1	1.5	9.8	7.1	0.1	0.5	1.9	3.1	0.2	
11+	28.0	26.8	7.9	15.1	11.6	2.5	83.3	6.8	0.9	4.3	4.7	0.0	
Total	266.3	135.8	79.8	164.3	124.7	168.4	261.9	147.1	76.5	84.1	79.0	23.7	21.5

Autumn Spawners

Age	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0
3	0.6	0.4	6.2	0.9	0.7	2.0	0.0	0.1	0.1	0.3	0.0	0.1	0.3	0.3
4	0.6	9.3	10.9	36.8	8.0	4.6	1.1	1.8	1.0	2.3	1.1	1.4	5.4	5.6
5	2.0	1.7	53.6	14.2	16.6	8.2	1.2	3.8	4.5	8.1	3.7	3.8	2.2	2.6
6	0.2	4.8	16.0	39.0	10.2	14.9	2.9	1.5	2.8	2.3	5.4	3.8	2.0	0.1
7	0.0	0.9	22.9	14.4	42.2	8.5	5.2	3.8	2.9	0.9	1.6	3.8	2.8	0.8
8	0.2	0.4	1.6	12.2	10.4	20.6	5.0	2.8	3.3	2.3	0.8	1.4	4.1	1.4
9	0.1	0.7	4.1	1.5	3.6	7.5	8.3	2.0	6.7	1.5	1.9	0.6	1.9	0.6
10	0.0	0.4	0.8	2.5	1.5	0.7	1.2	5.0	2.0	0.9	1.0	0.6	0.7	0.1
11+	0.5	2.4	13.6	10.9	4.5	4.6	4.4	4.3	29.7	6.0	16.4	9.7	16.9	2.3
Total	4.1	21.0	129.4	132.5	97.8	71.6	29.2	24.9	52.9	24.6	31.9	25.3	36.4	13.8

Age	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
3	0.0	4.3	0.8	3.6	1.1	0.1	0.3	0.5	0.4	0.1	0.1	0.5	
4	0.9	3.5	12.0	10.8	22.4	3.6	3.3	1.5	5.3	9.5	2.0	6.7	
5	13.8	2.7	4.7	15.6	20.2	11.0	6.0	13.7	2.6	11.0	7.6	8.0	
6	17.8	8.9	2.6	19.8	22.8	12.9	47.7	2.0	15.1	5.1	9.3	13.8	
7	3.6	13.7	5.2	5.1	25.2	12.4	54.7	7.2	2.8	7.3	1.1	15.2	
8	5.8	2.1	7.9	4.5	8.5	18.7	11.9	11.7	3.0	4.3	4.8	3.0	
9	5.8	4.0	2.1	6.9	3.3	2.3	9.7	2.6	2.3	5.8	0.5	0.1	
10	2.6	3.0	1.3	1.8	1.4	2.0	8.4	0.3	0.5	25.0	1.3	0.3	
11+	11.1	12.6	4.4	13.8	2.2	0.4	3.2	5.8	1.1	1.7	1.3	0.1	
Total	61.3	54.7	40.9	82.0	107.1	63.3	145.4	45.2	33.1	70.0	27.9	47.8	7.1

Spring and Autumn Spawners

	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
Total	16.0	64.8	245.8	275.7	270.3	282.3	169.9	148.2	192.4	66.9	86.7	71.5	142.4	84.1
% SS	74.4	67.6	47.3	51.9	63.8	74.6	82.8	83.2	72.5	63.2	63.2	64.6	74.4	83.6
% AS	25.6	32.4	52.7	48.1	36.2	25.4	17.2	16.8	27.5	36.8	36.8	35.4	25.6	16.4

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Total	327.6	190.5	120.8	246.3	231.7	231.7	407.2	192.3	109.6	154.1	106.9	71.5	28.7
% SS	81.3	71.3	66.1	66.7	53.8	72.7	64.3	76.5	69.8	54.6	73.9	33.1	75.1
% AS	18.7	28.7	33.9	33.3	46.2	27.3	35.7	23.5	30.2	45.4	26.1	66.9	24.9

Table 17. Spring research gill net catch rates at age (numbers per nights fished), of spring and autumn spawning herring, for Fortune Bay, 1982-2007, catch rates only in 2008.

Spring Spawners

Age	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0
3	0.6	8.4	0.0	14.3	0.0	0.0	0.0	12.1	98.8	0.6	0.3	0.0	1.3	0.0
4	0.8	6.0	22.1	2.8	224.0	0.0	0.0	0.9	1.4	54.4	3.6	0.0	32.1	22.6
5	0.6	3.9	15.0	204.5	8.8	532.2	3.1	0.9	0.0	16.8	61.3	9.1	14.0	85.4
6	0.1	3.1	6.1	69.2	69.9	11.7	420.7	15.8	0.0	2.2	11.6	140.4	21.4	8.9
7	0.2	2.4	1.4	15.7	48.3	48.3	9.8	659.3	6.2	1.7	1.3	5.0	252.5	19.8
8	6.0	2.7	4.1	4.6	10.0	20.7	50.6	14.8	236.8	21.9	1.7	3.7	3.3	258.4
9	0.3	44.0	0.3	8.8	0.8	4.8	11.4	64.9	19.7	283.8	6.3	0.0	12.0	39.0
10	0.8	4.6	4.4	6.5	2.0	1.4	2.1	33.4	59.0	38.1	70.3	9.5	12.0	12.3
11+	0.8	53.7	102.5	135.3	35.9	71.8	19.6	124.3	56.1	141.4	175.0	245.3	319.3	237.2
Total	10.3	128.7	156.0	461.6	399.3	690.2	516.8	927.3	479.4	560.9	331.4	413.0	668.0	683.6

Age	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	
3	0.0	0.0	2.4	82.8	0.0	0.0	8.1	0.0	2.9	44.6	3.4	0.5	
4	19.0	0.0	3.7	36.7	124.2	1.1	0.9	19.0	3.1	0.7	167.5	2.9	
5	134.5	89.2	0.0	21.3	40.7	235.2	4.9	0.9	44.8	2.1	9.0	102.6	
6	112.1	193.1	514.2	15.4	8.7	49.7	194.2	5.6	7.0	40.1	2.9	2.2	
7	12.1	103.9	144.5	245.8	10.9	65.6	23.3	246.2	2.3	3.1	15.6	3.4	
8	19.0	19.6	161.6	161.3	124.2	75.8	6.3	16.7	62.1	3.8	1.8	4.2	
9	187.1	17.6	19.6	40.1	109.7	122.1	5.8	3.7	3.9	107.0	6.9	1.4	
10	19.0	104.9	28.2	21.3	55.9	117.6	11.6	0.9	2.3	9.8	16.1	0.9	
11+	360.4	451.8	350.2	230.4	251.4	463.6	192.8	169.4	65.0	137.4	40.9	62.6	
Total	862.3	980.0	1224.3	853.5	726.6	1130.6	447.4	462.8	194.1	348.6	264.1	180.9	280.9

Autumn Spawners

Age	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	0.0	0.0	0.0	0.1	0.0	0.0	0.0	7.4	2.2	0.0	0.0	0.0	0.7	0.0
4	0.3	18.0	0.0	13.8	8.5	0.1	0.2	0.2	6.6	1.9	1.1	0.1	0.1	0.0
5	1.4	6.0	31.1	7.9	5.0	3.3	0.1	3.6	1.0	4.4	6.3	3.5	2.8	9.5
6	0.2	20.6	11.8	73.9	9.3	4.0	3.0	1.4	2.0	1.7	9.2	5.8	7.6	3.9
7	0.0	2.0	19.5	38.6	28.2	4.5	3.8	11.1	1.4	1.2	5.2	17.5	8.0	16.8
8	0.0	1.1	4.1	17.5	9.0	25.6	3.0	8.8	4.7	1.4	3.7	3.3	15.2	14.2
9	0.0	0.5	1.0	13.8	2.0	10.0	12.2	3.1	9.4	1.6	5.8	0.9	0.5	10.9
10	0.0	0.0	0.2	3.3	1.0	5.2	1.1	20.6	0.5	5.5	2.1	0.0	0.0	0.2
11+	0.1	0.7	3.5	5.9	1.7	17.3	13.9	24.6	19.6	18.5	17.9	18.4	11.5	18.7
Total	2.0	48.9	71.3	174.6	64.8	69.9	37.3	80.7	47.4	36.4	51.3	49.5	46.4	74.3

Age	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8	0.0	0.0	0.0	0.0	
4	0.0	0.0	4.2	0.0	11.2	0.0	7.4	0.4	14.8	15.9	4.7	2.8	
5	4.7	0.0	2.1	7.7	8.1	5.3	3.4	12.6	12.1	27.3	13.9	3.3	
6	11.0	5.4	12.8	26.9	2.1	12.8	24.5	0.5	43.6	21.7	28.4	11.0	
7	3.1	32.1	4.2	28.8	53.9	9.3	23.2	19.1	1.9	15.4	9.9	10.7	
8	7.8	10.7	17.0	53.8	5.4	13.2	1.9	11.5	5.5	2.6	5.9	4.2	
9	3.1	10.7	2.1	34.6	14.4	34.6	7.5	5.5	10.1	5.9	2.7	1.0	
10	1.6	7.1	0.0	15.4	3.3	10.8	1.9	4.0	3.2	1.9	5.8	1.1	
11+	26.6	25.0	8.5	46.1	60.9	11.0	23.0	24.1	5.6	14.0	12.2	3.0	
Total	58.0	91.0	51.0	213.4	159.5	97.0	92.9	78.5	96.9	104.7	83.4	37.1	57.5

Spring and Autumn Spawners

	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
Total	12.3	177.6	227.2	636.2	464.0	760.1	554.1	1008.0	526.8	597.4	382.7	462.5	714.4	757.8
% SS	83.7	72.5	68.6	72.6	86.0	90.8	93.3	92.0	91.0	93.9	86.6	89.3	93.5	90.2
% AS	16.3	27.5	31.4	27.4	14.0	9.2	6.7	8.0	9.0	6.1	13.4	10.7	6.5	9.8

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Total	920.3	1071.0	1275.3	1066.9	886.1	1227.6	540.4	541.2	291.0	453.4	347.6	218.0	338.4
% SS	93.7	91.5	96.0	80.0	82.0	92.1	82.8	85.5	66.7	76.9	76.0	83.0	83.0
% AS	6.3	8.5	4.0	20.0	18.0	7.9	17.2	14.5	33.3	23.1	24.0	17.0	17.0

Table 18. Acoustic survey biomass estimates (t), by stock area, 1983-2000.

Year	White Bay / Notre Dame Bay	Bonavista Bay / Trinity Bay	St. Mary's Bay / Placentia Bay	Fortune Bay
1983	136000	-	-	-
1984	78700	59800	-	-
1985	198400	99900	-	-
1986	126200	25700	42200	9100
1987	30900	10400	-	-
1988	22500	29700	-	-
1989	-	-	-	-
1990	-	51900	32700	14400
1991	-	-	-	-
1992	104500	-	10200	18400
1993	-	23100	-	-
1994	2100	-	29300	-
1995	-	12300	-	2500
1996	-	33000	17700	-
1997	-	-	-	15500
1998	19200	-	6300	-
1999	-	15200	-	30000
2000	-	-	2000	-

Table 19. Parameters, catch data, catch rates, effort, and abundance indices, by stock area and year, from commercial gill net logbook data.

Stock area	Year	Number of fishers	Mean fisher age	Fishing dates Start	Fishing dates End	Mean mesh size (mm)	Mean panel size (sq m)	Total logbook catch (t)	Total comm. landings (t)	Catch/ Std. net /Night fished (kg)	Effort (net nights per fisher)	Current year abundance index	Cumulative abundance index
WBNDB	1981	8	-	01-Apr	23-May	-	-	50.5	2855	68.5	825	-	-
	1983	38	-	18-Apr	14-Jul	-	-	68.0	406	41.8	2088	-	-
	1996	16	-	01-Apr	18-Jun	64.7	299	68.5	229	38.4	2970	-	-
	1997	9	45	10-May	30-Jun	63.8	205	9.2	21	36.7	1031	5.00	-0.60
	1998	13	47	15-Apr	30-Jun	62.6	237	8.7	36	14.9	1832	3.00	-3.45
	1999	5	38	20-Apr	30-Jun	63.3	363	9.7	57	17.3	1027	5.83	-0.95
	2000	8	47	15-Apr	10-Jul	63.4	310	6.8	19	22.5	727	2.69	-1.78
	2001	10	45	05-May	12-Jul	60.8	201	8.2	7	25.3	910	4.60	-1.11
	2002	8	49	30-Apr	05-Jul	60.0	243	0.8	13	2.2	719	2.30	-2.00
	2003	9	52	29-Apr	01-Jul	59.2	175	9.4	46	24.3	1405	4.00	-1.00
	2004	8	51	22-Apr	30-Jun	62.2	161	4.9	12	21.4	710	3.86	-0.75
	2005	8	50	30-Apr	18-Jun	61.9	175	6.5	12	34.3	731	5.47	0.00
	2006	10	52	02-May	12-Jul	62.9	249	17.5	27	65.9	1361	5.67	0.22
	2007	15	53	03-May	14-Jul	60.8	177	18.6	0	41.0	1515	5.45	0.70
	2008	8	55	02-May	07-Jul	61.6	258	23.9	2	86.2	542	6.56	2.76
BBTB	1981	10	-	02-Apr	04-May	-	-	33.0	1766	25.9	1291	-	-
	1983	18	-	18-Apr	25-Jun	-	-	11.5	69	15.5	823	-	-
	1996	11	-	02-Apr	05-Jun	65.3	214	51.5	378	52.6	2153	-	-
	1997	6	45	07-Apr	27-Jun	66.1	312	39.4	201	27.9	1818	8.00	0.93
	1998	6	45	02-Apr	21-Jun	66.0	245	16.3	170	13.5	1655	5.00	-1.07
	1999	5	51	02-Apr	29-Jun	66.0	330	28.7	194	27.8	657	6.00	-1.07
	2000	9	49	08-Apr	30-Jun	65.3	349	23.6	202	36.7	1018	4.27	-0.67
	2001	10	46	13-Apr	30-Jun	66.3	298	22.3	56	33.2	964	3.82	-1.31
	2002	10	53	20-Apr	21-Jun	66.5	309	6.0	38	10.2	574	2.50	-2.19
	2003	4	57	01-May	30-Jun	66.7	210	4.9	56	23.4	358	4.80	-0.94
	2004	5	63	21-Apr	30-Jun	64.3	169	6.8	24	16.6	608	3.57	-0.61
	2005	6	52	22-Apr	22-Jun	64.9	276	14.0	315	39.5	716	5.60	0.19
	2006	12	54	11-Apr	30-Jun	65.0	223	31.6	136	46.4	890	6.31	1.32
	2007	13	54	04-Apr	30-Jun	63.0	247	54.3	154	85.6	887	7.19	2.03
	2008	3	52	26-Apr	30-Jun	65.7	221	1.9	27	16.8	147	5.42	1.26

Table 19 (cont'd').

Stock area	Year	Number of fishers	Mean fisher age	Fishing dates Start	Fishing dates End	Mean mesh size (mm)	Mean panel size (sq m)	Total logbook catch (t)	Total comm. landings (t)	Catch/ Std. net /Night fished (kg)	Effort (net nights per fisher)	Current year abundance index	Cumulative abundance index
SMBPB	1983	6	-	18-Apr	29-Jun	-	-	1.2	40	3.4	320	-	-
	1996	13	-	19-Mar	15-Jun	67.1	261	45.3	37	31.4	2073	-	-
	1997	6	50	12-Feb	24-Jun	68.3	265	15.4	21	20.7	2171	3.50	-2.00
	1998	8	52	17-Mar	25-Jun	68.2	257	25.9	18	20.2	5361	2.57	-2.71
	1999	6	51	21-Feb	29-May	65.6	319	11.9	1	12.0	2981	2.75	-3.34
	2000	1	57	01-Apr	26-May	66.7	334	2.7	4	10.1	280	4.00	-3.84
	2001	3	52	28-Apr	23-Jun	65.3	226	2.0	38	10.2	235	3.00	-3.64
	2002	4	56	20-Feb	08-Jun	66.3	241	75	135	39.4	1692	5.00	-2.24
	2003	4	56	20-Mar	17-Jun	65.7	240	9.2	84	23.9	658	3.60	-2.04
	2004	2	57	08-Apr	15-Jun	64.8	259	1.1	179	5.4	332	3.67	-2.71
	2005	3	57	07-Apr	10-Jun	63.3	268	1.2	134	7.9	210	5.00	-1.51
	2006	5	56	03-Apr	05-Jun	64.6	292	3.2	150	9.1	432	3.00	-1.68
	2007	9	55	10-Mar	15-Jun	66.3	336	17.3	167	17.4	836	4.63	-1.99
	2008	7	55	15-Mar	13-Jun	65.9	223	53.4	79	36.8	1440	4.80	-3.24
FB	1996	11	-	08-Apr	10-Jun	68.6	304	60	31	37.5	3044	-	-
	1997	13	50	29-Mar	28-Jun	66.9	271	68.9	28	39.4	5919	7.60	0.45
	1998	11	49	01-Apr	17-Jun	65.2	218	41.3	0	54.7	2776	7.40	1.35
	1999	8	49	21-Mar	15-Jun	65.8	313	36.1	30	37.9	1432	8.14	1.06
	2000	11	50	25-Mar	12-Jun	66.5	263	96.5	16	83.5	2364	8.45	1.56
	2001	8	54	28-Mar	21-Jun	65.6	311	54.6	0	38.2	1668	6.75	0.68
	2002	7	53	28-Mar	29-Jun	65.5	297	35.7	0	50.6	1093	6.71	0.54
	2003	7	53	08-Apr	18-Jun	66.1	283	16.3	0	36.6	581	5.00	-0.46
	2004	5	53	30-Mar	23-Jun	68.1	305	10.7	54	24.6	728	4.33	-0.79
	2005	6	55	06-Apr	19-Jun	67.4	303	8.6	5	16.0	552	5.08	-2.02
	2006	6	55	03-Apr	21-Jun	65.9	313	7.4	4	11.6	707	3.33	-3.24
	2007	15	52	09-Apr	22-Jun	64.4	?	27.7	2	30.3	1746	4.26	-3.66
	2008	12	53	02-Apr	20-Jun	65.9	220	25.4	2	50.9	1121	4.07	-4.57

Table 20. Comparison of abundance indices for commercial gill net fishers who responded before and after a reminder letter in August 2008.

Commercial Gillnet Logbook Catch Rates	WB-NDB		BB-TB		SMB-PB		FB	
	Before	After	Before	After	Before	After	Before	After
Number of Fishers	3	5	2	1	4	3	5	6
Catch Rate (catch per std. net per nights fished–kg)	71.3	96.5	9.6	67.2	50.2	25.9	53.4	20.9
Effort (net nights per fisher)	285	266	154	11	564	928	522	508

Gillnet Fisher Cumulative Index	WB-NDB		BB-TB		SMB-PB		FB	
	Before	After	Before	After	Before	After	Before	After
Number of Fishers	12	5	10	3	9	1	10	6
Cumulative Index	1.41	3.50	-0.65	-1.17	-1.44	0.50	-1.85	0.67

Table 21. Results of the phone survey of herring commercial gill net licence and/or bait permit holders, by stock area and year (2006-08).

Stock Area	Year	Licences and Bait Permits		Fishers Phoned		Fishers Contacted		Active Fishers		Fished for Bait		Fished Commercially		Mean Fisher Age
		#	% of total	#	% within	#	% within	#	% within	#	% within	#	% within	
WBNDB	2006	989	42.5	113	11.4	84	74.3	40	47.6	39	97.5	1	2.5	52
	2007	969	42.5	113	11.7	103	91.2	42	40.8	42	100.0	0	0.0	50
	2008	959	42.3	113	11.8	92	81.4	32	34.8	32	100.0	0	0.0	52
BBTB	2006	577	24.8	106	18.4	88	83.0	49	55.7	44	89.8	5	10.2	49
	2007	562	24.6	106	18.9	88	83.0	50	56.8	44	88.0	6	12.0	50
	2008	560	24.7	106	18.9	92	86.8	43	46.7	41	95.3	2	4.7	52
SMBPB	2006	453	19.5	103	22.7	79	76.7	22	27.8	21	95.5	1	4.5	54
	2007	445	19.5	102	22.9	83	81.4	19	22.9	17	89.5	2	10.5	57
	2008	444	19.6	102	23.0	78	76.5	17	21.8	17	100.0	0	0.0	54
FB	2006	307	13.2	95	30.9	79	83.2	57	72.2	55	96.5	2	3.5	51
	2007	304	13.3	94	30.9	81	86.2	52	64.2	51	98.1	1	1.9	49
	2008	304	13.4	94	30.9	84	89.4	50	59.5	50	100.0	0	0.0	51
Combined	2006	2326	100.0	417	17.9	330	79.1	168	50.9	159	94.6	9	5.4	52
	2007	2280	100.0	415	18.2	355	85.5	163	45.9	152	93.3	11	6.7	52
	2008	2267	100.0	415	18.3	346	83.4	142	41.0	140	98.6	2	1.4	52

Table 21 (cont'd.).

Stock Area	Year	Number of Respondents	Current Year Abundance Index	Previous Year Abundance Index	Cumulative Index
WBNDB	2005	-	-	5.29	-
	2006	40	5.68	5.46	0.45
	2007	42	5.99	4.70	0.90
	2008	32	5.63	-	1.45
BBTB	2005	-	-	4.84	-
	2006	49	5.48	5.91	0.51
	2007	50	7.09	6.44	1.89
	2008	43	6.13	-	2.02
SMBPB	2005	-	-	4.78	-
	2006	22	5.00	5.39	0.22
	2007	19	6.39	6.53	1.25
	2008	17	7.00	-	2.28
FB	2005	-	-	6.00	-
	2006	57	5.34	5.50	-0.65
	2007	52	3.75	4.55	-2.48
	2008	50	3.67	-	-4.02

Table 22a. Estimation of herring landings used for bait, by stock area; data from the 2007 gill net fisher phone survey.

	WBNDB	BBTB	SMBPB	FB
Number of licences and bait permits	969	562	445	304
Percentage active fishers from 2007 phone survey	40.8	56.8	22.9	64.2
Estimated number of active fishers by stock area	395	319	102	195
Number of active bait fishers from 2007 phone survey	42	44	17	51
Total bait fisher landings (lbs) from survey	170220	196748	63599	293401
Total bait fisher landings (kg) from survey	77212	89245	28849	133087
Landings per bait fisher (kg)	1838	2028	1697	2610
Estimated bait landings (t) by stock area	727	647	173	509
Bait landings estimate (t) used by Fisheries Management	500	300	150	400

Table 22b. Estimation of herring landings used for bait, by stock area; data from the 2008 gill net fisher phone survey.

	WBNDB	BBTB	SMBPB	FB
Number of licences and bait permits	959	560	444	304
Percentage active fishers from 2008 phone survey	34.8	46.7	21.8	59.5
Estimated number of active fishers by stock area	334	262	97	181
Number of active bait fishers from 2008 phone survey	32	41	17	50
Total bait fisher landings (lbs) from survey	100210	155955	49290	240690
Total bait fisher landings (kg) from survey	45455	70741	22358	109177
Landings per bait fisher (kg)	1420	1725	1315	2184
Estimated bait landings (t) by stock area	474	451	127	395
Bait landings estimate (t) used by Fisheries Management	500	300	150	400

Table 23. Parameters, landings data, discard data, effort, and abundance indices, by stock area and year, from commercial purse seine questionnaires.

Stock Area	Year	Number who Fished	Number to Respond	Mean Fisher Age	Total Estimate of Landings (t)	Total Comm. Landings (t)	Total Estimate of Discards (t)	Estimate of Discard Survival (%)	Total Estimate of Removals (t)	Effort (sets per fisher)	Current Year Abundance Index	Cumulative Abundance Index
WBNDB	1996	18	17	43	392	435	446	49	620	1.5	7.88	1.33
	1997	15	14	49	1801	2375	2045	97	1866	21.0	6.92	0.83
	1998	6	6	46	302	606	540	93	338	18.0	6.75	0.58
	1999	7	7	52	882	931	116	39	953	10.0	8.50	6.08
	2000	12	9	50	651	1071	130	100	651	2.4	5.88	6.08
	2001	0	0	-	-	13	-	-	-	-	-	-
	2002	3	3	51	260	300	25	93	262	4.0	8.67	8.41
	2003	4	4	53	201	195	193	40	317	2.0	9.00	8.41
	2004	5	4	51	109	163	13	0	121	1.0	8.25	8.41
	2005	4	4	48	84	136	12	35	92	1.0	9.00	8.08
	2006	6	4	49	160	139	15	10	174	1.0	8.00	8.08
	2007	2	2	50	325	333	0	-	325	4.3	6.50	7.93
BBTB	1996	21	21	46	738	358	209	50	842	4.4	8.62	1.12
	1997	16	15	45	736	650	47	60	755	9.1	6.93	0.74
	1998	13	11	48	621	708	9	50	625	10.1	7.55	0.11
	1999	14	14	47	894	808	219	69	962	8.8	5.79	-1.64
	2000	7	5	50	344	495	264	95	358	14.6	5.00	-3.44
	2001	5	4	54	260	259	2030	83	615	31.5	7.75	-3.94
	2002	5	4	55	200	200	225	100	200	3.8	6.75	-3.94
	2003	2	2	55	378	343	25	20	398	17.0	6.00	-3.94
	2004	4	1	49	100	322	0	-	100	8.0	8.00	-1.94
	2005	10	7	50	1315	1515	59	30	1356	8.4	9.29	-0.19
	2006	12	10	47	1100	1043	765	86	1209	7.4	8.60	0.71
	2007	18	15	47	1474	1249	0	-	1474	5.5	8.30	1.38
SMBPB	1996	10	9	47	460	446	225	50	572	1.8	8.67	0.50
	1997	15	15	48	4401	3836	403	82	4474	21.1	8.19	0.50
	1998	15	13	47	1727	2281	790	99	1736	10.8	2.60	-4.94
	1999	3	2	47	186	330	0	-	186	13.0	5.00	-5.94
	2000	1	1	57	400	447	105	90	411	24.0	5.00	-2.94
	2001	2	2	59	430	451	100	95	435	5.5	7.67	-2.64
	2002	8	8	49	1440	1398	1050	98	1458	6.9	9.13	-2.64
	2003	9	4	50	467	925	165	98	471	7.5	6.00	-1.64
	2004	11	10	51	1272	1240	2	100	1272	8.7	8.38	-0.93
	2005	14	9	52	975	1247	572	98	984	8.1	8.67	-0.26
	2006	9	7	48	1005	1378	58	100	1005	6.7	8.29	0.24
	2007	3	3	39	601	558	25	65	610	10.0	8.33	1.57
	2008	2	2	50	219	160	0	-	219	5.0	9.00	1.07

Table 24. Mean weights at age (g) of spring and autumn spawning herring, from samples collected January to June, for White Bay–Notre Dame Bay, 1970-2007.

Spring Spawners

Age	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
1																			
2						66		54											81
3		105				143		93	99	99		138	131				144		148
4		143	149		179	177	208		201	181	199	197	205	204	252	197	201	207	213
5	209	161	181		189	222	237	225	243	254	297	233	217	240	242	262	223	234	236
6	214	198	192		203	230	222	236	253	274	282	264	278	265	341	263	273	272	256
7	231	201	207		217	241	240	247	266	283		290	314	330	305	300	281	297	294
8	280	220	218		236	255	260	252	271	287	299	337	323		355	325	319	319	316
9	282	275	243		249	274	261	270	269	281	307	306	322	357	367	332	331	346	323
10	301	278	280		258	284	278	281	279	291	305	305	324		391	353	338	338	333
11+	327	309	300		291	311	305	317	311	323	328	345	350	394	388	376	375	399	414

Age	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
1																30			
2				42	27								106		78	65		111	141
3	122	124	122	130	79	74	125		106	112		116	134	126	134	127	134	152	148
4	179	195	171	165	159	132	131	154		145	155	170	149	195	162	155	174	179	190
5	234	227	212	199	189	187	166	167	230	170	176	193	185	206	198	189	208	207	218
6	259	249	247	229	221	210	200	201	192	196	216	214	215	260	217	235	234	242	235
7	279	273	278	261	253	238	226	239	223	228	245	261	238	276	245	250	253	256	268
8	296	296	287	277	280	271	249	254	250	242	245	302	265	283	258	244	271	289	275
9	329	311	312	296	300	283	286	274	259	257	259	300	330	341	266	287	291		332
10	336	332	330	321	305	304	288	289	292	288	294	320	327	299	272	288	300	301	
11+	418	412	393	373	345	330	324	371	354	362	340	378	336	397	332	376	415	365	352

Autumn Spawners

Age	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
1																			
2																			
3																			
4								198					201	253					
5		125				244		214		232		251	225	229	277	213		238	217
6		279	205			240			246	267		297	254	262	314	261	264	288	233
7		300						257	274	271	295		354		375	281	308	279	263
8		351				312	333		289	315		310	330		491	342	359	309	289
9		335	249					203	211	296			319	370	426	336		323	317
10		371	263		272				254			353			308	312	414		346
11+	323	432	300		345	363	481	350	278	325	328	374	338		440	385	465	442	375

Age	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
1																			
2				16															
3		86																132	174
4	149		160		123	126			116	146	137	139	141	191	163	158	165	160	194
5	211	201	193	199	164	155	151	173	168	181	191	220	202	211	195	180	188	186	198
6	236	224	199	210	201	192	200	210	180	202	193	226	228	250	210	211	210	209	226
7	255	257	257	253	247	212	234	249	213	255	254	257	243	285	217	242	247	222	241
8	274	291	303	215	274	256	216	269	209	264	280	267	270	294	248	265	273	283	255
9	299	314	294	291	295	284	308	284	221	237	242	343	345	300	268	264	297	228	266
10	303	325		324	298	326	299	290		310	297	312		335	269	279	283	295	285
11+	362	393	358	348	375	370	296	400	332	355	388	356	343	392	274	326	355	336	370

Table 25. Mean weights at age (g) of spring and autumn spawning herring, from samples collected January to June, for Bonavista Bay–Trinity Bay, 1970-2007.

Spring Spawners

Age	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
1								13						9			10		
2		40					67		49	58	59	49			53		59	69	83
3		92	103		143	152		127		124		149	125	137	130	118	121	136	129
4		146	151			183	215	221	212	204	216	244	215	211	193	198	189	205	194
5		183	184		258	225	221	242	253	255	269	275	236	284	241	249	235	222	232
6		214	237		229	234	243	262	272	310	307	313	283		289	274	281	268	255
7	260	238	231		227	254	253	265	305	304	307	329	276	339	315	300	301	324	290
8	266	255	256		274	276	272	259	271	288	311	350	323		328	343	329	344	320
9	298	287	274		291	306	293	283	286	297	317	343	332	378	333	340	371	418	353
10	307	284	303		294	320	312	296	300	308	311	331	324	399	342	365	377	326	359
11+	353	329	327		311	356	341	332	338	339	349	366	348	433	383	393	408	416	421

Age	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
1				2															
2	67	82		34	22							101	97			84			
3	141	147	132	127	108	81	101		115	143	168	139	145	136	147	129	132	163	169
4	216	212	202	173	171	144	133	161		172	187	186	164	186	183	175	178	187	186
5	259	248	257	214	211	198	172	189	203	219	207	225	194	196	218	202	212	202	214
6	271	264	287	254	240	224	218	215	214	238	234	243	243	239	227	233	234	245	233
7	282	280	286	287	284	255	237	258	235	245	246	251	261	269	284	256	262	265	266
8	312	293	289	284	311	295	270	271	272	254	275	276	283	277	280	291	277	292	276
9	352	323	322	280	299	308	291	280	287	256	282	312	288	288	294	281	284	294	296
10	361	347	339	308	309	306	289	308	301	293	287	325	304	301	323	303	298	302	323
11+	417	411	387	340	343	345	331	345	341	339	340	332	328	328	353	365	363	331	340

Autumn Spawners

Age	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
1																	12		
2																			
3												125		161					
4								186			180	229		199	143	174	215	154	190
5		160					210		243	254	252	265	215	269	221	224	232	231	211
6		231					250	255	232	269	279	320	271	297	244	259	261	261	241
7	268	251	259			255	227	257	227	293	299	335	290	366	266	288	290	266	273
8	233	259	277			299	295	270	288	325	313	342	301	403	305	323	312	349	302
9	287		307				295	267	265	339	327	345	331	454	293	324	319	367	323
10	284	264	317						276	264	282	401		426	354	337	348		397
11+	353	342	353		345	380	363	364	344	389	379	403	374	416		393	364	535	372

Age	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
1																			
2				14			13												
3	82		80	79	89	66	81										117	117	140
4	163	198	172	112	130	119	140		139	166	183	176	153	170	166	165	161	177	180
5	218	218	210	214	190	166	186	194	152	196	206	192	188	189	200	193	193	194	187
6	246	242	236	228	210	202	197	213	218	214	231	221	213	213	216	220	221	208	213
7	288	278	274	250	256	225	233	237	237	248	259	239	242	228	234	240	235	235	234
8	291	289	309	297	277	247	246	270	259	265	292	253	260	242	249	257	275	256	259
9	318	298	308	291	306	286	265	296	293	282	288	273	273	270	268	280	279	288	282
10	315	318	294	286	314	293	264	289	295	293	294	302	311	285	272	303	299	279	309
11+	373	366	356	335	360	337	349	366	368	331	330	330	318	294	308	314	332	332	330

Table 26. Mean weights at age (g) of spring and autumn spawning herring, from samples collected January to June, for St. Mary's Bay–Placentia Bay, 1970-2007.

Spring Spawners

Age	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
1	17				28										32				14
2	51			83	71	86	73	81	79	99	106	81	111	99	78		89	80	120
3	162	101	154	151	159	153	163	154	154	155	182	168	163	164	177	133	172	183	164
4	197	127	190	208	213	210	236	242	234	243	235	218	243	237	230	215	216	222	232
5	231	205	229	217	229	243	250	288	286	293	311	300	290	280	263	241	263	264	261
6	269	208	258	233	242	245	273	298	327	326	338	321	324	312	301	283	300	291	285
7	285	267	278	260	269	272	262	305	326	360	362	256	349	349	343	316	316	310	305
8	308	179	294	255	290	287	282	294	330	391	392	371	365	377	361	332	378	340	320
9	314	286	309	280	307	307	302	321	319	376	408	373	394	378	372	347	374	362	330
10	341	227	326	312	310	314	322	331	341	340	377	370	383	395	375	386	389	378	350
11+	383	303	351	318	338	345	349	373	393	386	437	419	414	430	434	410	453	447	419

Age	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
1	30	30		22															
2	87	97	77	59	39	59			71	79	157	113	79	94	120	96	95	105	
3	162	163	140	137	130	115	107		122	130	143	135	138	136	148	127	136	143	146
4	242	221	211	191	189	168	171	170	112	178	175	170	166	175	181	166	186	181	197
5	273	266	258	242	215	219	229	224	211	205	198	192	189	202	208	218	229	220	216
6	291	271	278	275	267	249	264	270	251	258		228	244	230	240	234	269	242	230
7	311	309	297	294	292	291	278	301	278	286	264	239	266	257	246	266	280	277	268
8	343	328	302	301	305	322	324	353	312	300	309	271	289	278	274	277	287	275	280
9	362	343	331	315	317	332	347	349	317	328	298	300	280	304	309	297	291	271	288
10	367	347	346	331	330	330	334	388	331	326	322	306	312	301	322	315	310	272	298
11+	406	430	362	362	372	384	381	426	413	424	394	352	341	354	368	362	359	317	318

Autumn Spawners

Age	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
1																			
2															45			46	
3			115	112			113			119		168	113	119	119	113	118	127	98
4	174	148	183	171		297	188	193	195	187	212	195	200	195	198	156	212	202	203
5	244	186	196	216	228	209	227	242	240	257	244	243	240	243	243	209	219	233	236
6	244	195	230	216	237	250	257	271	269	287	290	263	285	292	278	242	266	254	260
7	285	223	242	255	266	261	277	289	302	320	310	302	292	303	318	268	299	290	282
8	284	241	289	287	279	271	271	306	311	339	339	355	344	330	326	291	335	318	315
9	311	258	317	278	290	286	293	299	329	364	338	358	356	397	353	307	354	349	328
10	342	306	331	325	293	301	289	312	313	325	355		366	393	393	331	368	336	342
11+	370	330	361	240	358	365	368	371	367	399	400	406	400	408	410	385	417	396	379

Age	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
1																			
2					17														
3	114	97	121	85	71	88	86		103	105	102	112	106	141	116	99	169	127	105
4	193	189	175	162	143	144	149	147	154	165	159	148	160	159	167	154	162	170	173
5	245	235	216	210	192	180	195	196	186	202	194	171	184	189	194	184	195	199	184
6	274	273	248	232	220	212	211	222	218	221	215	201	200	208	218	212	218	214	209
7	290	279	273	273	255	239	259	250	244	256	247	228	231	231	242	238	246	242	239
8	322	300	300	295	275	273	274	290	259	272	274	247	255	261	259	251	266	265	261
9	337	328	319	306	299	292	297	308	279	297	293	273	265	274	279	274	279	255	298
10	343	333	336	310	313	292	297	322	308	312	302	283	274	293	292	292	290	283	312
11+	383	378	366	350	365	364	372	403	371	371	377	332	322	332	336	325	336	304	340

Table 27. Mean weights at age (g) of spring and autumn spawning herring, from samples collected January to June, for Fortune Bay, 1970-2007.

Spring Spawners

Age	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
1			21																
2	74	100	75	13	78	127	58	55			112		104		73				
3	133	137	158	88	153	159	131	118	154		212	145	157	164	170	148			
4	191	194	206	153	205	221	202	206	209	226	234	291	221	238	221	202	209		
5	256	236	234	167	230	253	249	260	263	261	272		277	264	258	251	251	247	236
6	269	278	274	194	277	289	285	294	299	257	307		354	316	307	287	287	293	275
7	309	316	323	229	276	322	322	297	318	324	377	353	359	363	333	317	318	323	295
8	342	328	350	279	310	316	343	309	330	370	343		384	360	372	368	370	352	331
9	340	357	352	250	276	350	377	324	350	345	344	353	386	400	435	373	415	375	353
10	460	367	352	269	353	355	376	348	359		368		398	412	401	387	412	424	390
11+	408	417	397	304	374	417	419	375	396	397	399		420	426	443	439	474	460	462

Age	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
1				15			23												
2	102	112		61							79		79			69			
3	145	144	134	138	120	114	90		121	99	103		128	138	134	122	126	129	151
4	215	180	186	170	177	157	150	167	168	186	152	148	177	162	171	135	176	162	159
5	252	212	233	209	222	195	185	205	190		185	186	179	175	197	193	214	186	191
6	268	261	244	254	240	214	218	237	226	227	217	218	214	221	210	213	235	219	254
7	292	293	276	288	281	257	237	256	262	250	249	226	251	264	241	221	272	252	254
8	322	328	289	295	297	279	265	292	285	281	279	255	260	284	268	256	266	260	247
9	339	348	319	309	284	294	311	309	287	292	303	296	278	307	305	282	275	260	287
10	356	378	338	329	287	320	311	337	317	320	323	311	303	300	307	308	301	273	262
11+	421	463	372	367	355	362	359	391	384	360	373	361	338	357	347	354	365	326	317

Autumn Spawners

Age	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
1																			
2																			
3					104		97					110	98			114			
4		165		204	208	192	181	179		240	210	180	205	200	193	173	184	149	166
5	200		220	202	222	228	233	236	236	231	224	255	246	251	241	210	222	240	237
6		269	251	175	227	263	276	261	391	305	257		279	290	270	252	269	254	265
7	246	272	278	292	290	273	264	260	271		303		300	318	299	286	303	295	288
8	294	286	290	232	272	300		335	313	336				337	342	314	320	324	300
9	282	332	312		306	391	326		287	317				345	340	340	345	338	318
10		321	347	97		341								405	307	326	357	332	334
11+	375	359	407	350	337	359	426	396	388	383	430		414		369	386	395	389	372

Age	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
1																			
2																			
3	117	118				94			110		94		172		102				
4	177	162	173	160	121	161	120		148	165		143		159	161	149	151	161	189
5	230	203	207	205	190	158	187	213	186	204	194	171	192	192	190	166	182	185	177
6	261	242	240	221	242	202	208	223	237	219	217	191	191	204	206	198	206	201	199
7	281	276	268	256	251	221	239	239	236	226	232	221	223	236	238	226	226	230	227
8	322	280	295	279	283	265	257	281	256	268	229	221	239	281	239	235	270	248	246
9	303	313	294	282	304	285	289	298	295	221	256	244	243	278	269	246	264	251	265
10	312	328	322	311	296		309	243	304		301	251	277	305	281	285	248	241	256
11+	383	385	370	351	336	330	380	353	385	361	340	317	312	337	314	305	309	283	285

Table 28. Diagnostics of the ADAPT–VPA results for White Bay–Notre Dame Bay using age-disaggregated spring and fall research gill net population number indices, and age-aggregated acoustic, commercial gill net logbook, gill net fisher and purse seine fisher population biomass indices.

White Bay - Notre Dame Bay Spring Spawners

Approximate Statistics Assuming Linearity Near Solution

Mean Square Residual = **2.419583**

Parameter	Estimate	Std. Err.	Rel. Err.	Bias	Rel. Bias.
N 2008 age 4	338	543	1.606	436	1.291
N 2008 age 5	349	572	1.637	337	0.965
N 2008 age 6	4670	3870	0.829	965	0.207
N 2008 age 7	410	704	1.719	339	0.829
N 2008 age 8	528	446	0.846	149	0.283
N 2008 age 9	1560	966	0.618	206	0.132
N 2008 age 10	14	12	0.808	4	0.300
N 2008 age 11	143	93	0.653	24	0.168
q Spring RGNs age 3	0.0005	0.0002	0.366	0.000029	0.056
q Spring RGNs age 4	0.0094	0.0034	0.360	0.000612	0.065
q Spring RGNs age 5	0.0149	0.0053	0.357	0.000979	0.066
q Spring RGNs age 6	0.0254	0.0092	0.360	0.002000	0.079
q Spring RGNs age 7	0.0230	0.0082	0.355	0.001570	0.069
q Spring RGNs age 8	0.0285	0.0101	0.353	0.001880	0.066
q Spring RGNs age 9	0.0247	0.0087	0.352	0.001550	0.063
q Spring RGNs age 10	0.0735	0.0257	0.350	0.004560	0.062
q Spring RGNs age 11	0.1200	0.0419	0.350	0.007400	0.062
q Fall RGNs age 3	0.0008	0.0004	0.449	0.000084	0.101
q Fall RGNs age 4	0.0023	0.0010	0.449	0.000231	0.101
q Fall RGNs age 5	0.0024	0.0011	0.449	0.000246	0.101
q Fall RGNs age 6	0.0021	0.0010	0.449	0.000214	0.101
q Fall RGNs age 7	0.0026	0.0012	0.449	0.000258	0.101
q Fall RGNs age 8	0.0029	0.0013	0.449	0.000290	0.101
q Fall RGNs age 9	0.0024	0.0011	0.449	0.000243	0.101
q Fall RGNs age 10	0.0040	0.0018	0.449	0.000401	0.101
q Fall RGNs age 11	0.0050	0.0022	0.449	0.000501	0.101
Acoustics ages 3-11	-	-	-	-	-
Commercial GNs ages 4-11	0.0227	0.0107	0.473	0.001610	0.071
GN Fisher ages 4-11	0.0035	0.0017	0.497	0.000274	0.079
PS Fisher ages 4-11	0.0044	0.0023	0.523	0.000326	0.074

Table 28 (cont'd.).

White Bay - Notre Dame Bay Autumn Spawners

Approximate Statistics Assuming Linearity Near Solution

Mean Square Residual = **3.191769**

Parameter	Estimate	Std. Err.	Rel. Err.	Bias	Rel. Bias.
N 2008 age 4	780	1430	1.831	1290	1.652
N 2008 age 5	2660	3270	1.227	1620	0.607
N 2008 age 6	1340	1480	1.101	656	0.488
N 2008 age 7	1260	1320	1.050	471	0.374
N 2008 age 8	1480	1490	1.011	425	0.287
N 2008 age 9	269	240	0.892	86	0.319
N 2008 age 10	92	84	0.913	34	0.367
N 2008 age 11	272	128	0.473	27	0.098
q Spring RGNs age 3	0.000	0.000	0.426	0.000001	0.094
q Spring RGNs age 4	0.000	0.000	0.416	0.000039	0.089
q Spring RGNs age 5	0.008	0.003	0.414	0.000687	0.088
q Spring RGNs age 6	0.015	0.006	0.415	0.001400	0.095
q Spring RGNs age 7	0.016	0.007	0.416	0.001500	0.096
q Spring RGNs age 8	0.026	0.011	0.419	0.002350	0.090
q Spring RGNs age 9	0.027	0.011	0.419	0.002350	0.086
q Spring RGNs age 10	0.043	0.018	0.422	0.003680	0.086
q Spring RGNs age 11	0.033	0.014	0.422	0.002850	0.086
q Fall RGNs age 3	0.000	0.000	0.516	0.000035	0.133
q Fall RGNs age 4	0.003	0.001	0.516	0.000345	0.133
q Fall RGNs age 5	0.004	0.002	0.516	0.000491	0.133
q Fall RGNs age 6	0.004	0.002	0.516	0.000563	0.133
q Fall RGNs age 7	0.003	0.001	0.516	0.000353	0.133
q Fall RGNs age 8	0.002	0.001	0.516	0.000256	0.133
q Fall RGNs age 9	0.004	0.002	0.516	0.000474	0.133
q Fall RGNs age 10	0.006	0.003	0.516	0.000774	0.133
q Fall RGNs age 11	0.001	0.001	0.516	0.000159	0.133
Acoustics ages 3-11	-	-	-	-	-
Commercial GNs ages 4-11	0.037	0.020	0.544	0.002670	0.071
GN Fisher ages 4-11	0.005	0.003	0.570	0.000389	0.079
PS Fisher ages 4-11	0.006	0.004	0.603	0.000403	0.065

Table 29. Diagnostics of the ADAPT–VPA results for Bonavista Bay–Trinity Bay using age-disaggregated spring and fall research gill net population number indices, and age-aggregated acoustic, commercial gill net logbook, gill net fisher and purse seine fisher population biomass indices.

Bonavista Bay - Trinity Bay Spring Spawners

Approximate Statistics Assuming Linearity Near Solution

Mean Square Residual = **1.918714**

Parameter	Estimate	Std. Err.	Rel. Err.	Bias	Rel. Bias.
N 2008 age 4	17400	24500	1.404	16700	0.955
N 2008 age 5	6610	7120	1.077	3500	0.530
N 2008 age 6	31400	23400	0.744	5540	0.176
N 2008 age 7	2100	2920	1.387	1170	0.556
N 2008 age 8	2530	2090	0.827	666	0.263
N 2008 age 9	7930	5470	0.689	1280	0.161
N 2008 age 10	966	767	0.794	222	0.230
N 2008 age 11	2250	881	0.392	165	0.073
q Spring RGNs age 3	0.000	0.000	0.342	0.000006	0.051
q Spring RGNs age 4	0.001	0.000	0.337	0.000041	0.050
q Spring RGNs age 5	0.002	0.001	0.336	0.000092	0.052
q Spring RGNs age 6	0.003	0.001	0.339	0.000145	0.057
q Spring RGNs age 7	0.003	0.001	0.340	0.000140	0.053
q Spring RGNs age 8	0.003	0.001	0.345	0.000133	0.053
q Spring RGNs age 9	0.003	0.001	0.360	0.000153	0.057
q Spring RGNs age 10	0.004	0.001	0.377	0.000237	0.061
q Spring RGNs age 11	0.002	0.001	0.377	0.000142	0.061
q Fall RGNs age 3	0.001	0.000	0.401	0.000052	0.076
q Fall RGNs age 4	0.001	0.001	0.401	0.000110	0.076
q Fall RGNs age 5	0.001	0.001	0.401	0.000099	0.075
q Fall RGNs age 6	0.002	0.001	0.402	0.000119	0.075
q Fall RGNs age 7	0.001	0.001	0.401	0.000105	0.075
q Fall RGNs age 8	0.001	0.000	0.401	0.000060	0.075
q Fall RGNs age 9	0.001	0.000	0.401	0.000063	0.075
q Fall RGNs age 10	0.001	0.000	0.401	0.000092	0.075
q Fall RGNs age 11	0.002	0.001	0.401	0.000160	0.075
Acoustics ages 3-11	-	-	-	-	-
Commercial GNs ages 4-11	0.005	0.002	0.457	0.000282	0.061
GN Fisher ages 4-11	0.000	0.000	0.478	0.000027	0.069
PS Fisher ages 4-11	0.000	0.000	0.461	0.000018	0.043

Table 29 (cont'd.).

Bonavista Bay - Trinity Bay Autumn Spawners

Approximate Statistics Assuming Linearity Near Solution

Mean Square Residual = **3.007196**

Parameter	Estimate	Std. Err.	Rel. Err.	Bias	Rel. Bias.
N 2008 age 4	2340	4180	1.785	3730	1.591
N 2008 age 5	1970	2600	1.322	1630	0.829
N 2008 age 6	3800	4130	1.087	2050	0.538
N 2008 age 7	16000	13800	0.861	3510	0.219
N 2008 age 8	4580	5830	1.271	2030	0.443
N 2008 age 9	1700	1410	0.834	489	0.288
N 2008 age 10	1190	958	0.806	316	0.267
N 2008 age 11	1040	502	0.484	98	0.094
q Spring RGNs age 3	0.000	0.000	0.432	0.000000	0.087
q Spring RGNs age 4	0.000	0.000	0.421	0.000007	0.085
q Spring RGNs age 5	0.001	0.000	0.415	0.000099	0.084
q Spring RGNs age 6	0.003	0.001	0.414	0.000231	0.087
q Spring RGNs age 7	0.005	0.002	0.416	0.000420	0.091
q Spring RGNs age 8	0.005	0.002	0.416	0.000430	0.084
q Spring RGNs age 9	0.009	0.004	0.428	0.000830	0.088
q Spring RGNs age 10	0.018	0.008	0.445	0.001640	0.092
q Spring RGNs age 11	0.004	0.002	0.445	0.000394	0.092
q Fall RGNs age 3	0.000	0.000	0.502	0.000013	0.122
q Fall RGNs age 4	0.001	0.001	0.501	0.000140	0.123
q Fall RGNs age 5	0.002	0.001	0.501	0.000258	0.124
q Fall RGNs age 6	0.003	0.001	0.501	0.000327	0.124
q Fall RGNs age 7	0.004	0.002	0.501	0.000488	0.124
q Fall RGNs age 8	0.003	0.002	0.501	0.000385	0.123
q Fall RGNs age 9	0.007	0.003	0.501	0.000831	0.123
q Fall RGNs age 10	0.001	0.001	0.501	0.000150	0.123
q Fall RGNs age 11	0.001	0.000	0.501	0.000112	0.123
Acoustics ages 3-11	-	-	-	-	-
Commercial GNs ages 4-11	0.009	0.005	0.560	0.000781	0.090
GN Fisher ages 4-11	0.001	0.000	0.582	0.000071	0.098
PS Fisher ages 4-11	0.001	0.000	0.564	0.000062	0.073

Table 30. Diagnostics of the ADAPT–VPA results for St. Mary's Bay-Placentia Bay using an age-disaggregated spring research gill net population number index, and age-aggregated acoustic, commercial gill net logbook, gill net fisher, and purse seine fisher population biomass indices.

St. Mary's Bay - Placentia Bay Spring Spawners

Approximate Statistics Assuming Linearity Near Solution

Mean Square Residual = **1.512734**

Parameter	Estimate	Std. Err.	Rel. Err.	Bias	Rel. Bias.
N 2008 age 4	195	247	1.265	158	0.807
N 2008 age 5	463	419	0.905	191	0.413
N 2008 age 6	13200	8110	0.613	1910	0.144
N 2008 age 7	87	127	1.468	55	0.638
N 2008 age 8	580	397	0.684	119	0.205
N 2008 age 9	5360	3210	0.599	666	0.124
N 2008 age 10	86	79	0.919	30	0.353
N 2008 age 11	1370	594	0.435	107	0.078
q Spring RGNs age 3	0.001	0.000	0.258	0.000020	0.021
q Spring RGNs age 4	0.002	0.000	0.254	0.000036	0.021
q Spring RGNs age 5	0.002	0.000	0.252	0.000042	0.022
q Spring RGNs age 6	0.002	0.000	0.255	0.000050	0.028
q Spring RGNs age 7	0.002	0.001	0.256	0.000058	0.025
q Spring RGNs age 8	0.002	0.001	0.260	0.000065	0.028
q Spring RGNs age 9	0.003	0.001	0.262	0.000085	0.030
q Spring RGNs age 10	0.002	0.001	0.262	0.000061	0.027
q Spring RGNs age 11	0.002	0.000	0.262	0.000048	0.027
q Fall RGNs age 3					
q Fall RGNs age 4					
q Fall RGNs age 5					
q Fall RGNs age 6					
q Fall RGNs age 7					
q Fall RGNs age 8					
q Fall RGNs age 9					
q Fall RGNs age 10					
q Fall RGNs age 11					
Acoustics ages 3-11	-	-	-	-	-
Commercial GNs ages 4-11	0.003	0.001	0.381	0.000121	0.046
GN Fisher ages 4-11	0.000	0.000	0.400	0.000022	0.052
PS Fisher ages 4-11	0.001	0.000	0.384	0.000030	0.042

Table 30 (cont'd.).

St. Mary's Bay - Placentia Bay Autumn Spawners

Approximate Statistics Assuming Linearity Near Solution

Mean Square Residual = **2.366919**

Parameter	Estimate	Std. Err.	Rel. Err.	Bias	Rel. Bias.
N 2008 age 4	7160	10800	1.512	7720	1.078
N 2008 age 5	1810	2000	1.107	1050	0.577
N 2008 age 6	1510	1440	0.952	618	0.409
N 2008 age 7	2890	2610	0.902	766	0.265
N 2008 age 8	1130	1810	1.603	685	0.605
N 2008 age 9	205	331	1.614	145	0.706
N 2008 age 10	1	5	5.049	12	12.536
N 2008 age 11	181	385	2.126	229	1.266
q Spring RGNs age 3	0.000	0.000	0.317	0.000002	0.029
q Spring RGNs age 4	0.001	0.000	0.312	0.000033	0.024
q Spring RGNs age 5	0.003	0.001	0.310	0.000061	0.023
q Spring RGNs age 6	0.003	0.001	0.310	0.000073	0.024
q Spring RGNs age 7	0.004	0.001	0.311	0.000091	0.025
q Spring RGNs age 8	0.005	0.002	0.313	0.000091	0.018
q Spring RGNs age 9	0.005	0.002	0.323	0.000043	0.008
q Spring RGNs age 10	0.004	0.001	0.332	0.000072	0.017
q Spring RGNs age 11	0.001	0.000	0.332	0.000018	0.017
q Fall RGNs age 3					
q Fall RGNs age 4					
q Fall RGNs age 5					
q Fall RGNs age 6					
q Fall RGNs age 7					
q Fall RGNs age 8					
q Fall RGNs age 9					
q Fall RGNs age 10					
q Fall RGNs age 11					
Acoustics ages 3-11	-	-	-	-	-
Commercial GNs ages 4-11	0.005	0.002	0.465	0.000092	0.018
GN Fisher ages 4-11	0.001	0.000	0.487	0.000018	0.023
PS Fisher ages 4-11	0.001	0.001	0.465	-0.000010	-0.008

Table 31. Diagnostics of the ADAPT–VPA results for Fortune Bay using an age-disaggregated spring research gill net population number index, and age-aggregated acoustic, commercial gill net logbook, and gill net fisher population biomass indices.

Fortune Bay Spring Spawners

Approximate Statistics Assuming Linearity Near Solution

Mean Square Residual = **5.521238**

Parameter	Estimate	Std. Err.	Rel. Err.	Bias	Rel. Bias.
N 2008 age 4	10700	25600	2.399	30900	2.904
N 2008 age 5	15800	26800	1.693	22800	1.443
N 2008 age 6	115000	119000	1.043	54400	0.475
N 2008 age 7	1850	2240	1.215	1390	0.751
N 2008 age 8	307	381	1.243	214	0.697
N 2008 age 9	1490	2230	1.496	1270	0.856
N 2008 age 10	22	83	3.815	96	4.408
N 2008 age 11	7	37	5.600	102	15.625
q Spring RGNs age 3	0.000	0.000	0.483	0.000004	0.090
q Spring RGNs age 4	0.001	0.000	0.473	0.000048	0.085
q Spring RGNs age 5	0.003	0.002	0.468	0.000274	0.084
q Spring RGNs age 6	0.007	0.004	0.467	0.000623	0.083
q Spring RGNs age 7	0.013	0.006	0.466	0.001130	0.089
q Spring RGNs age 8	0.019	0.009	0.465	0.001680	0.091
q Spring RGNs age 9	0.020	0.009	0.468	0.002310	0.118
q Spring RGNs age 10	0.027	0.012	0.466	0.002650	0.100
q Spring RGNs age 11	0.022	0.010	0.466	0.002170	0.100
q Fall RGNs age 3					
q Fall RGNs age 4					
q Fall RGNs age 5					
q Fall RGNs age 6					
q Fall RGNs age 7					
q Fall RGNs age 8					
q Fall RGNs age 9					
q Fall RGNs age 10					
q Fall RGNs age 11					
Acoustics ages 3-11	-	-	-	-	-
Commercial GNs ages 4-11	0.001	0.000	0.695	0.000141	0.197
GN Fisher ages 4-11	0.000	0.000	0.727	0.000025	0.217
PS Fisher ages 4-11					

Table 31 (cont'd.).

Fortune Bay Autumn Spawners

Approximate Statistics Assuming Linearity Near Solution

Mean Square Residual = **4.884**

Parameter	Estimate	Std. Err.	Rel. Err.	Bias	Rel. Bias.
N 2008 age 4	322	726	2.258	838	2.608
N 2008 age 5	971	1620	1.666	1260	1.301
N 2008 age 6	691	973	1.408	634	0.918
N 2008 age 7	1010	1250	1.242	678	0.672
N 2008 age 8	1770	1910	1.078	765	0.431
N 2008 age 9	25	110	4.457	156	6.312
N 2008 age 10	5	24	4.434	38	6.978
N 2008 age 11	107	237	2.216	154	1.441
q Spring RGNs age 3	0.000	0.000	0.460	0.000001	0.047
q Spring RGNs age 4	0.001	0.000	0.451	0.000037	0.046
q Spring RGNs age 5	0.007	0.003	0.447	0.000340	0.046
q Spring RGNs age 6	0.022	0.010	0.445	0.000879	0.041
q Spring RGNs age 7	0.041	0.018	0.445	0.000952	0.023
q Spring RGNs age 8	0.059	0.027	0.453	0.002870	0.048
q Spring RGNs age 9	0.077	0.036	0.465	0.003550	0.046
q Spring RGNs age 10	0.031	0.015	0.474	0.001620	0.052
q Spring RGNs age 11	0.048	0.023	0.474	0.002480	0.052
q Fall RGNs age 3					
q Fall RGNs age 4					
q Fall RGNs age 5					
q Fall RGNs age 6					
q Fall RGNs age 7					
q Fall RGNs age 8					
q Fall RGNs age 9					
q Fall RGNs age 10					
q Fall RGNs age 11					
Acoustics ages 3-11	-	-	-	-	-
Commercial GNs ages 4-11	0.009	0.006	0.671	0.000495	0.054
GN Fisher ages 4-11	0.001	0.001	0.702	0.000094	0.066
PS Fisher ages 4-11					

Table 32. Diagnostics of the ADAPT–VPA results for White Bay–Notre Dame Bay illustrating the impact of removing abundance indices.

White Bay - Notre Dame Bay Spring Spawners

ADAPT formulation	Mean Square Residual	Relative Errors 2008: Ages 4-11 Minimum	Maximum	Index Catchabilities Minimum	Maximum
Spring RGNs, Fall RGNs, Acoustics, Commercial GNs, GN Fisher, and PS Fisher	2.42	0.618	1.719	0.350	0.523
Spring RGNs, Fall RGNs, Acoustics, Commercial GNs, and GN Fisher	2.46	0.650	1.777	0.353	0.503
Spring RGNs, Fall RGNs, Acoustics, and Commercial GNs	2.53	0.698	1.756	0.358	0.490
Spring RGNs, Fall RGNs, and Acoustics	2.62	0.751	1.796	0.364	0.467
Spring RGNs, and Fall RGNs	2.61	0.750	1.796	0.364	0.467
Spring RGNs only	3.67	0.889	2.127	0.431	1.454

White Bay - Notre Dame Bay Autumn Spawners

ADAPT formulation	Mean Square Residual	Relative Errors 2008: Ages 4-11 Minimum	Maximum	Index Catchabilities Minimum	Maximum
Spring RGNs, Fall RGNs, Acoustics, Commercial GNs, GN Fisher, and PS Fisher	3.19	0.473	1.831	0.414	0.603
Spring RGNs, Fall RGNs, Acoustics, Commercial GNs, and GN Fisher	3.28	0.484	1.861	0.420	0.579
Spring RGNs, Fall RGNs, Acoustics, and Commercial GNs	3.38	0.495	1.891	0.427	0.563
Spring RGNs, Fall RGNs, and Acoustics	3.48	0.504	1.919	0.435	0.538
Spring RGNs, and Fall RGNs	3.28	0.492	1.862	0.422	0.523
Spring RGNs only	3.84	0.533	2.016	0.457	0.473

Table 33. Diagnostics of the ADAPT–VPA results for Bonavista Bay–Trinity Bay illustrating the impact of removing abundance indices.

Bonavista Bay - Trinity Bay Spring Spawners

ADAPT formulation	Mean Square Residual	Relative Errors 2008: Ages 4-11 Minimum	Maximum	Index Catchabilities Minimum	Maximum
Spring RGNs, Fall RGNs, Acoustics, Commercial GNs, GN Fisher, and PS Fisher	1.92	0.392	1.404	0.336	0.478
Spring RGNs, Fall RGNs, Acoustics, Commercial GNs, and GN Fisher	1.97	0.399	1.447	0.341	0.486
Spring RGNs, Fall RGNs, Acoustics, and Commercial GNs	2.03	0.410	1.470	0.347	0.474
Spring RGNs, Fall RGNs, and Acoustics	2.09	0.424	1.493	0.352	0.419
Spring RGNs, and Fall RGNs	2.12	0.453	1.502	0.354	0.422
Spring RGNs only	1.95	0.423	1.442	0.342	0.389

Bonavista Bay - Trinity Bay Autumn Spawners

ADAPT formulation	Mean Square Residual	Relative Errors 2008: Ages 4-11 Minimum	Maximum	Index Catchabilities Minimum	Maximum
Spring RGNs, Fall RGNs, Acoustics, Commercial GNs, GN Fisher, and PS Fisher	3.01	0.484	1.785	0.414	0.582
Spring RGNs, Fall RGNs, Acoustics, Commercial GNs, and GN Fisher	3.09	0.496	1.812	0.420	0.592
Spring RGNs, Fall RGNs, Acoustics, and Commercial GNs	3.19	0.510	1.840	0.426	0.580
Spring RGNs, Fall RGNs, and Acoustics	3.29	0.529	1.870	0.433	0.524
Spring RGNs, and Fall RGNs	3.16	0.609	1.833	0.423	0.514
Spring RGNs only	3.35	0.603	1.887	0.437	0.475

Table 34. Diagnostics of the ADAPT–VPA results for St. Mary's Bay-Placentia Bay illustrating the impact of removing abundance indices.

St. Mary's Bay - Placentia Bay Spring Spawners

ADAPT formulation	Mean Square Residual	Relative Errors 2008: Ages 4-11 Minimum	Maximum	Index Catchabilities Minimum	Maximum
Spring RGNs, Acoustics, Commercial GNs, GN Fisher, and PS Fisher	1.51	0.435	1.468	0.260	0.400
Spring RGNs, Acoustics, Commercial GNs, and GN Fisher	1.57	0.444	1.506	0.257	0.409
Spring RGNs, Acoustics, and Commercial GNs	1.62	0.455	1.550	0.262	0.398
Spring RGNs, and Acoustics	1.69	0.466	1.567	0.268	0.277
Spring RGNs only	1.72	0.476	1.585	0.270	0.280

St. Mary's Bay - Placentia Bay Autumn Spawners

ADAPT formulation	Mean Square Residual	Relative Errors 2008: Ages 4-11 Minimum	Maximum	Index Catchabilities Minimum	Maximum
Spring RGNs, Acoustics, Commercial GNs, GN Fisher, and PS Fisher	2.37	0.902	5.049	0.310	0.487
Spring RGNs, Acoustics, Commercial GNs, and GN Fisher	2.46	0.961	5.143	0.316	0.498
Spring RGNs, Acoustics, and Commercial GNs	2.55	1.006	5.244	0.322	0.485
Spring RGNs, and Acoustics	2.66	1.036	5.357	0.329	0.352
Spring RGNs only	2.70	1.043	5.406	0.325	0.337

Table 35. Diagnostics of the ADAPT–VPA results for Fortune Bay illustrating the impact of removing abundance indices.

Fortune Bay Spring Spawners

ADAPT formulation	Mean Square Residual	Relative Errors 2008: Ages 4-11 Minimum	Maximum	Index Catchabilities Minimum	Maximum
Spring RGNs, Acoustics, Commercial GNs, and GN Fisher	5.52	1.403	5.600	0.465	0.727
Spring RGNs, Acoustics, and Commercial GNs	5.74	1.211	5.709	0.474	0.713
Spring RGNs and Acoustics	6.00	1.270	5.839	0.485	0.505
Spring RGNs only	6.15	1.285	5.909	0.491	0.512

Fortune Bay Autumn Spawners

ADAPT formulation	Mean Square Residual	Relative Errors 2008: Ages 4-11 Minimum	Maximum	Index Catchabilities Minimum	Maximum
Spring RGNs, Acoustics, Commercial GNs, and GN Fisher	4.88	1.078	4.457	0.445	0.702
Spring RGNs, Acoustics, and Commercial GNs	5.08	1.195	4.612	0.453	0.685
Spring RGNs and Acoustics	5.31	1.261	4.475	0.464	0.494
Spring RGNs only	5.27	1.262	4.606	0.460	0.485

Table 36. Performance report standardization parameters, ranks, and weighting factors.

Data Source	Calculation of Ranks	Minimum Rank	Maximum Rank	Weighting Factor	Indicator of:
Research Gill Net Catch Rates (year = n) - spring and autumn spawners combined	<= 20% of mean = 1 21-40% of mean = 2 41- 60% of mean = 3 61-80% of mean = 4 81-100% of mean = 5 101-120% of mean = 6 121-140% of mean = 7 141-160% of mean = 8 161-180% of mean = 9 > 180% of mean = 10	1	10	2.0	Current Status
Commercial Gill Net Catch Rates (year = n) - from logbooks	<= 20% of mean = 1 21-40% of mean = 2 41- 60% of mean = 3 61-80% of mean = 4 81-100% of mean = 5 101-120% of mean = 6 121-140% of mean = 7 141-160% of mean = 8 161-180% of mean = 9 > 180% of mean = 10	1	10	0.5	Current Status
Gill Net Fisher Cumulative Index (year = n) - from logbooks (1997–2008)	<= -4 = 1 -4 to -3 = 2 -3 to -2 = 3 -2 to -1 = 4 -1 to 0 = 5 0 to 1 = 6 1 to 2 = 7 2 to 3 = 8 3 to 4 = 9 >= 4 = 10	1	10	0.5	Current Status
Gill Net Fisher Cumulative Index (year = n) - from phone survey (2006–2008)	<= -4 = 1 -4 to -3 = 2 -3 to -2 = 3 -2 to -1 = 4 -1 to 0 = 5 0 to 1 = 6 1 to 2 = 7 2 to 3 = 8 3 to 4 = 9 >= 4 = 10	1	10	0.5	Current Status
Purse Seine Fisher Cumulative Index (year = n–1)* * except SMBPB where year = n	<= -4 = 1 -4 to -3 = 2 -3 to -2 = 3 -2 to -1 = 4 -1 to 0 = 5 0 to 1 = 6 1 to 2 = 7 2 to 3 = 8 3 to 4 = 9 >= 4 = 10	1	10	0.5	Current Status
Research Gill Net Age Compositions (year = n-1) (number of age 3+ groups >= 5% of catch) - spring and autumn spawners combined	very poor if n = 1 average if n = 5 very good if n = 9	1	9	1.0	Current Status

Table 36 (cont'd.).

Data Source	Calculation of Ranks	Minimum Rank	Maximum Rank	Weighting Factor	Indicator of:
Strength of Fishery Dependent Year Classes (year classes = n–6 and n–7) - spring and autumn spawners combined	<= 20% of mean = 1 21-40% of mean = 2 41- 60% of mean = 3 61-80% of mean = 4 81-100% of mean = 5 101-120% of mean = 6 121-140% of mean = 7 141-160% of mean = 8 161-180% of mean = 9 > 180% of mean = 10	1	10	1.0	Prospects
Strength of Other Mature Year Classes (year classes = n–8, n–9, and n–10) - spring and autumn spawners combined	<= 20% of mean = 1 21-40% of mean = 2 41- 60% of mean = 3 61-80% of mean = 4 81-100% of mean = 5 101-120% of mean = 6 121-140% of mean = 7 141-160% of mean = 8 161-180% of mean = 9 > 180% of mean = 10	1	10	0.5	Prospects
Recruitment (year class = n–5) - spring and autumn spawners combined	<= 20% of mean = 1 21-40% of mean = 2 41- 60% of mean = 3 61-80% of mean = 4 81-100% of mean = 5 101-120% of mean = 6 121-140% of mean = 7 141-160% of mean = 8 161-180% of mean = 9 > 180% of mean = 10	1	10	0.5	Prospects

Table 37. White Bay–Notre Dame Bay performance table to the spring of 2008.

The Fishery	***Observation***	
Reported Landings: 2006-2007	Landings increased from 309 t in 2006 to 362 t in 2007; 21% of the TAC was taken in 2007; average landings of 2800 t during 1990's; peak landings of 15,700 t in 1979.	
Total Removals: 2007	In addition to reported landings in 2007, approximately 600 t were estimated to have been taken for bait purposes; fishers reported no discard mortality in the purse seine fishery.	
Effort: 2007 and 2008	Documented effort has declined since the 1980's; purse seine effort decreased by 80% from 1997 to 2007; gill net effort has also decreased by 82% from 1996 to 2008.	
Geographic Distribution of Fishery	The 2007 purse seine fishery, in November and December, was mostly in the Fogo Island area. The 2008 gill net fishery, from early May to early July, was mostly in Notre Dame Bay.	
Abundance Indices	***Observation***	***Interpretation***
Research Gill Net Catch Rates 1988–2008 (numbers / nights fished)	Decreased, but not significantly, from 2006 to 2008; 2008 = 233, mean = 380, maximum = 887.	Current abundance below average.
Commercial Gill Net Catch Rates 1996–2008 (kg / net / nights fished)	Increased, but not significantly, from 2006 to 2008; (2008 = 8 logbooks); 2008 = 86, mean = 33, maximum = 86.	Current abundance above average.
Gill Net Fisher Observations 1996–2008 from logbooks	16 observations in 2008; increasing trend in abundance over past 5 years; 2008 higher than 2007.	Increasing trend in abundance.
Gill Net Fisher Observations 2006–2008 from telephone surveys	32 observations in 2008; increasing trend in abundance since telephone survey began in 2006; 2008 higher than 2007.	Increasing trend in abundance.
Purse Seine Fisher Observations 1996-2007	2 observations in 2007; decreasing trend in abundance over past 5 years; 2007 slightly lower than 2006.	Decreasing trend in abundance.
Biological Characteristics	***Observation***	***Interpretation***
2007 Research Gill Net Age Compositions (ages 3+)	The 2002 and 2001 year classes accounted for 49% and 15% of the catch respectively; 5 year classes each account for >5% of catch.	Population age structure considered to be stable.
Current Year Classes: 1997 to 2003 Series: 1982-2003 year classes	3 of 7 current mature year classes above average, 3 below average, and 1 average..	Equal numbers of mature year classes above and below average.
Recruitment: 2003 year class Series: 1982 to 2003 year classes	2003 year class below average.	Below average recruitment of the most recent estimatible year class.

Stock Status	***Interpretation***	***Evaluation***
Current vs. Historical	Current abundance is substantially lower than historical estimates in the 1970's.	-
Current vs. Recent	Stock status improved from 2002 to 2008.	+
Short Term Prospects	Uncertain; below average recruitment of 2003 year class; equal numbers of current mature year classes are above and below average but are weak compared to historical levels.	?

Status Definitions	
-	Concern for Current Status or Prospect
?	Uncertainty of Interpretation
+	Positive Evaluation

The standardized performance index indicates that stock status improved from 2002 to 2008. However, current abundance is substantially lower than historical estimates in the 1970's. Short term prospects are uncertain; the 2003 year class is below average and equal numbers of mature year classes are above and below average but are weak, compared to historical levels.

Table 38. Bonavista Bay–Trinity Bay performance table to the spring of 2008.

The Fishery	***Observation***	
Reported Landings: 2006-2007	Landings increased from 1904 t in 2006 to 2777 t in 2007; 69% of the TAC was taken in 2007; average landings of 2600 t during 1990's; peak landings of 12,000 t in 1977.	
Total Removals: 2007	In addition to reported landings in 2007, approximately 550 t were estimated to have been taken for bait purposes; fishers reported no discard mortality in the purse seine fishery.	
Effort: 2007 and 2008	Documented effort has increased in the purse seine fishery in recent years and peaked in 2007; gill net effort decreased by 93% from 1996 to 2008.	
Geographic Distribution of Fishery	The 2007 purse seine fishery, in November and December, was in the northern part of Bonavista Bay and in Northwest Arm and the southern part of Trinity Bay. The 2008 gill net fishery, from mid April to late June, was distributed throughout Bonavista and Trinity Bays.	
Abundance Indices	***Observation***	***Interpretation***
Research Gill Net Catch Rates 1988–2008 (numbers / nights fished)	Decreased, but not significantly, from 2006 to 2008; 2008 = 186, mean = 150, maximum = 365.	Current abundance above average.
Commercial Gill Net Catch Rates 1996–2008 (kg / net / nights fished)	Decreased, but not significantly, from 2006 to 2008; (2008 = 3 logbooks); 2008 = 17, mean = 33, maximum = 86.	Current abundance below average.
Gill Net Fisher Observations 1996–2008 from logbooks	13 observations in 2008; increasing trend in abundance over past 5 years; 2008 lower than 2007.	Increasing trend in abundance.
Gill Net Fisher Observations 1996–2008 from telephone surveys	41 observations in 2008; increasing trend in abundance since telephone survey began in 2006; 2008 higher than 2007.	Increasing trend in abundance.
Purse Seine Fisher Observations 1996-2007	15 observations in 2007; increasing trend in abundance over past 5 years; 2008 higher than 2007.	Increasing trend in abundance.
Biological Characteristics	***Observation***	***Interpretation***
2007 Research Gill Net Age Compositions (ages 3+)	The 2002 and 2000 year classes accounted for 49% and 35% of the catch respectively; 5 year classes each account for >5% of catch.	Population age structure considered to be stable.
Current Year Classes: 1997 to 2003 Series: 1982-2003 year classes	5 of 7 current mature year classes above average.	Most current mature year classes above average.
Recruitment: 2003 year class Series: 1982 to 2003 year classes	2003 year class above average.	Below average recruitment of the most recent estimatible year class.

Stock Status	***Interpretation***	***Evaluation***
Current vs. Historical	Current abundance is substantially lower than historical estimates in the 1970's.	-
Current vs. Recent	Stock status improved from 2002 to 2007 but deteriorated in 2008.	+
Short Term Prospects	Uncertain; below average recruitment of 2003 year class; most current mature year classes are above average but are weak compared to historical levels.	?

Status Definitions	
-	Concern for Current Status or Prospect
?	Uncertainty of Interpretation
+	Positive Evaluation

The standardized performance index indicates that stock status improved from 2002 to 2007 but deteriorated in 2008. However, current abundance is substantially lower than historical estimates in the 1970's. Short term prospects are uncertain; the 2003 year class is below average but most mature year classes are above average but weak, compared to historical levels.

Table 39. St. Mary's Bay–Placentia Bay performance table to the spring of 2008.

The Fishery	***Observation***	
Reported Landings: 2006-2007	Landings decreased from 1528 t in 2006 to 759 t in 2007; 30% of the TAC was taken in 2007; average landings of 1200 t during 1990's; peak landings of 4000 t in 1997 (since large mobile purse seine fishery in 1960's).	
Total Removals: 2007	In addition to reported landings in 2007, approximately 150 t were estimated to have been taken for bait purposes; fishers reported no discard mortality in the purse seine fishery.	
Effort: 2008	Documented effort increased from the 1980's to the 1990's; purse seine effort peaked in 2000 and has since declined by 79% from 2001 to 2008; gill net effort peaked in 1998 and has since declined by 73% from 1998 to 2008.	
Geographic Distribution of Fishery	The 2008 purse seine fishery, from April to June, was along the eastern sides of Placentia Bay and St. Mary's Bay. The 2008 gill net fishery, from early April to early June, was mostly in Placentia Bay.	
Abundance Indices	***Observation***	***Interpretation***
Research Gill Net Catch Rates 1982–2008 (numbers / nights fished)	Decreased, but not significantly, from 2006 to 2008; 2008 = 29, mean = 168, maximum = 407.	Current abundance below average.
Commercial Gill Net Catch Rates 1996–2008 (kg / net / nights fished)	Increased, but not significantly, from 2006 to 2008 (2008 = 7 logbooks); 2008 = 37, mean = 19, maximum = 39.	Current abundance above average.
Gill Net Fisher Observations 1996–2008 from logbooks	10 observations in 2008; decreasing trend in abundance over past 5 years; 2008 lower than 2007.	Decreasing trend in abundance.
Gill Net Fisher Observations 1996–2008 from telephone surveys	15 observations in 2008; increasing trend in abundance since telephone survey began in 2006; 2008 higher than 2007.	Increasing trend in abundance.
Purse Seine Fisher Observations 1996–2008	2 observations in 2008; increasing trend in abundance over past 5 years; 2008 lower than 2007.	Increasing trend in abundance.
Biological Characteristics	***Observation***	***Interpretation***
2007 Research Gill Net Age Compositions (ages 3+)	The 2002 and 2000 year classes accounted for 36% and 24% of the catch respectively; 5 year classes each account for >5% of catch.	Population age structure considered to be stable.
Current Year Classes: 1997 to 2003 Series: 1976-2003 year classes	5 of 7 current mature year classes below average.	Most current mature year classes below average.
Recruitment: 2003 year class Series: 1976 to 2003 year classes	2003 year class below average.	Below average recruitment of the most recent estimatible year class.

Stock Status	***Interpretation***	***Evaluation***
Current vs. Historical	Current abundance is substantially lower than historical estimates in the 1970's.	-
Current vs. Recent	Stock status deteriorated slightly since 2005.	-
Short Term Prospects	Negative; below average recruitment of 2003 year class; most current mature year classes are below average and are weak compared to historical levels.	-

Status Definitions	
-	Concern for Current Status or Prospect
?	Uncertainty of Interpretation
+	Positive Evaluation

The standardized performance index indicates that stock status deteriorated from 2002 to 2004, improved slightly in 2005, and deteriorated slightly from 2005 to 2008. However, current abundance is substantially lower than historical estimates in the 1970's. Short term prospects are negative; the 2003 year class is below average and most mature year classes are below average and are weak, compared to historical levels.

Table 40. Fortune Bay performance table to the spring of 2008.

The Fishery	***Observation***	
Reported Landings: 2006-2007	Landings increased from 2340 t in 2006 to 2448 t in 2007; 77% of the TAC was taken in 2007; average landings of 200 t during 1990's; peak landings in 2003 (since large mobile purse seine fishery in 1960's).	
Total Removals: 2007	In addition to reported landings in 2007, approximately 450 t were estimated to have been taken for bait purposes.	
Effort: 2008	Documented effort in 1980's and 1990's was very low; gill net effort peaked in 1997 and has since declined by 81% from 1997 to 2008; there is no purse seine fishery in Fortune Bay. The current fishery is primarily by bar seines and traps for which no effort information is available. However, combined bar seine and trap landings have increased from 0 t in 1998 to 2440 t in 2008.	
Geographic Distribution of Fishery	The 2008 spring bar seine fishery was concentrated in the Long Harbour area; the gill net fishery, from early April to mid June, was distributed throughout Fortune Bay.	
Abundance Indices	***Observation***	***Interpretation***
Research Gill Net Catch Rates 1982–2008 (numbers / nights fished)	Decreased, but not significantly, from 2006 to 2008; 2008 = 338, mean = 610, maximum = 1275.	Current abundance below average.
Commercial Gill Net Catch Rates 1996–2008 (kg / net / nights fished)	Increased, but not significantly, from 2006 to 2008 (2008 = 12 logbooks); 2008 = 60, mean = 39, maximum = 84.	Current abundance above average.
Gill Net Fisher Observations 1996–2008 from logbooks	16 observations in 2008; decreasing trend in abundance over past 5 years; 2008 lower than 2007.	Decreasing trend in abundance.
Gill Net Fisher Observations 1996–2008 from telephone surveys	47 observations in 2008; decreasing trend in abundance since telephone survey began in 2006; 2008 lower than 2007.	Decreasing trend in abundance.
Biological Characteristics	***Observation***	***Interpretation***
2007 Research Gill Net Age Compositions (ages 3+)	The 2002 year class and fish aged 11+ accounted for 49% and 30% of the catch respectively; 4 year classes each account for >5% of the catch.	Population age structure considered to be stable due to substantial contribution of older fish.
Current Year Classes: 1997 to 2003 Series: 1976-2003 year classes	5 of 7 current mature year classes average or below average.	Most current mature year classes average or below average.
Recruitment: 2003 year class Series: 1976 to 2003 year classes	2003 year class below average.	Below average recruitment of the most recent estimatible year class.

Stock Status	***Interpretation***	***Evaluation***
Current vs. Historical	Current abundance is lower than peak estimates in the late 1990's.	-
Current vs. Recent	Stock status deteriorated steadily from 2001 to 2004, improved slightly in 2005, deteriorated again in 2006, and has remained stable from 2006 to 2008.	-
Short Term Prospects	Negative; below average recruitment of 2003 year class; most current mature year classes are below average.	-

Status Definitions	
-	Concern for Current Status or Prospect
?	Uncertainty of Interpretation
+	Positive Evaluation

The standardized performance index indicates that stock status deteriorated from 2001 to 2004, improved slightly in 2005, deteriorated again in 2006, and remained stable from 2006 to 2008. Current abundance is substantially lower than peak estimates in the mid to late 1980's. Short term prospects are negative; the 2003 year class is below average and most mature year classes are below average.

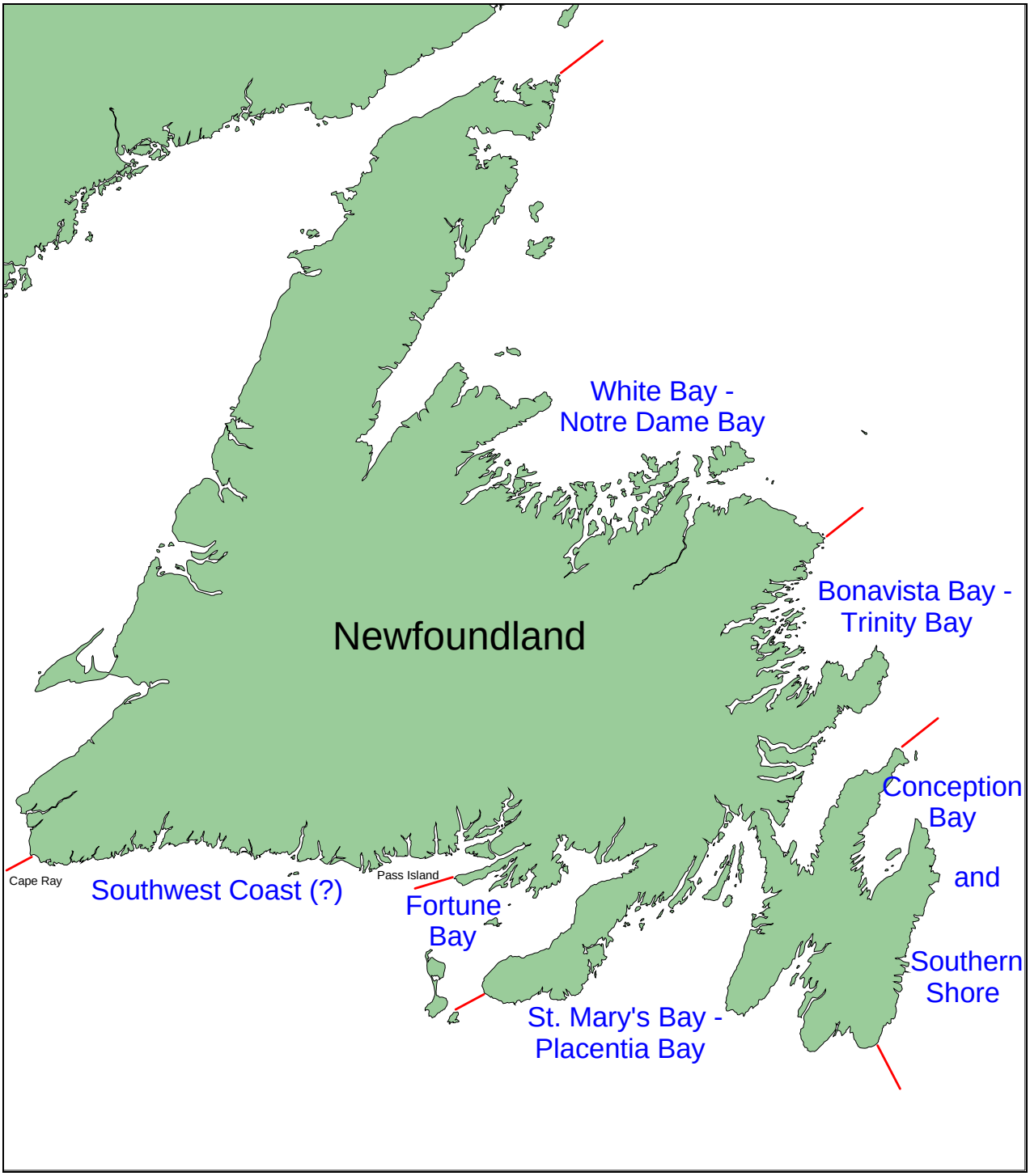


Figure 1. Area map indicating herring stock complexes within the Newfoundland and Labrador Region.

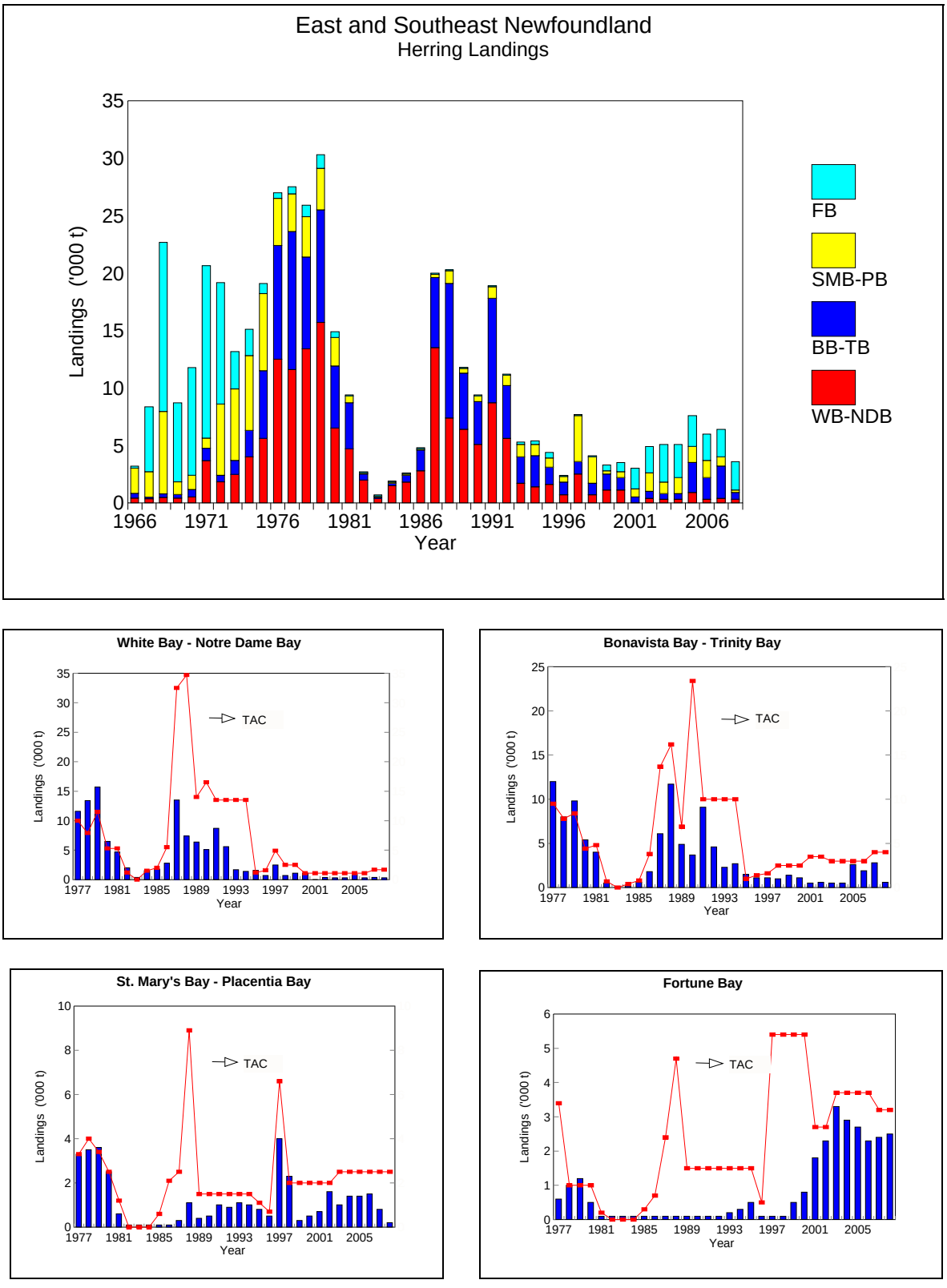


Figure 2. East and southeast Newfoundland herring landings (1966–2008) and TAC's (1977–2008), by stock area.

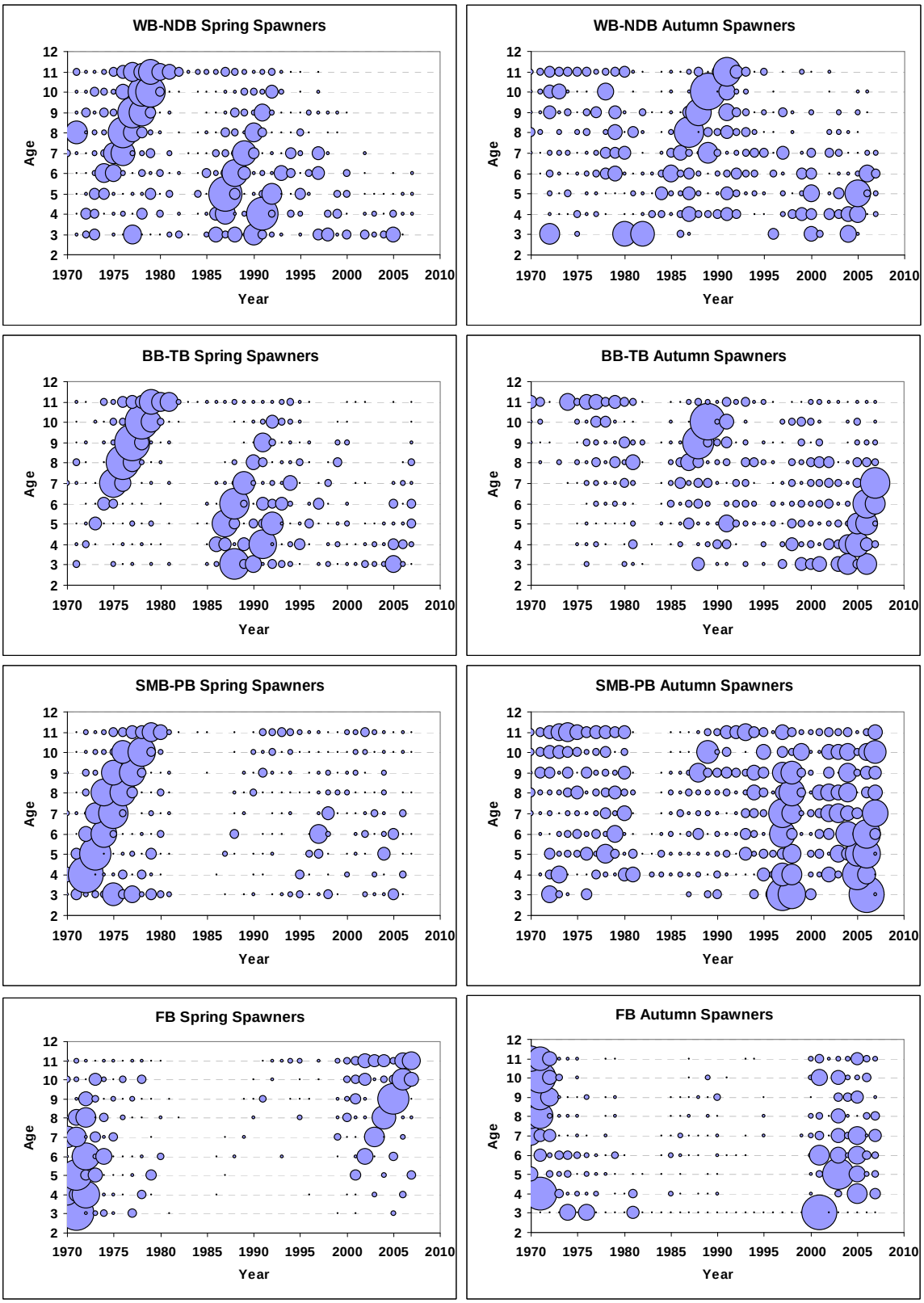


Figure 3. Commercial catch numbers at age (normalized by age), by stock area and spawning type, 1970-2007.

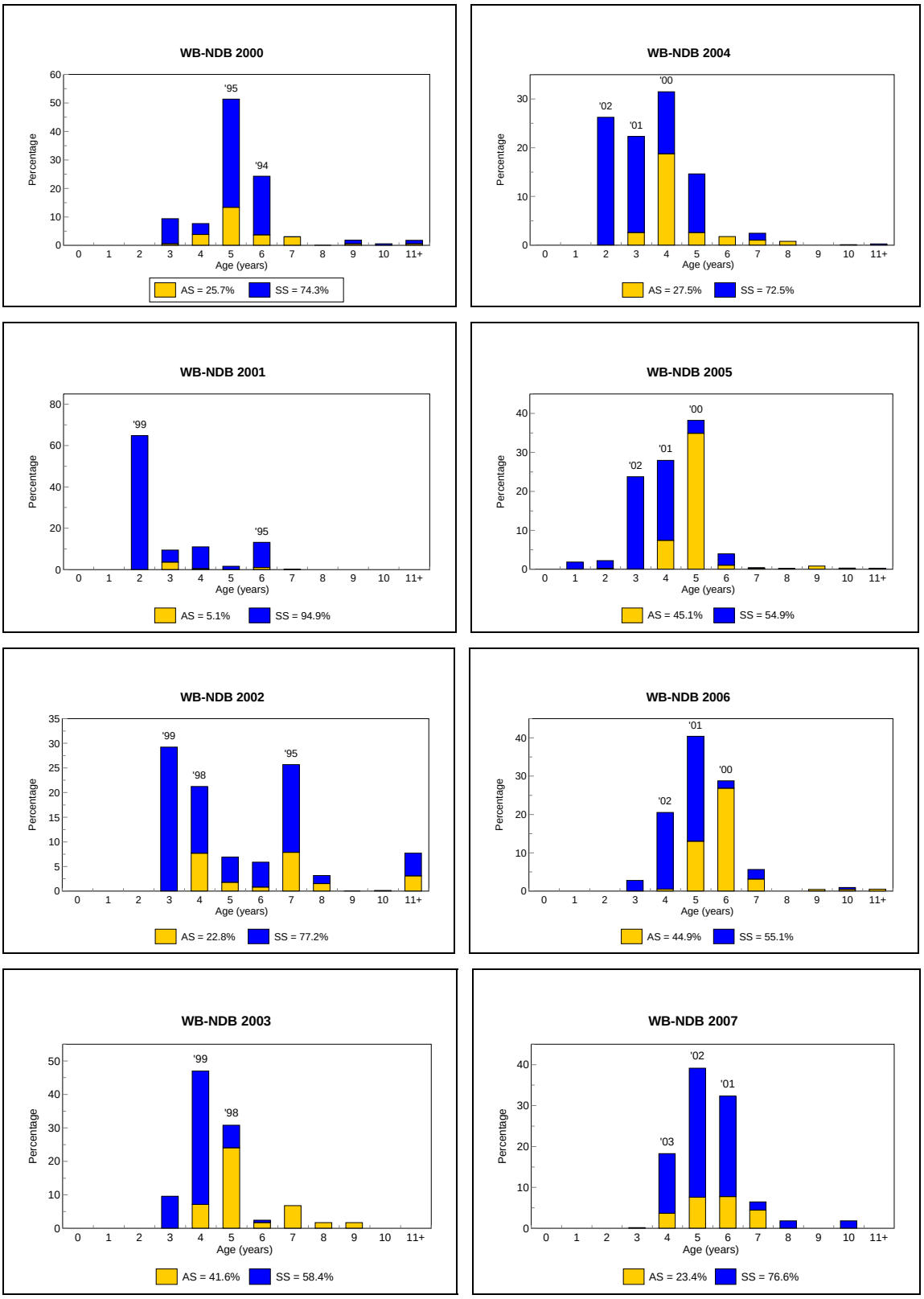


Figure 4. Age distribution of herring from the commercial fishery, by spawning type, White Bay–Notre Dame Bay, 2000-07.

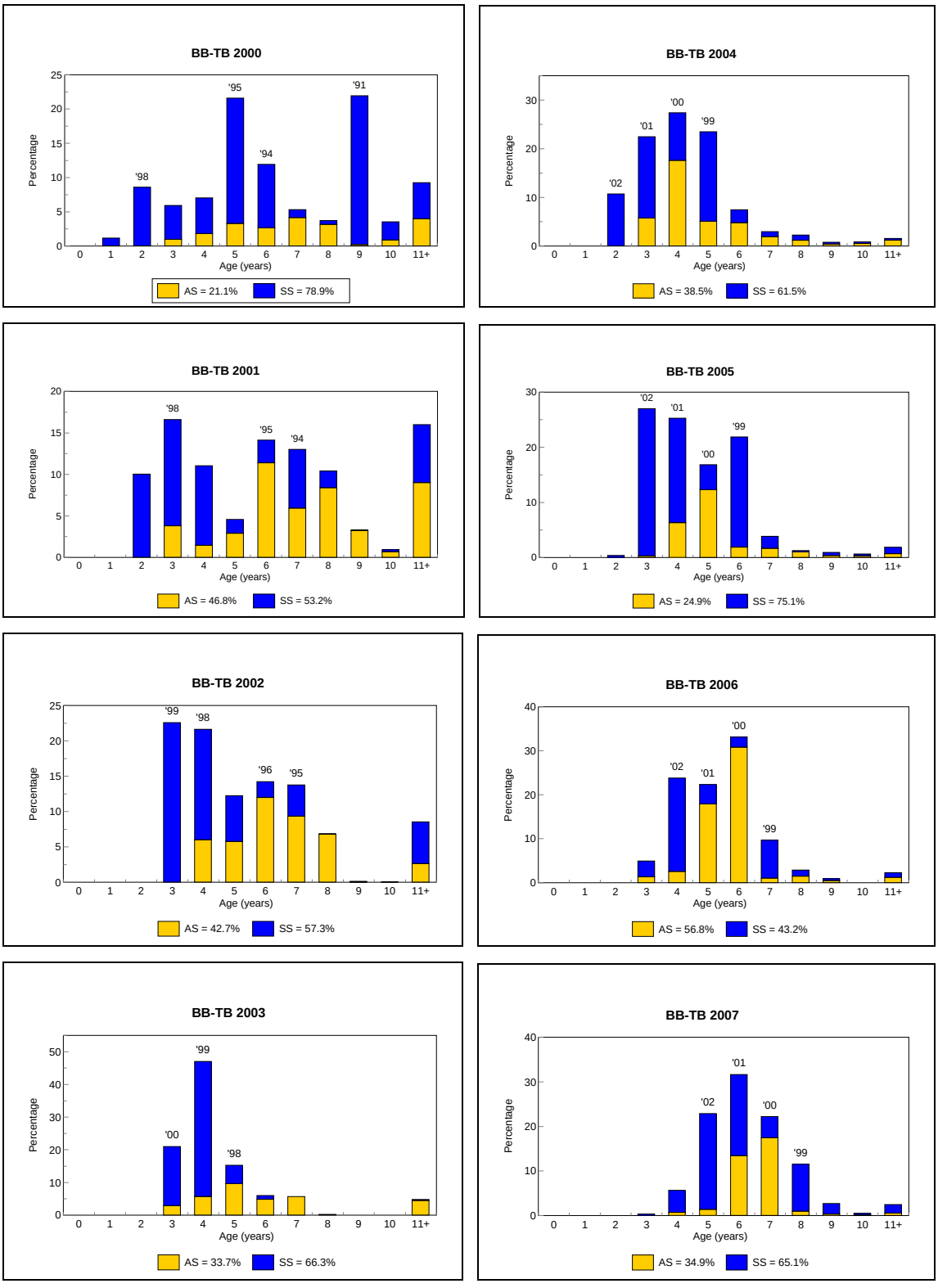


Figure 5. Age distribution of herring from the commercial fishery, by spawning type, Bonavista Bay-Trinity Bay, 2000-07.

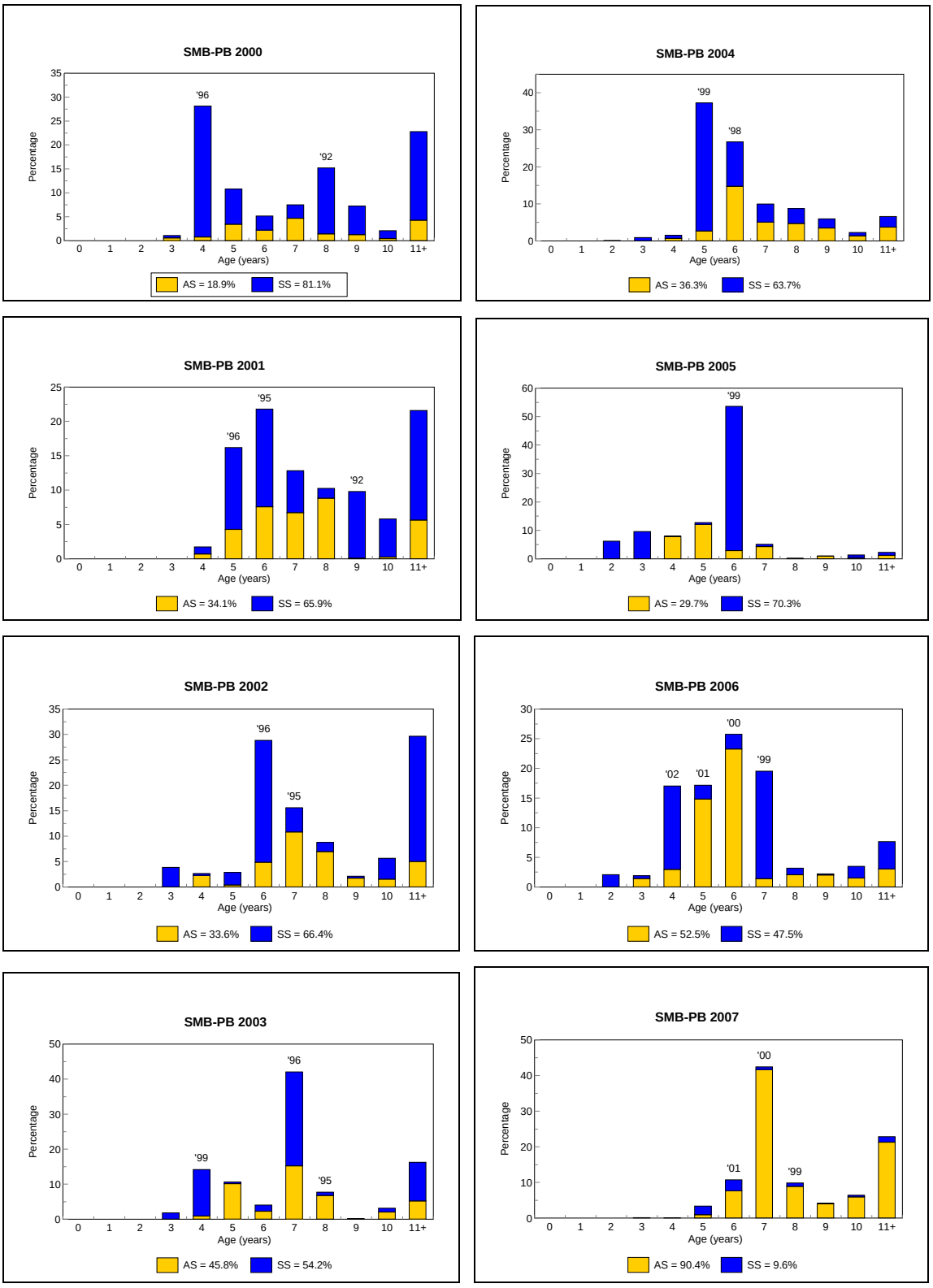


Figure 6. Age distribution of herring from the commercial fishery, by spawning type, St. Mary's Bay-Placentia Bay, 2000-07.

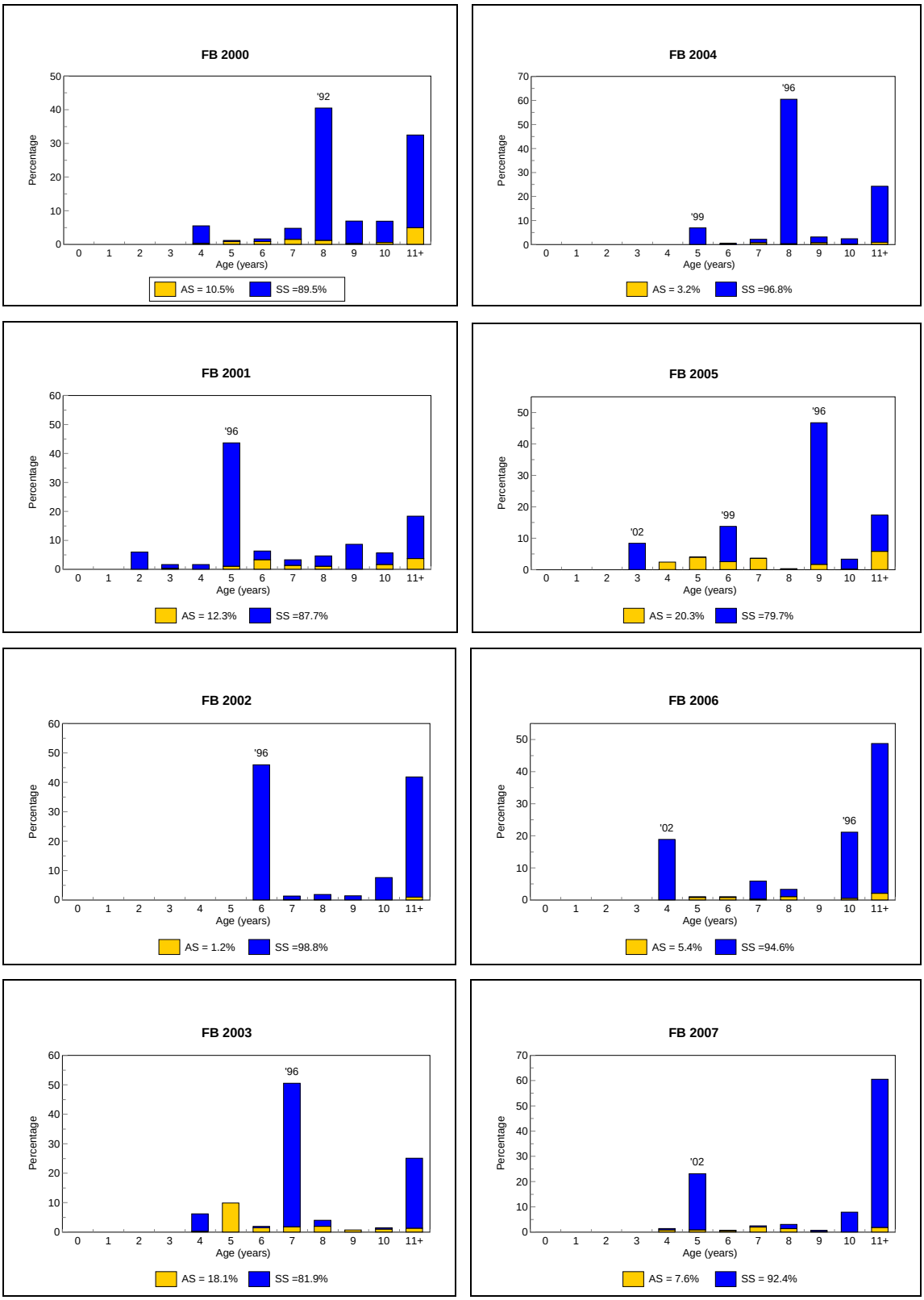


Figure 7. Age distribution of herring from the commercial fishery, by spawning type, Fortune Bay, 2000-07.

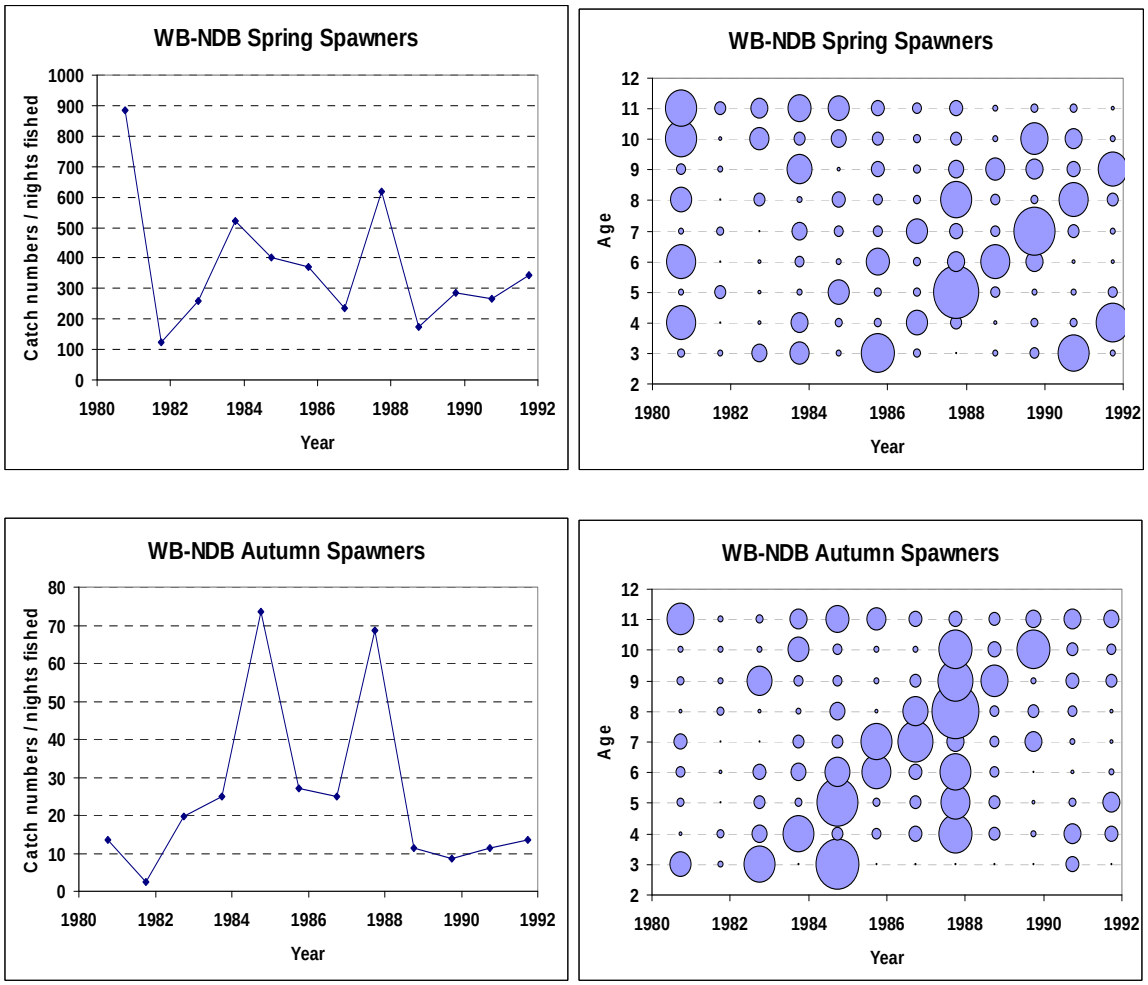


Figure 8. Fall research gill net catch rates (numbers per nights fished) and indices at age (normalized by age) for White Bay–Notre Dame Bay, by spawning type, 1980-91.

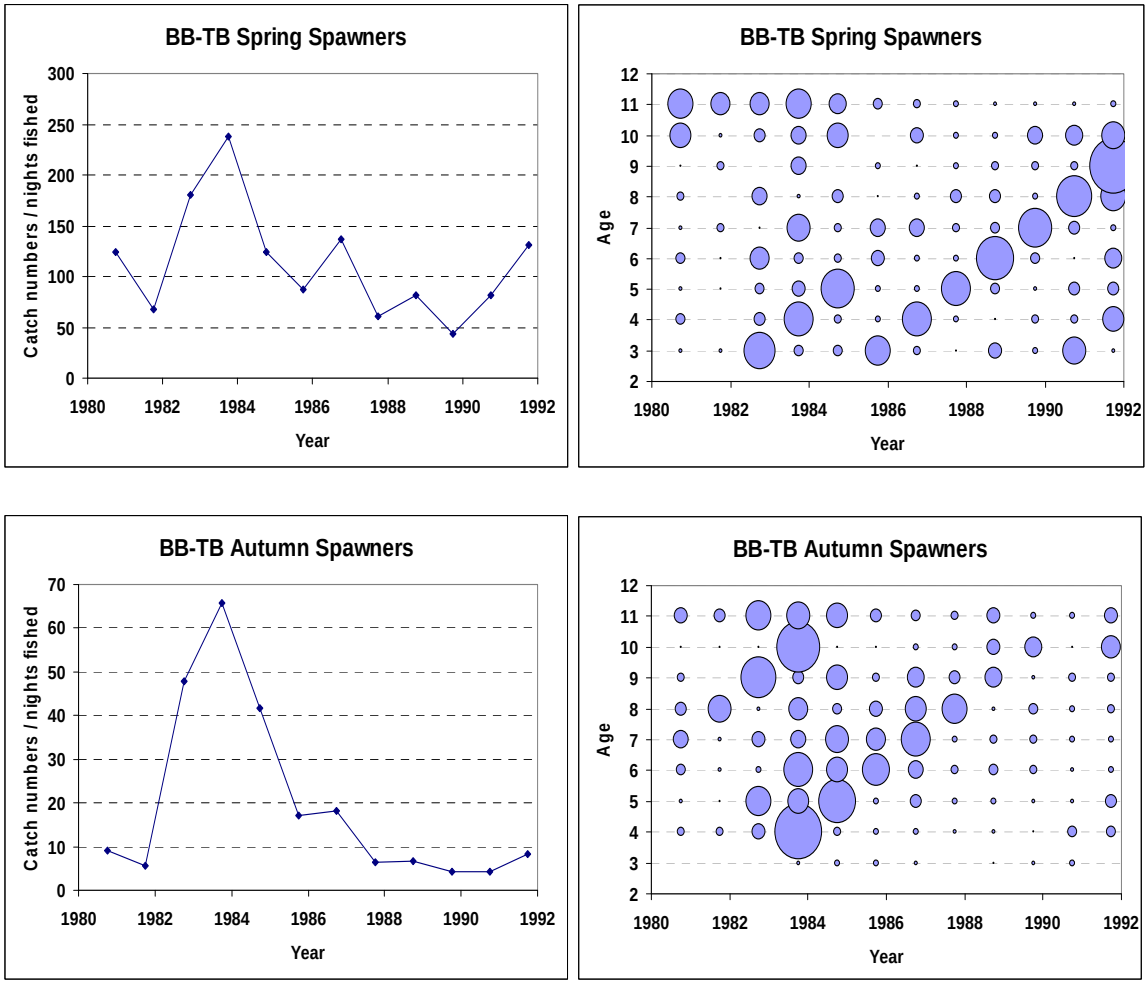


Figure 9. Fall research gill net catch rates (numbers per nights fished) and indices at age (normalized by age) for Bonavista Bay-Trinity Bay, by spawning type, 1980-91.

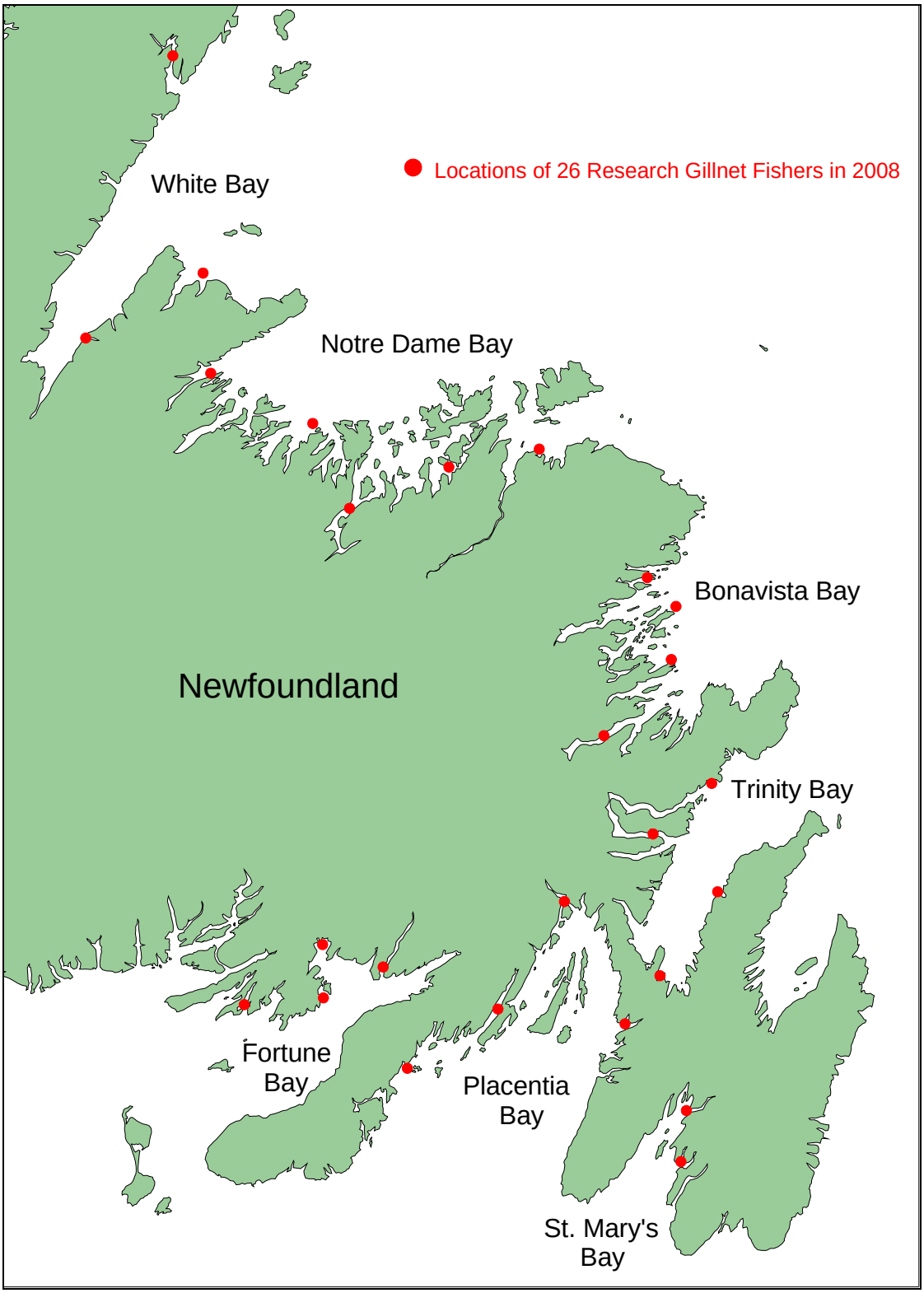


Figure 10. Herring research gill net locations, by stock area, in 2008.

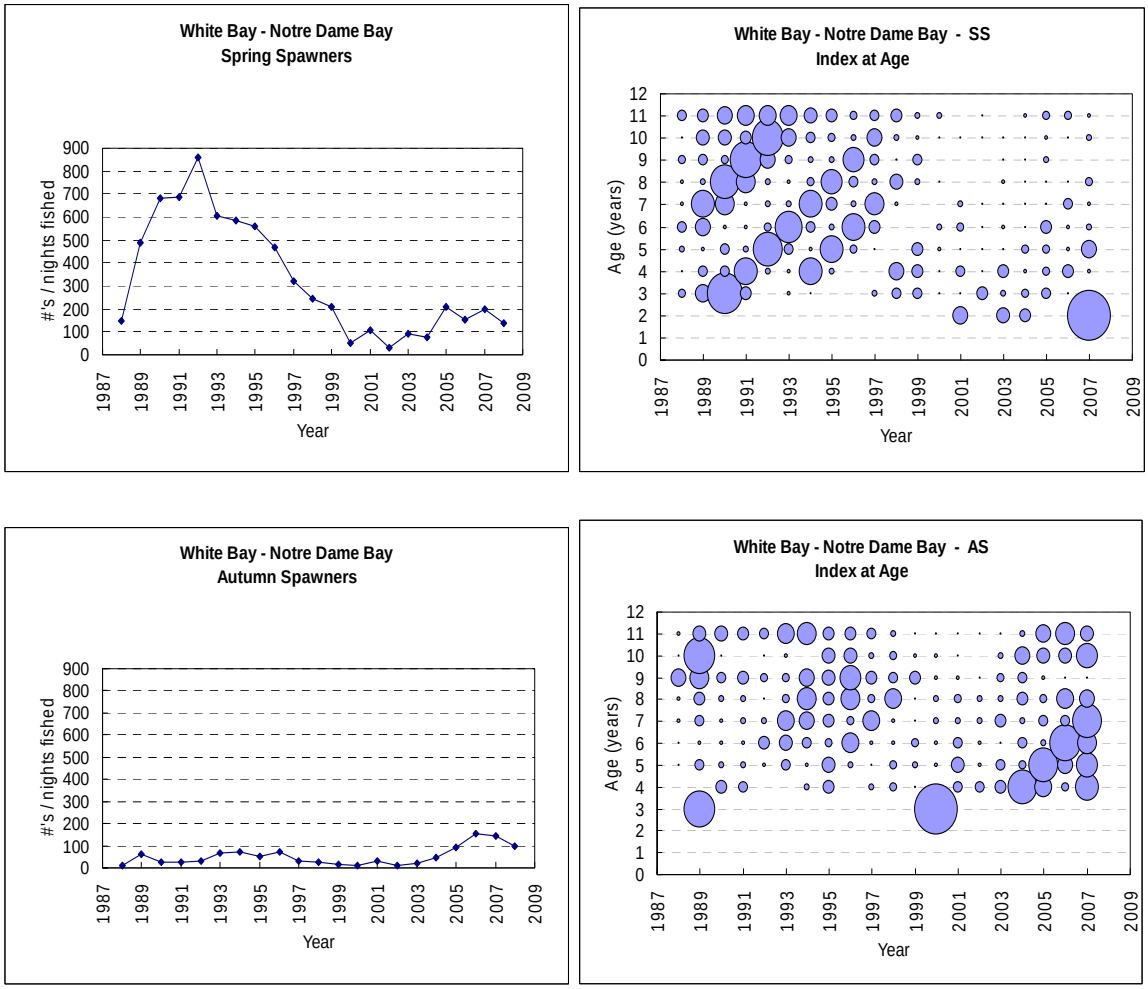


Figure 11. Research gill net catch rates (numbers per nights fished) 1988-2008 and indices at age (normalized by age) for White Bay–Notre Dame Bay, by spawning type 1988-2007.

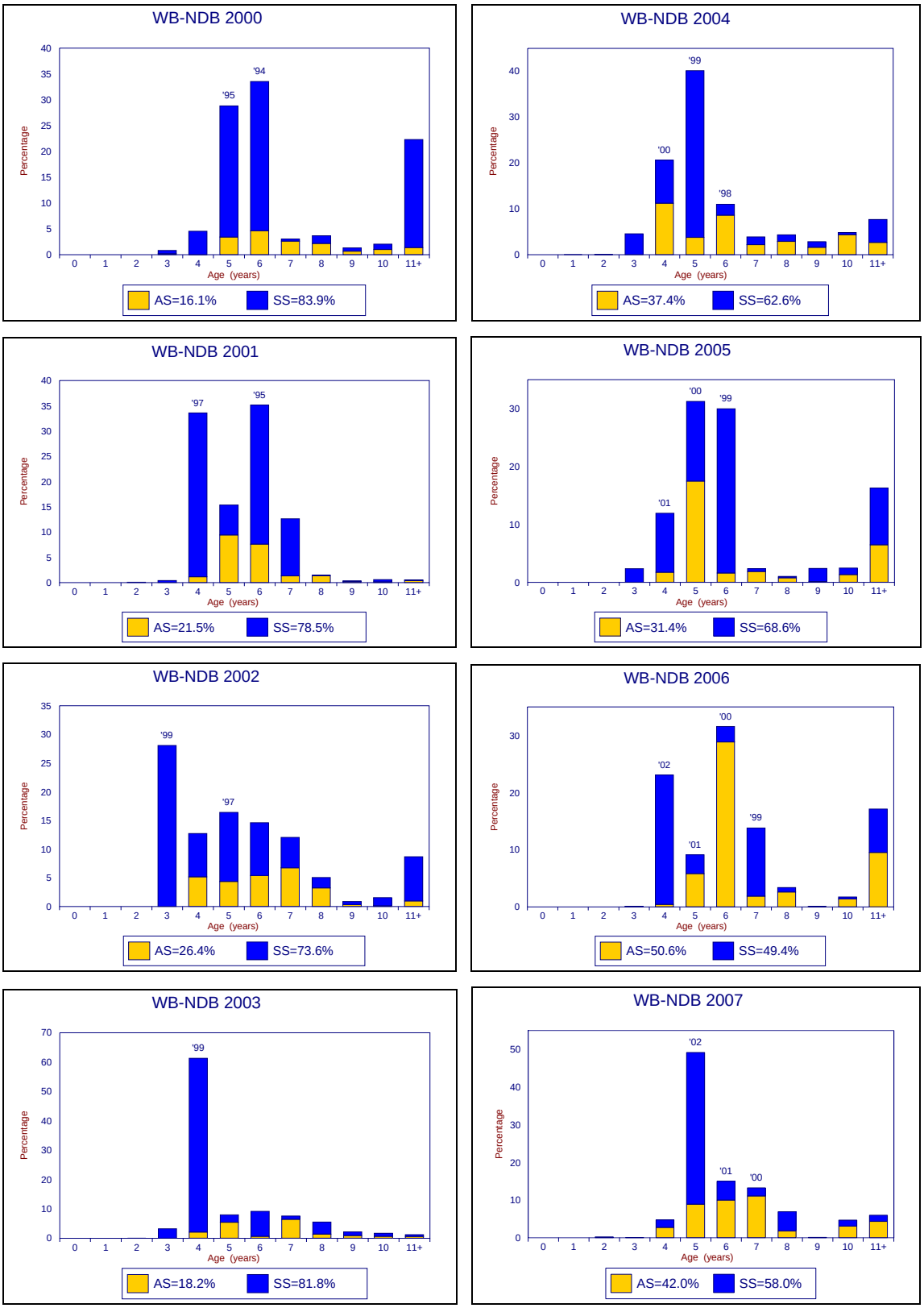


Figure 12. Age distribution of herring from the spring research gill net program, by spawning type, White Bay–Notre Dame Bay, 2000-07.

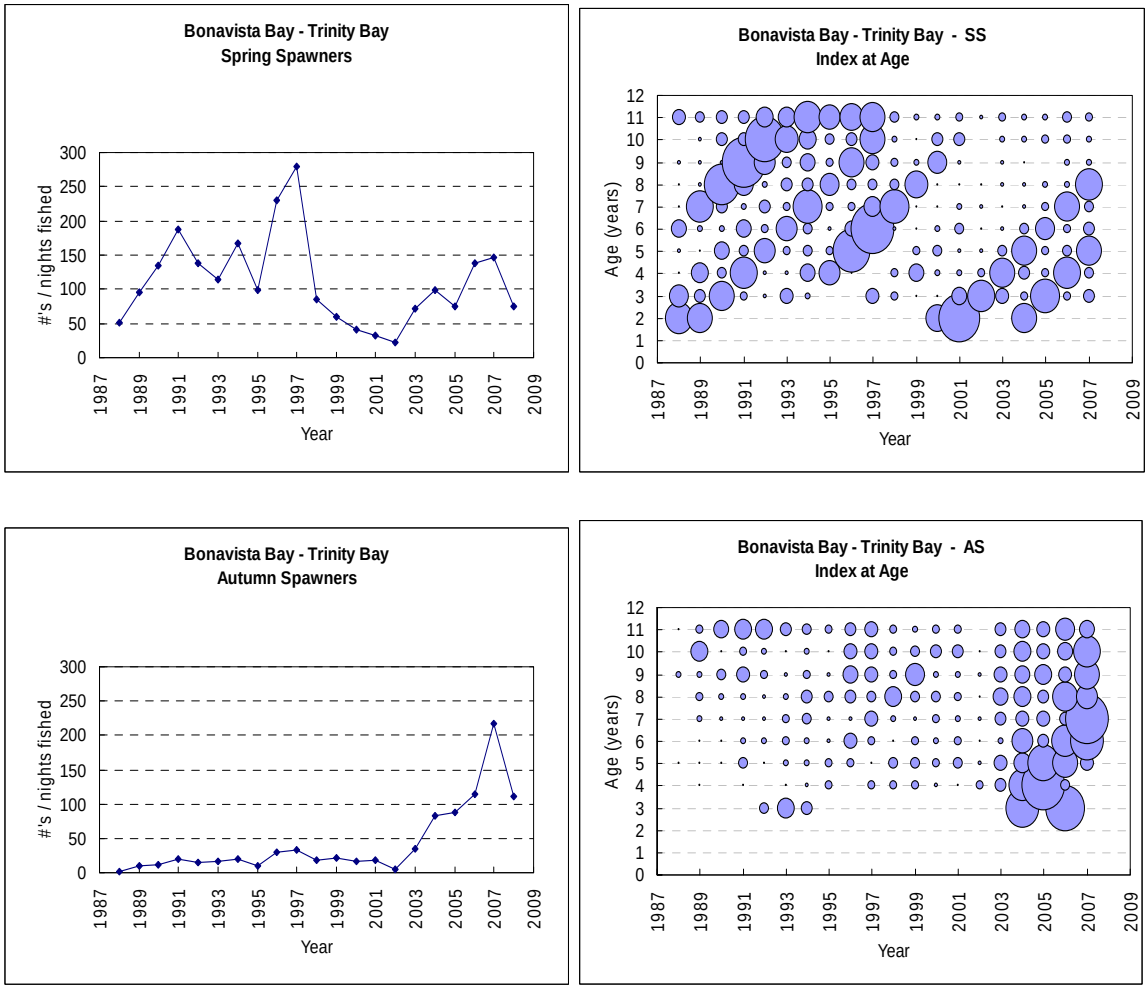


Figure 13. Research gill net catch rates (numbers per nights fished) 1988-2008 and indices at age (normalized by age) for Bonavista Bay–Trinity Bay, by spawning type 1988-2007.

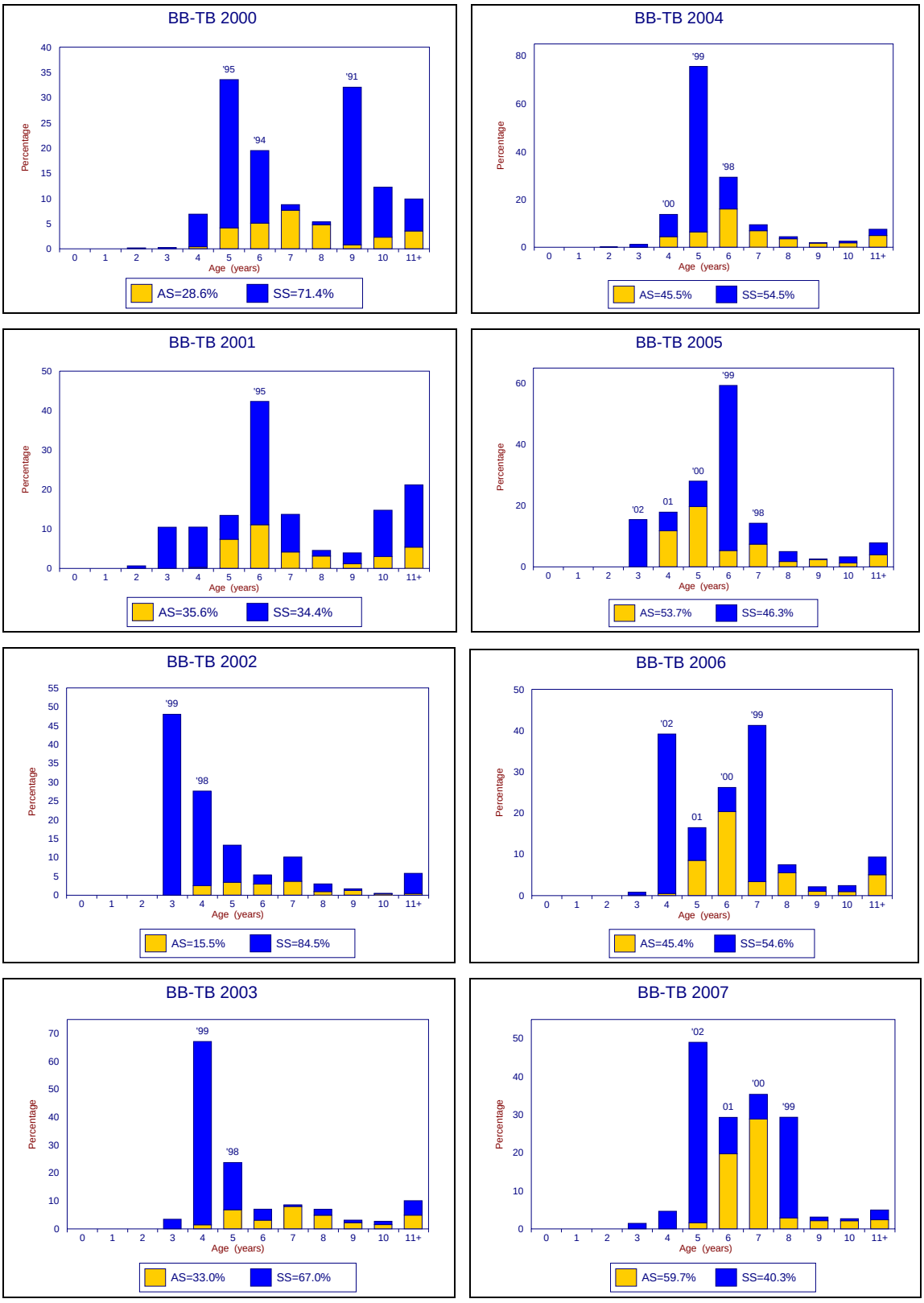
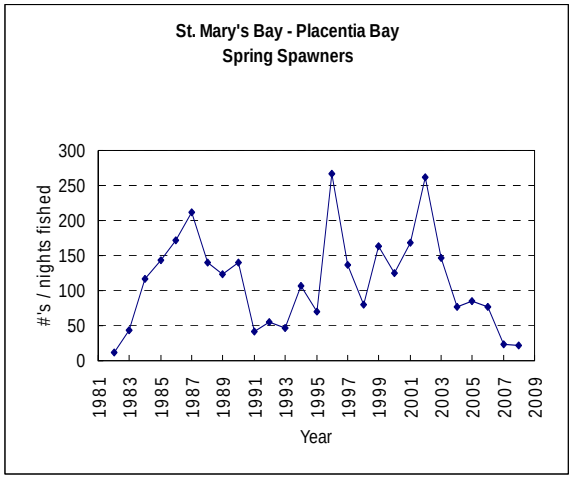
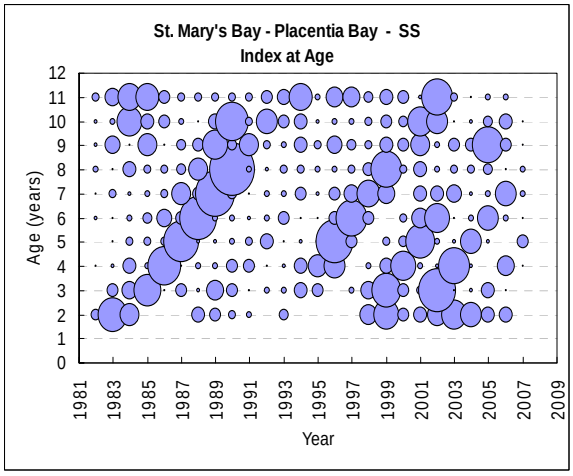
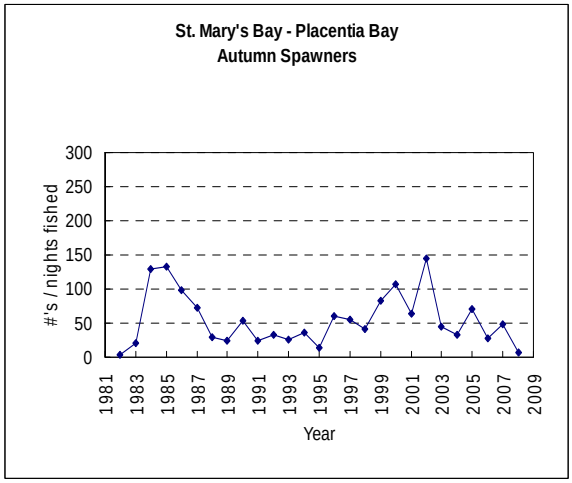


Figure 14. Age distribution of herring from the spring research gill net program, by spawning type, Bonavista Bay–Trinity Bay, 2000-07.







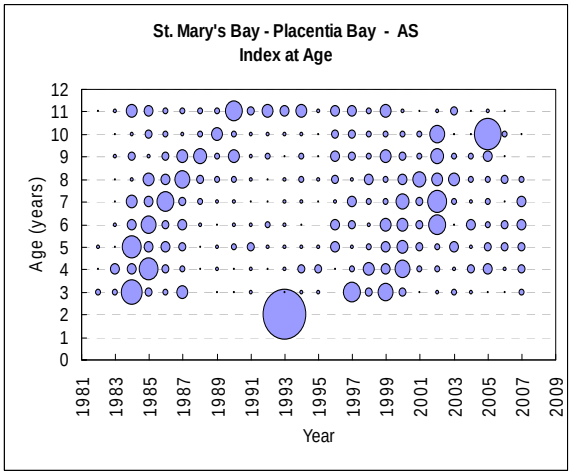


Figure 15. Research gill net catch rates (numbers per nights fished) 1982-2008, and indices at age (normalized by age) for St. Mary's Bay–Placentia Bay, by spawning type 1982-2007.

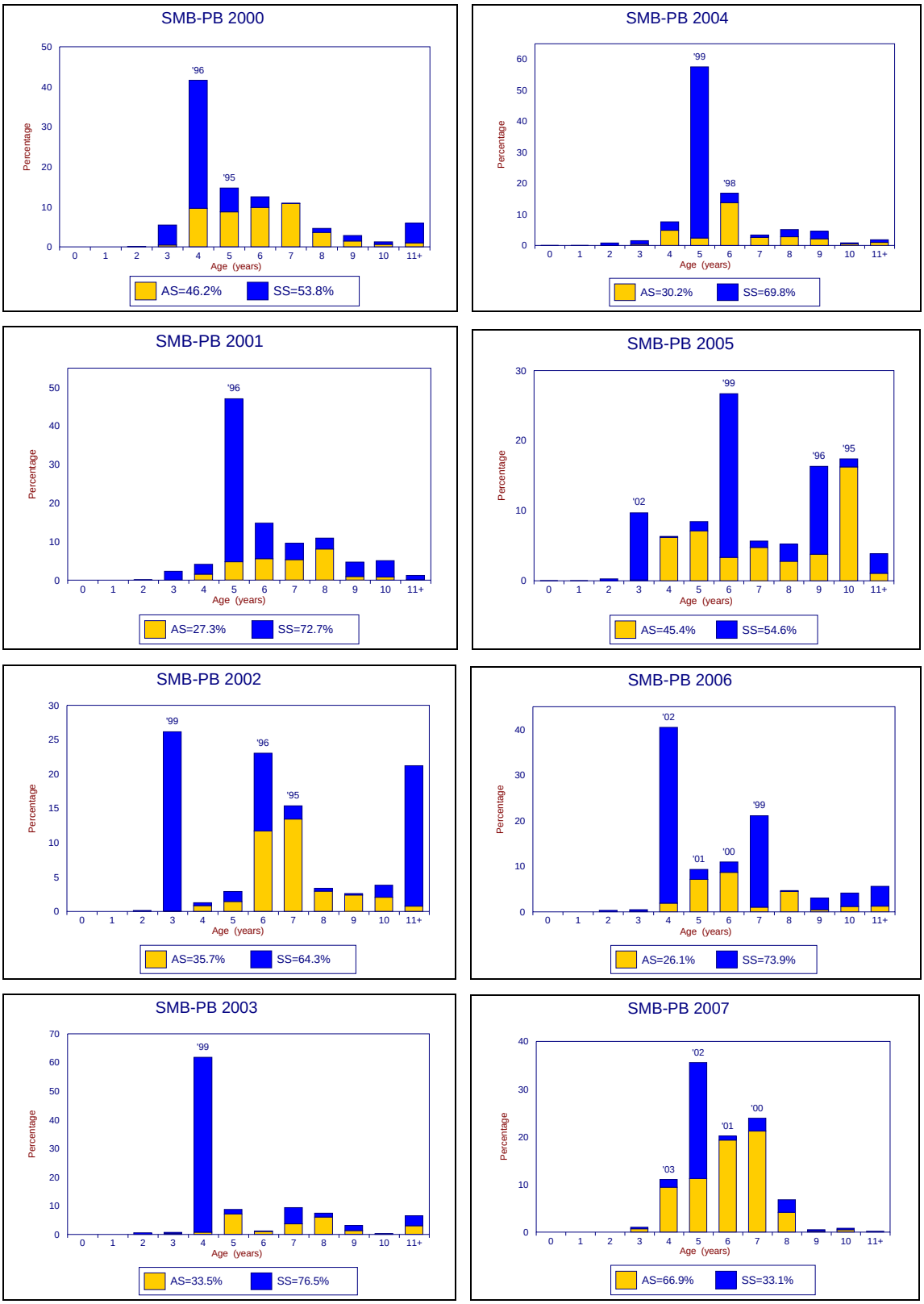


Figure 16. Age distribution of herring from the spring research gill net program, by spawning type, St. Mary's Bay-Placentia Bay, 2000-07.

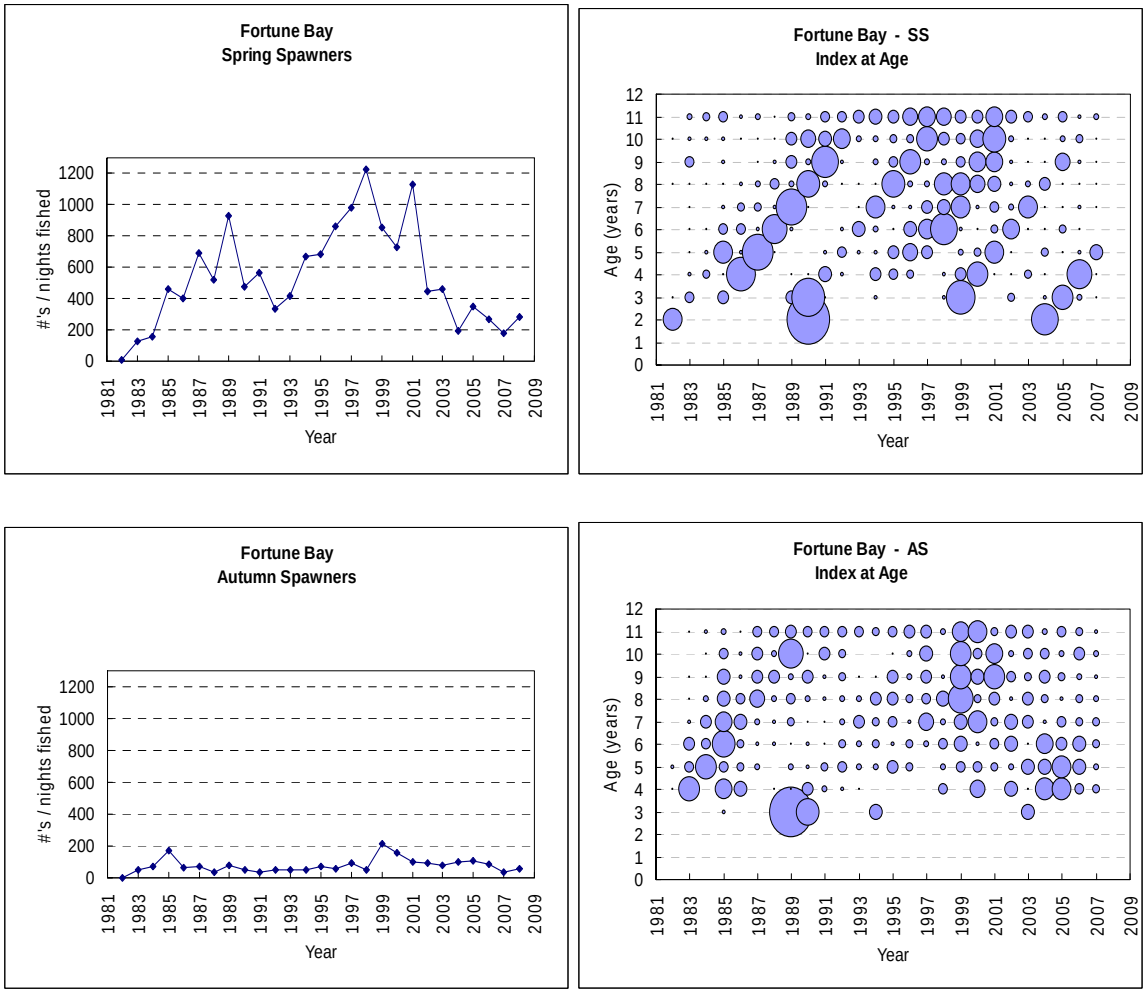


Figure 17. Research gill net catch rates (numbers per nights fished) 1982-2008, and indices at age (normalized by age) for Fortune Bay, by spawning type 1982-2007.

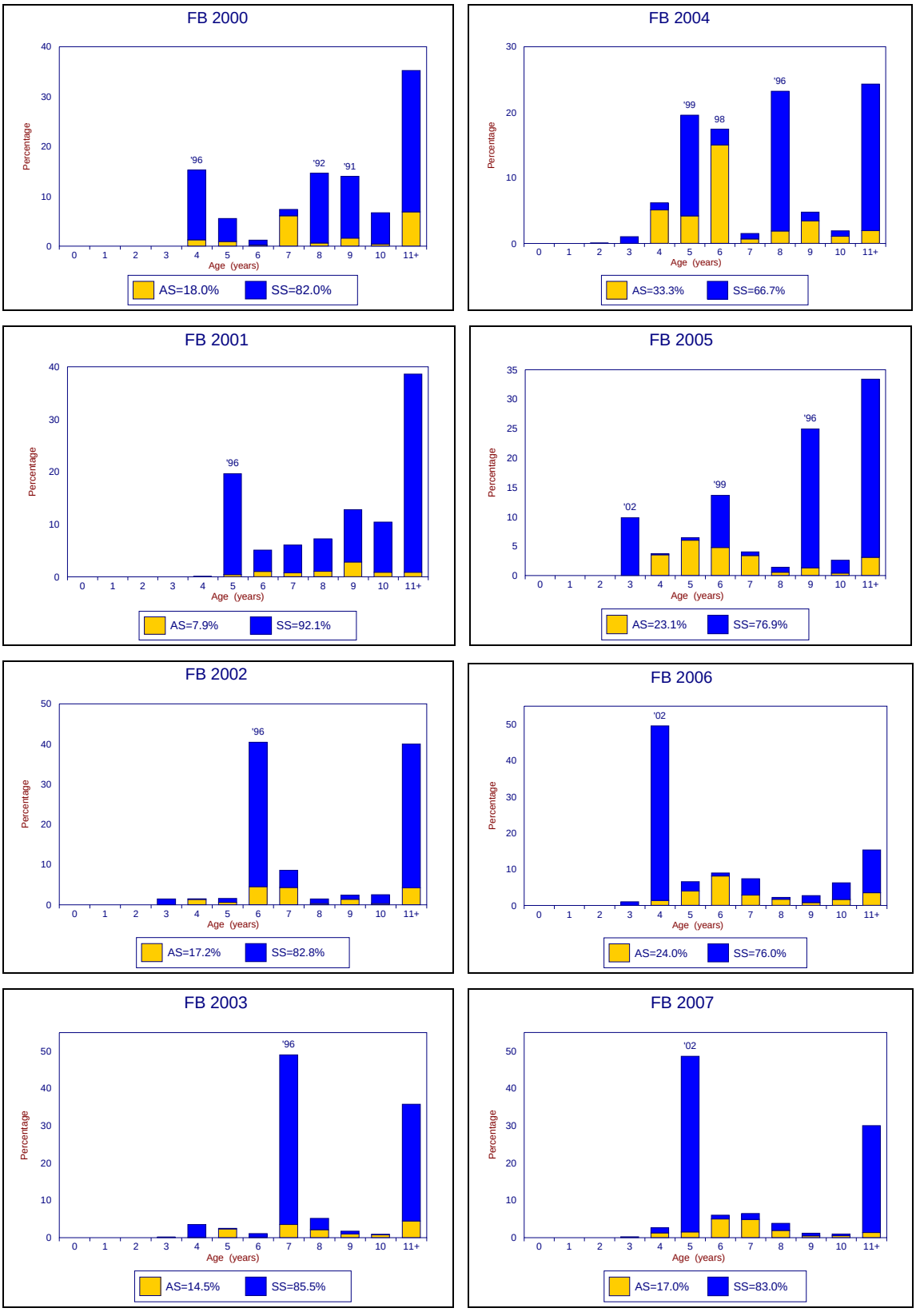


Figure 18. Age distribution of herring from the spring research gill net program, by spawning type, Fortune Bay, 2000-07.

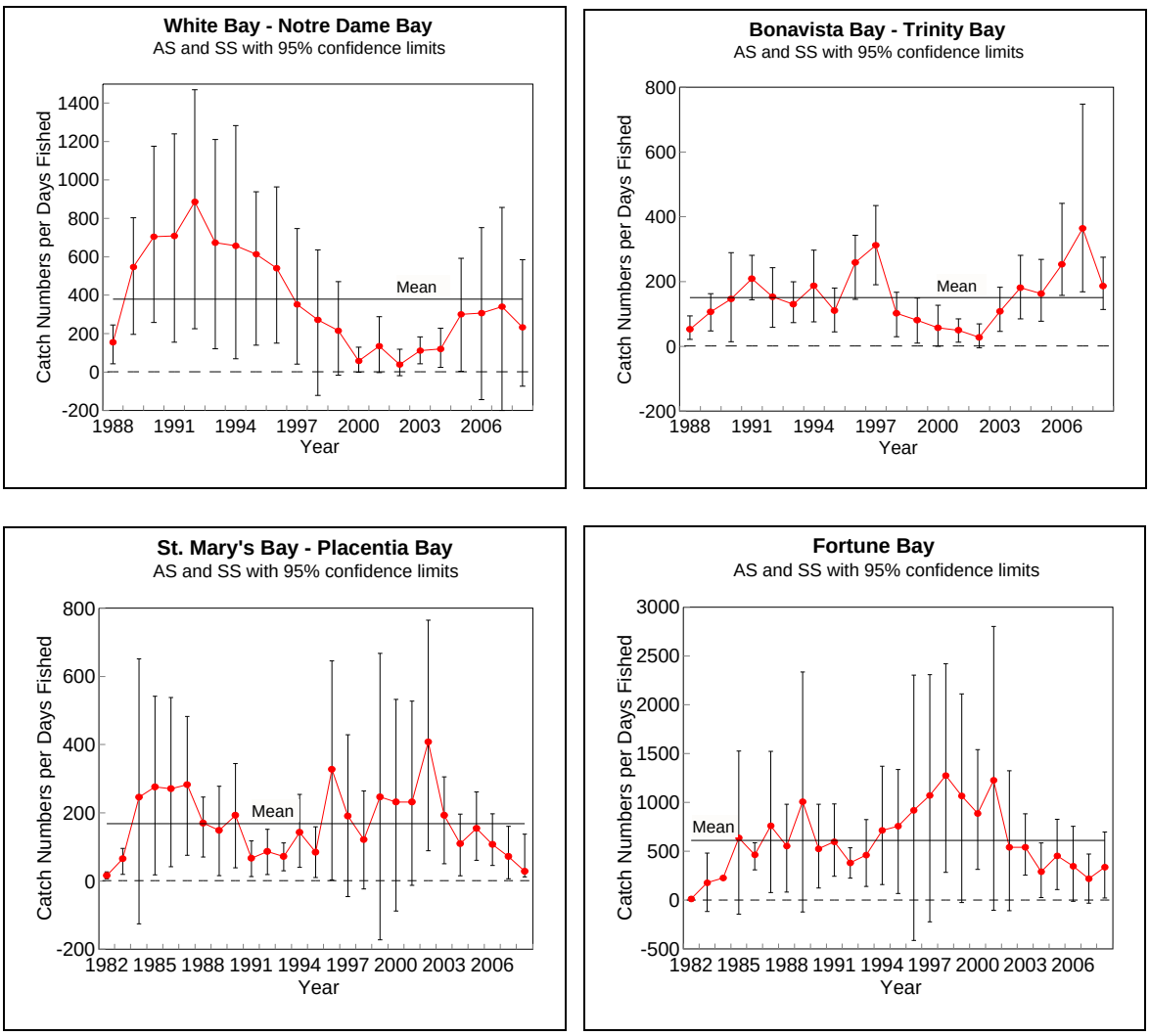


Figure 19. Research gill net catch rates (numbers per nights fished), by stock area and year, spring and autumn spawners combined (with 95% confidence limits).

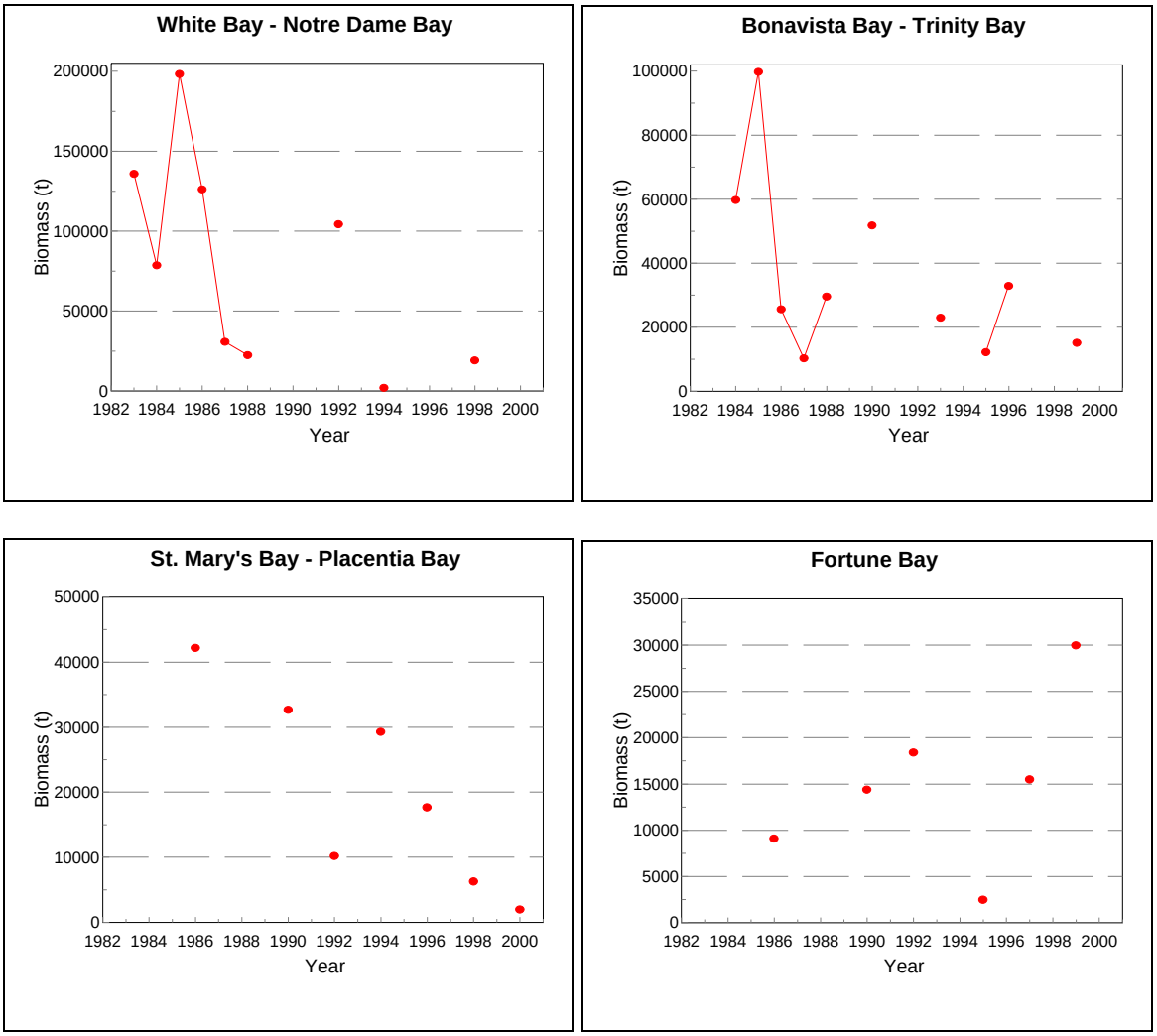


Figure 20. Acoustic survey biomass estimates (tonnes), by stock area, 1983-2000.

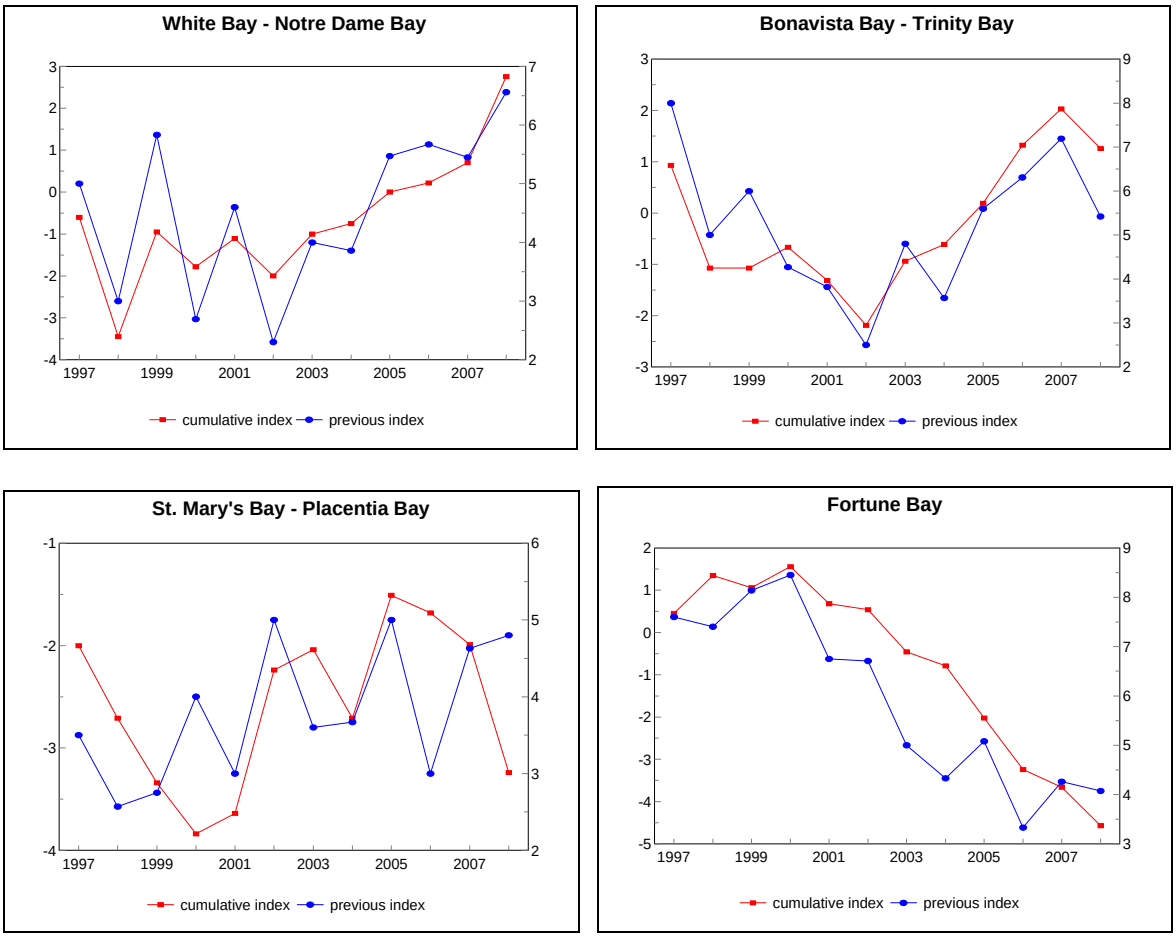


Figure 21. Comparison of gill net fisher cumulative abundance indices, used in this assessment, and the non-cumulative indices used in the 2006 assessment (Wheeler et al. 2006).

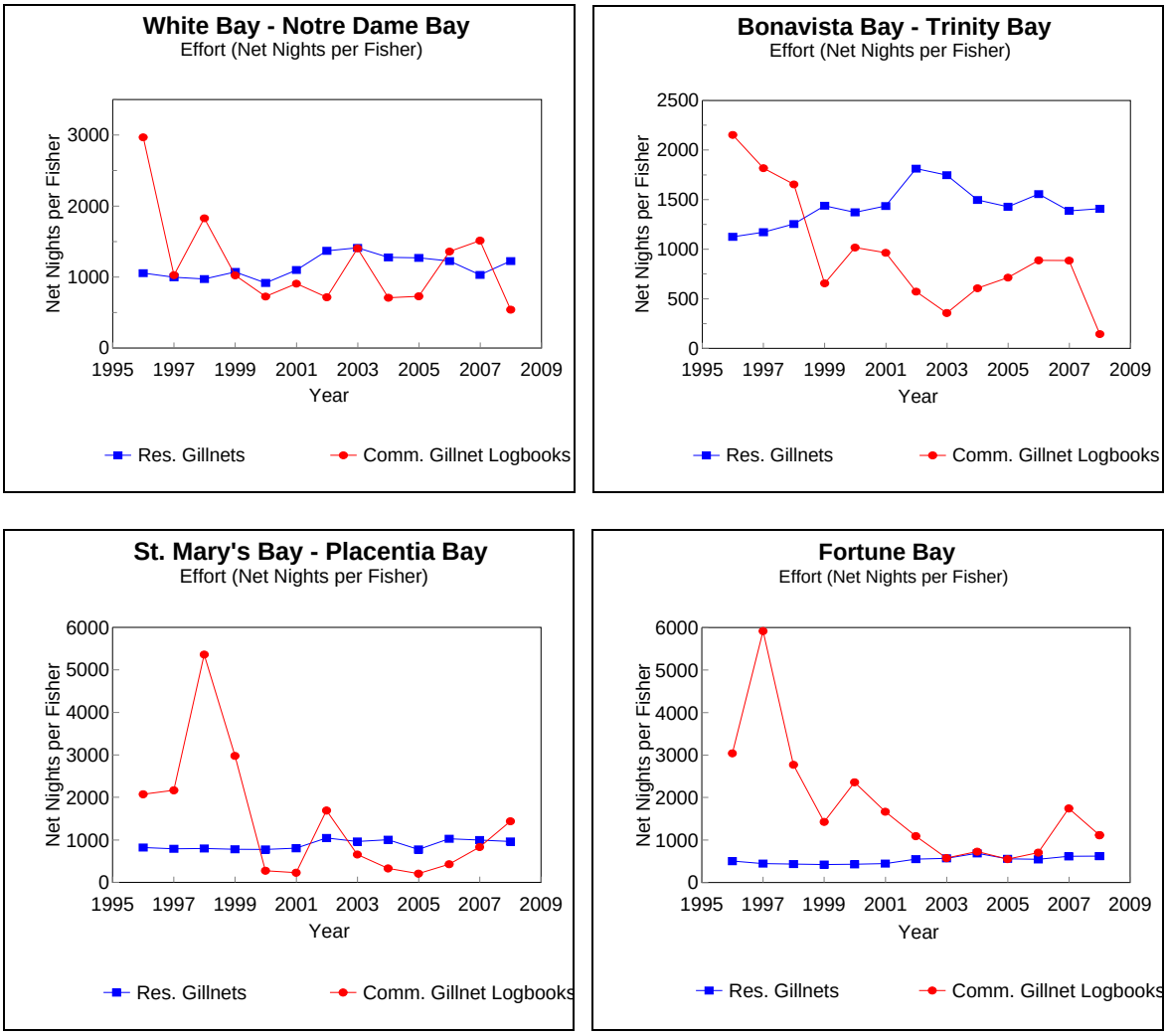


Figure 22. Comparison of total effort (net nights per fisher) for research gill net and commercial gill net logbook data, by stock area and year.

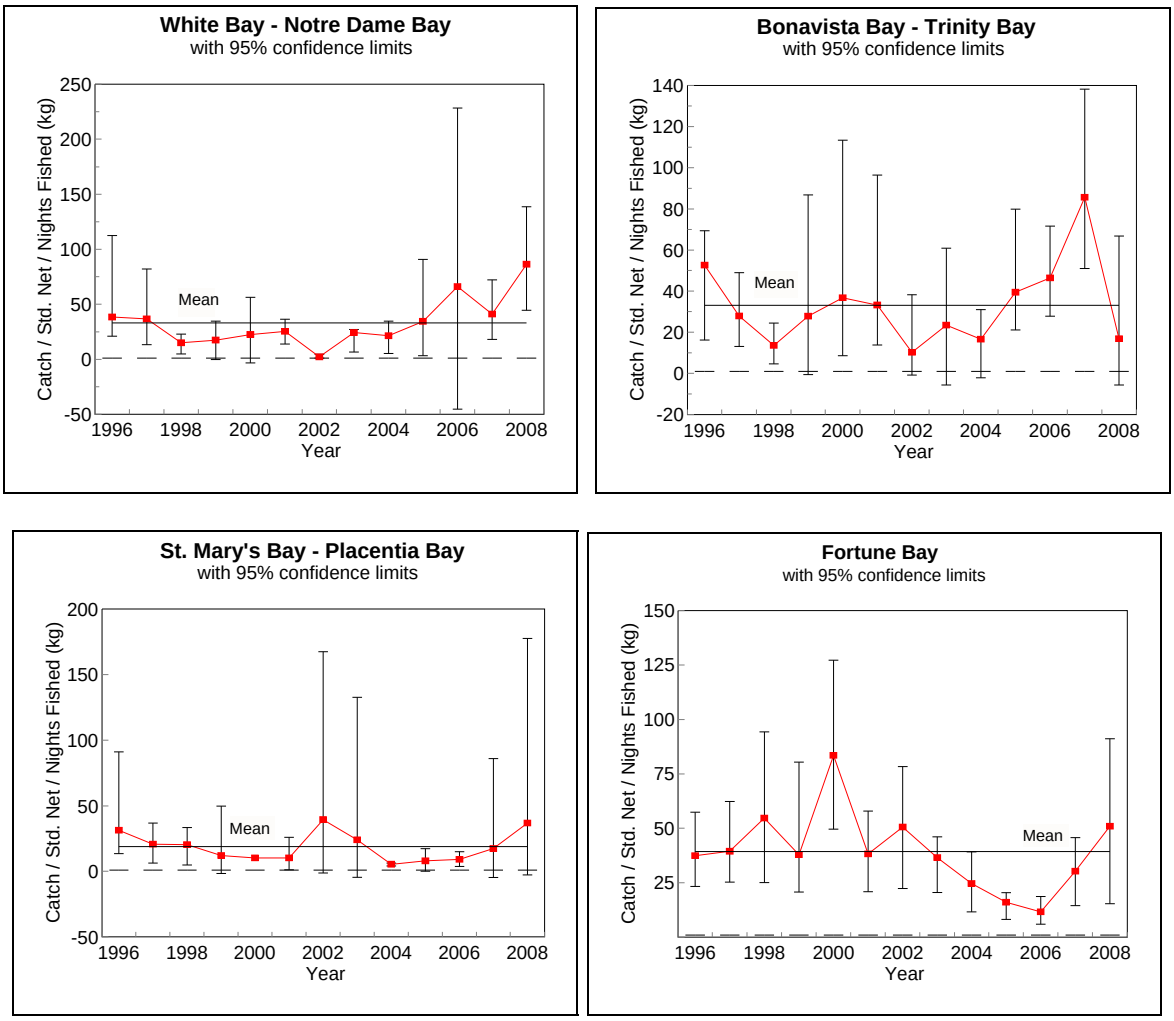


Figure 23. Commercial gill net logbook catch rates (kgs per standard net per nights fished) and confidence limits, by stock area and year, spring and autumn spawners combined.

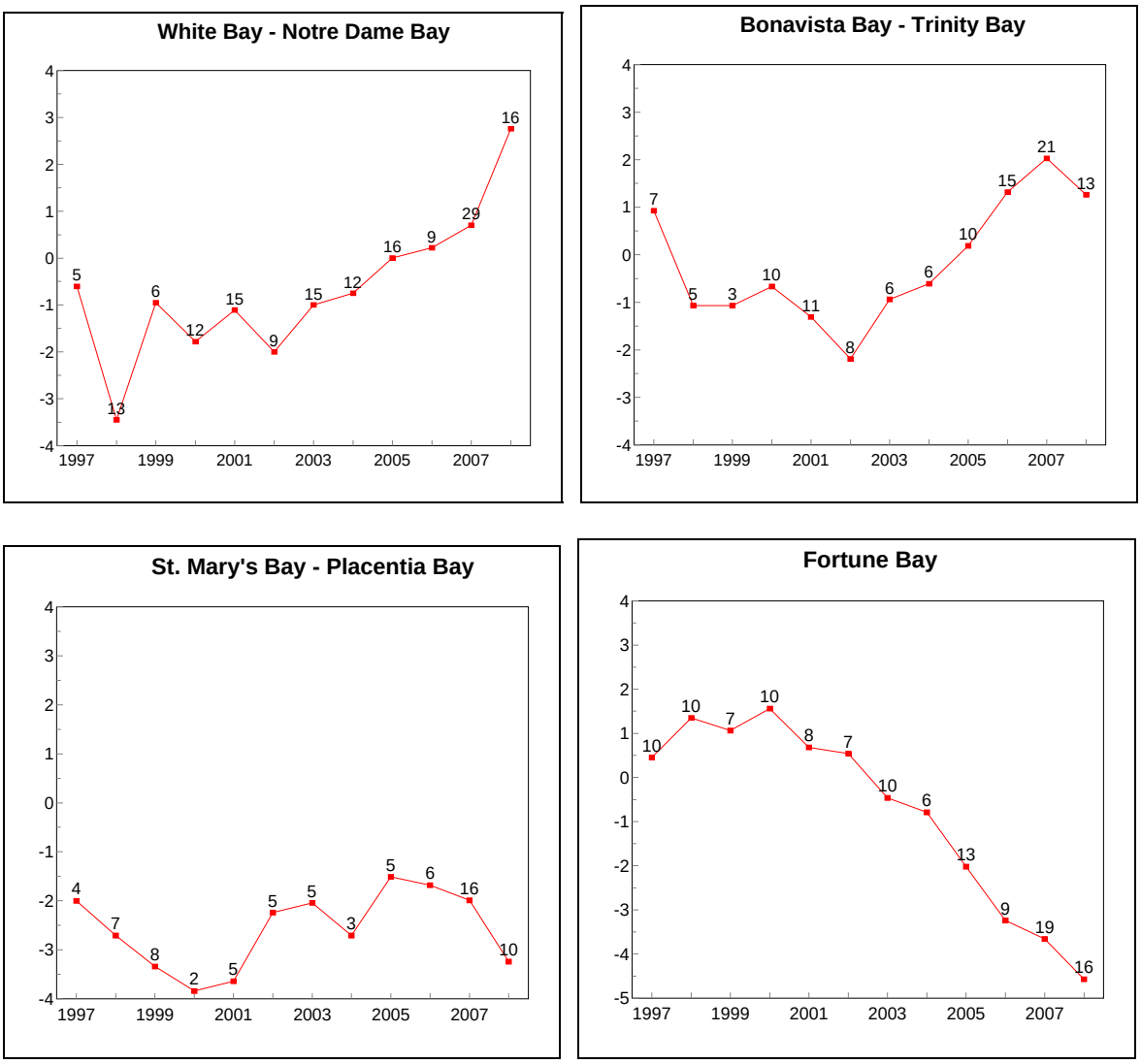


Figure 24. Cumulative abundance indices from commercial gill net logbooks, by stock area and year. Sample sizes (number of fishers) are listed above each data point.

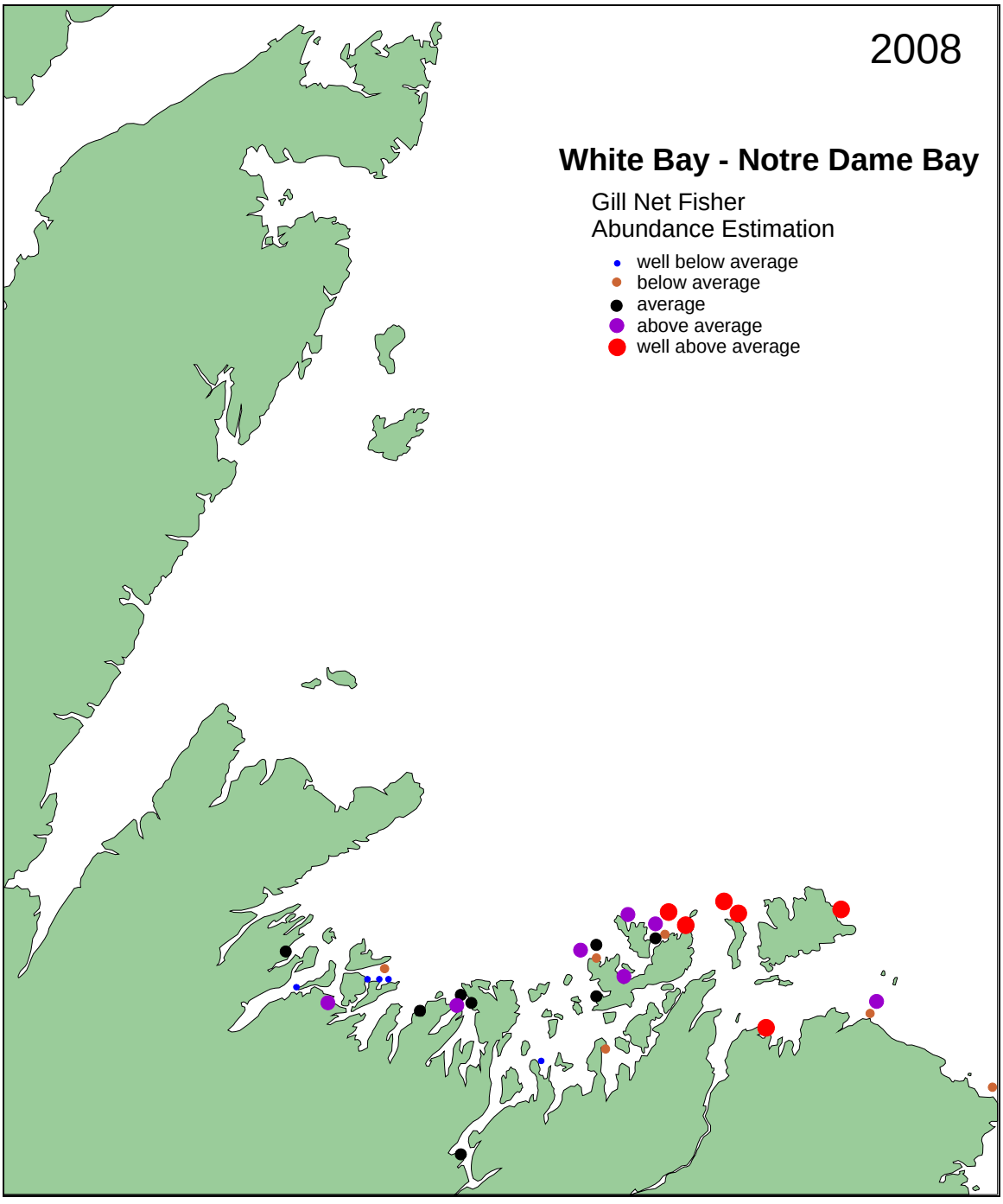


Figure 25. White Bay–Notre Dame Bay bait and commercial gill net set locations and abundance estimation from 2008 phone survey

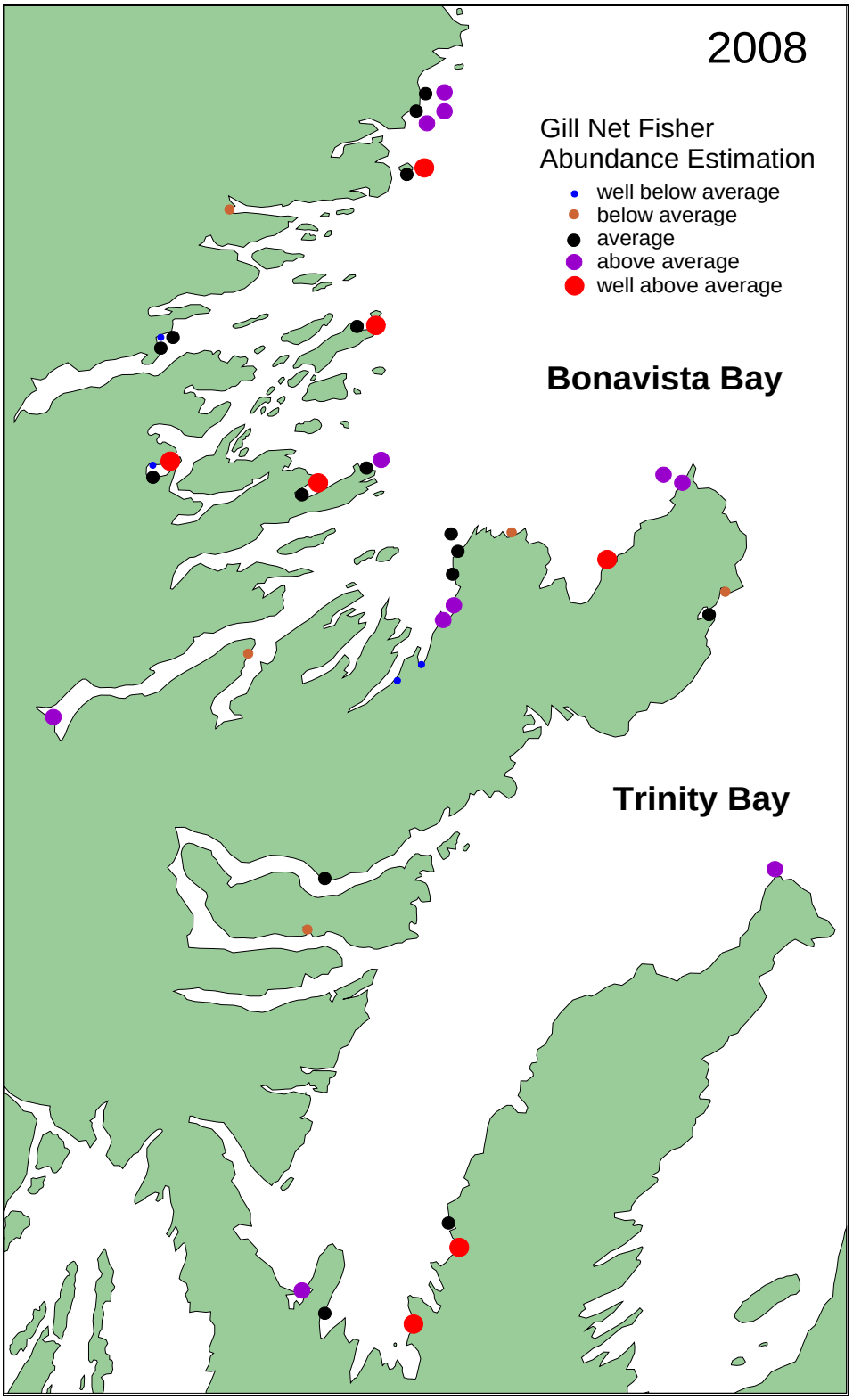


Figure 26. Bonavista Bay–Trinity Bay bait and commercial gill net set locations and abundance estimation from 2008 phone survey

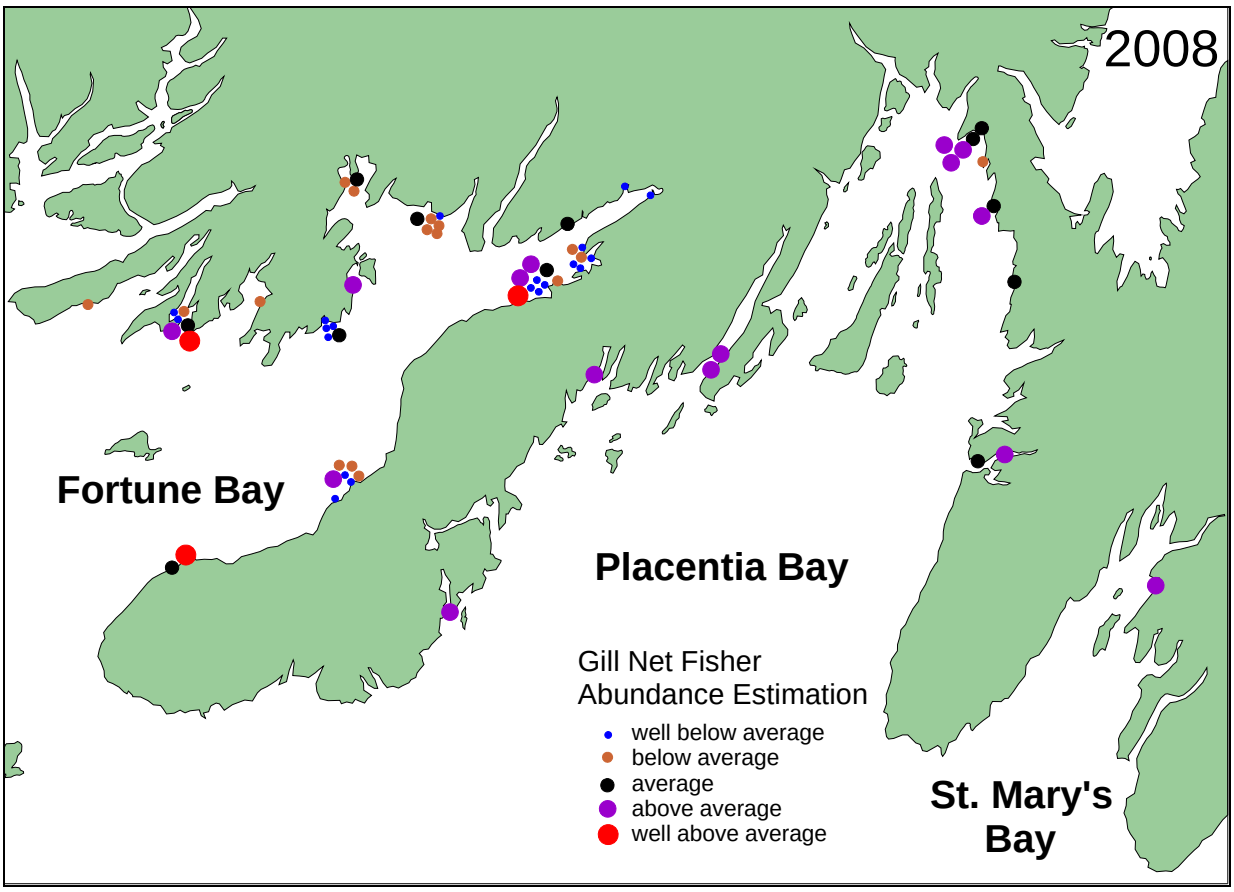


Figure 27. St. Mary's Bay–Placentia Bay and Fortune Bay bait and commercial gill net set locations and abundance estimation from 2008 phone survey

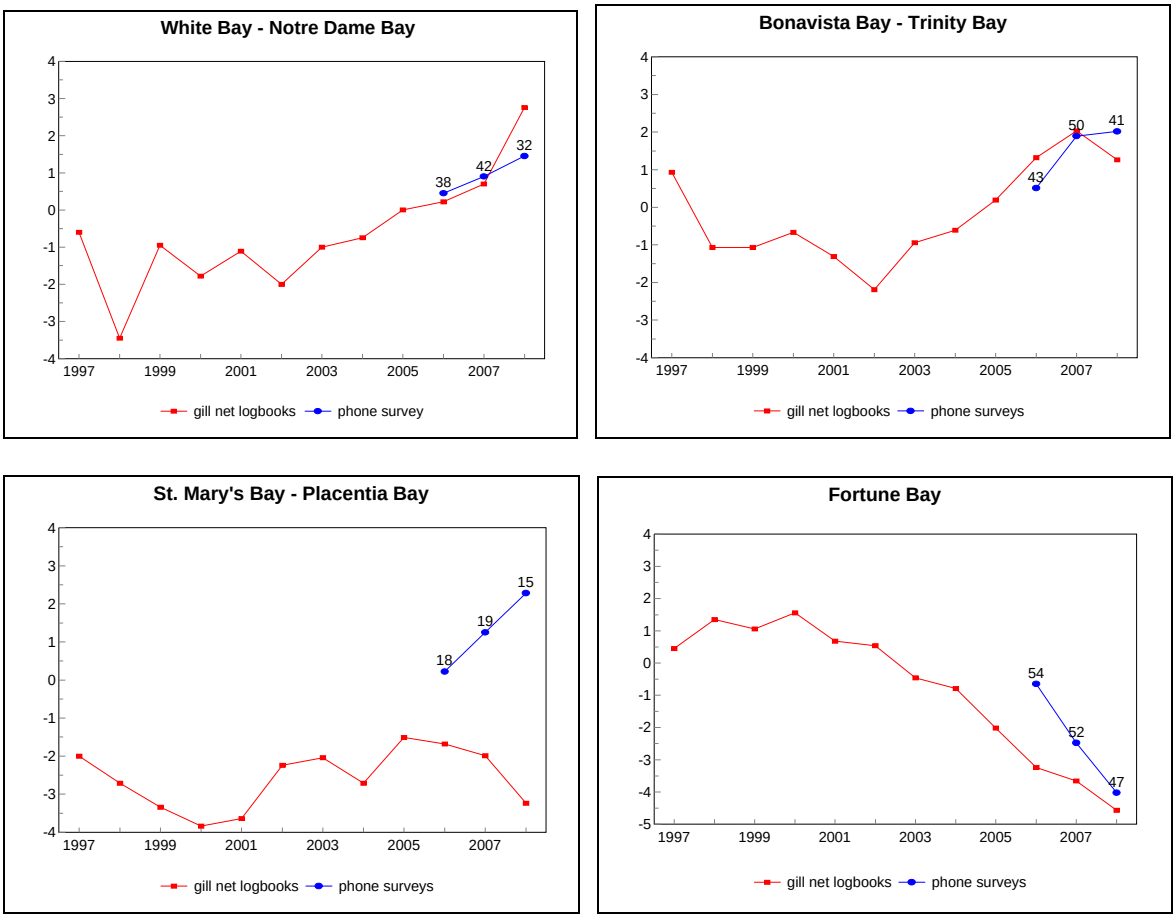


Figure 28. Cumulative abundance indices from gill net fisher phone surveys compared to similar indices from commercial gill net logbooks. Sample sizes (number of fishers) are listed above each data point for the phone survey.

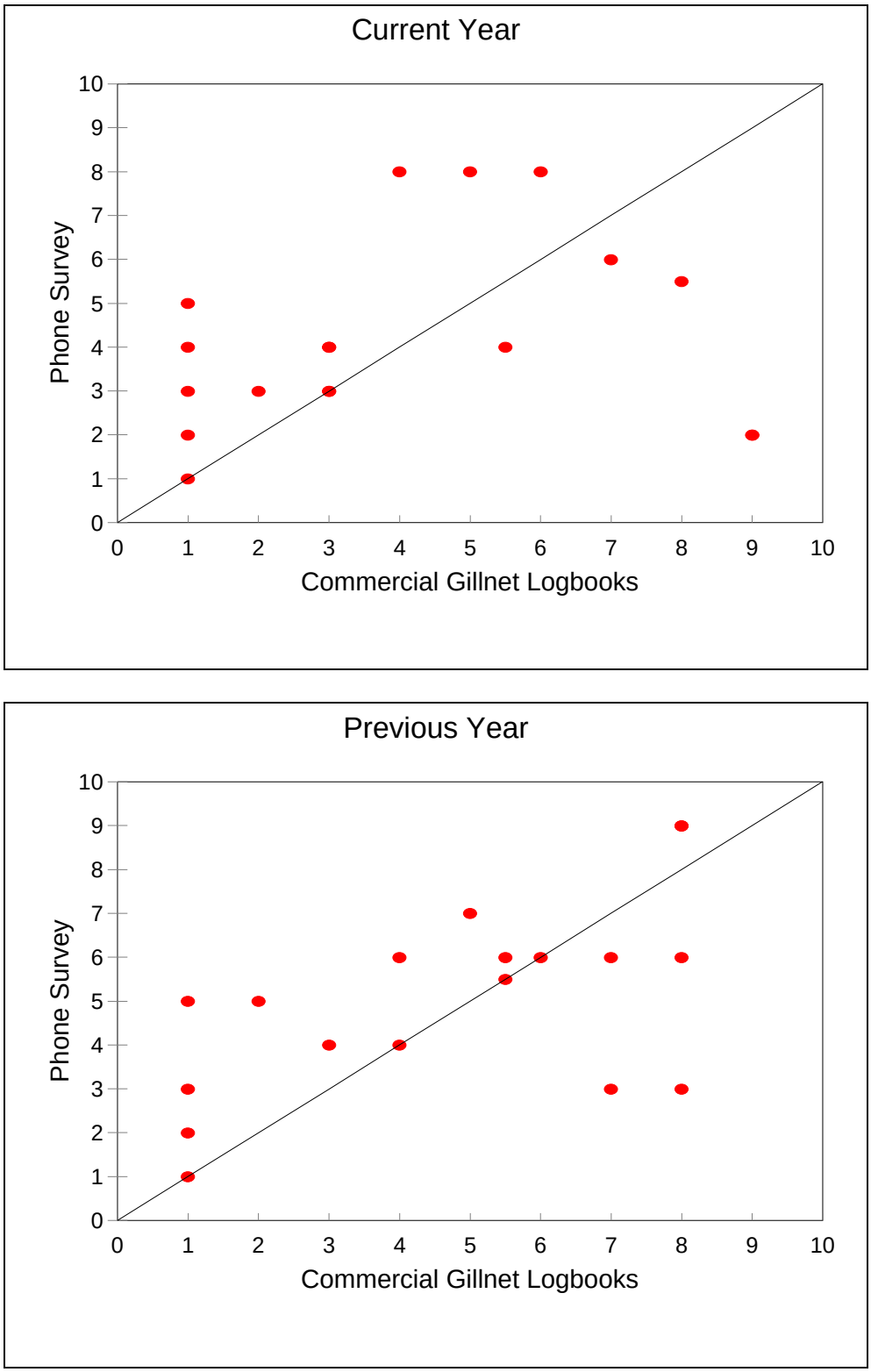
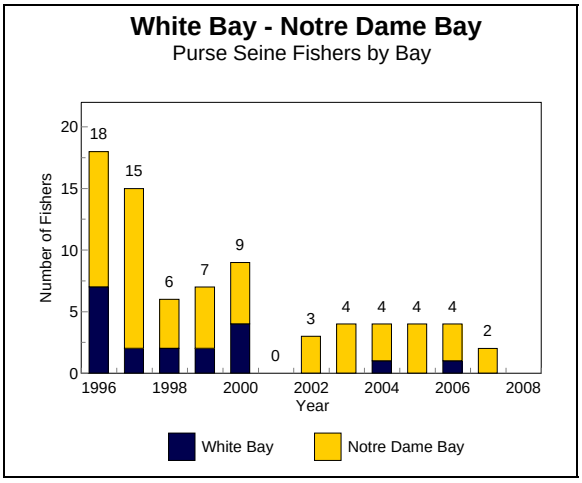
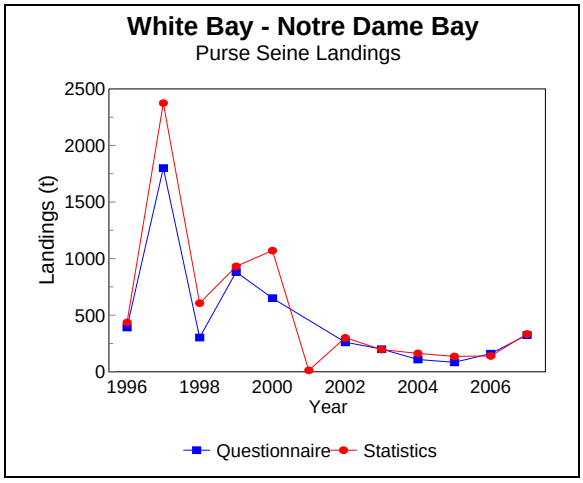
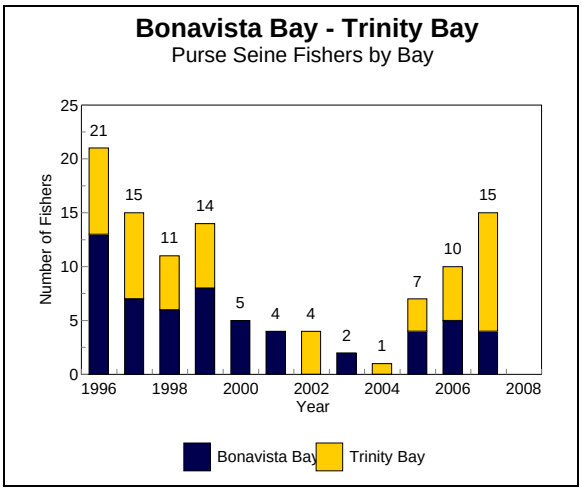
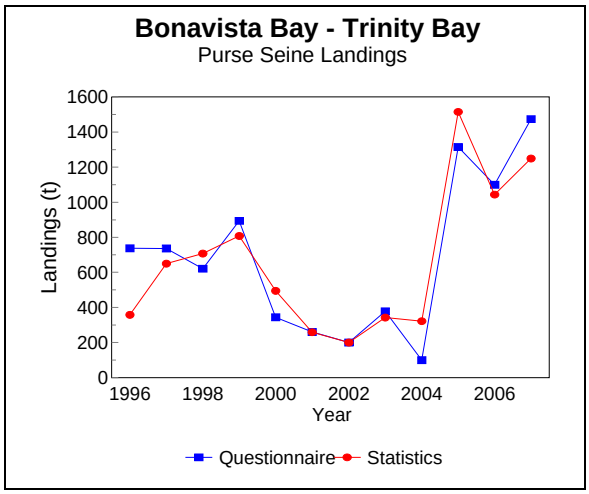


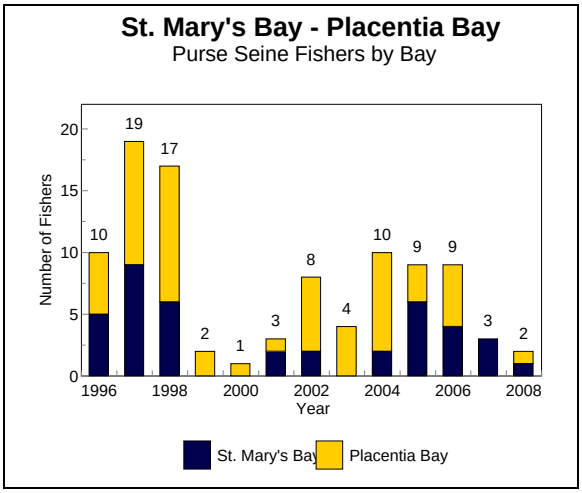
Figure 29. Comparison of abundance indices of common gill net fishers from commercial gill net logbooks and from phone surveys, 2006 to 2008, all stock areas combined. Upper panel indicates observations of abundance in the current year; lower panel indicates observations of abundance in the previous year.











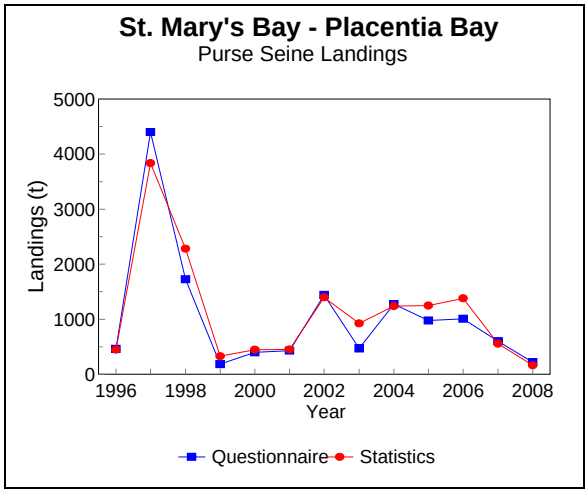
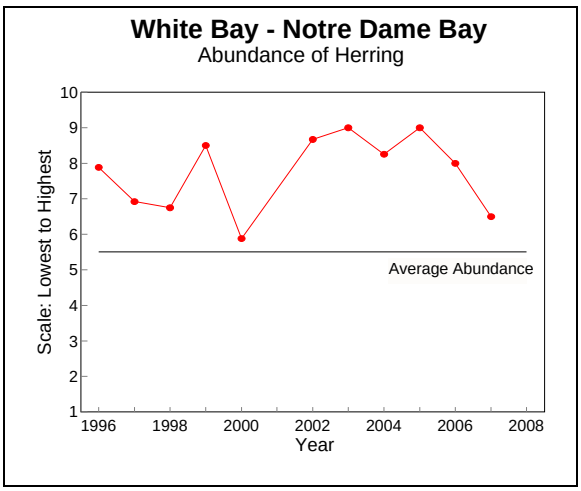
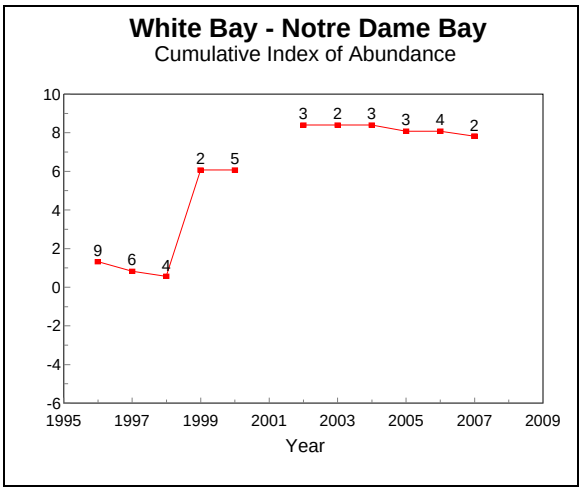
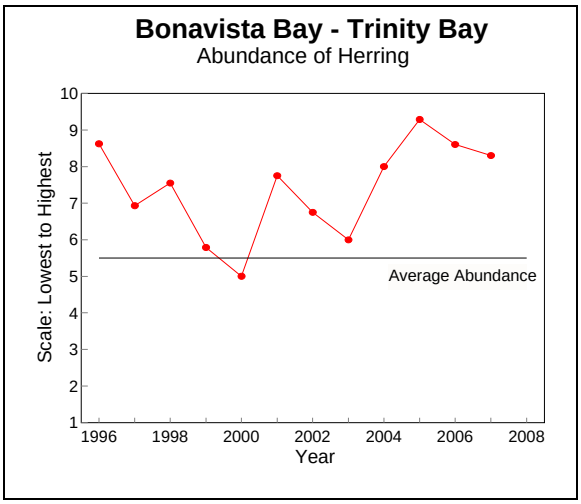
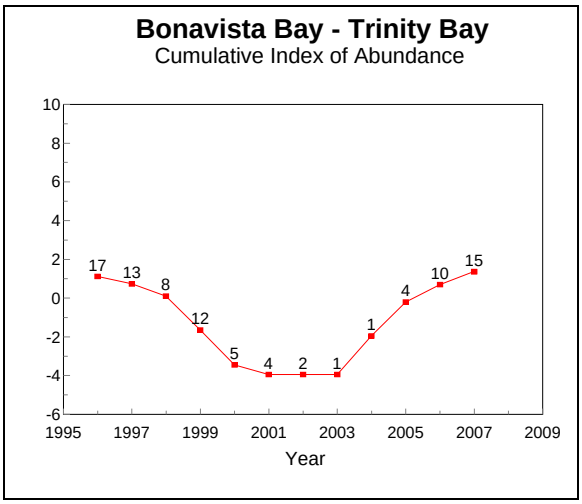


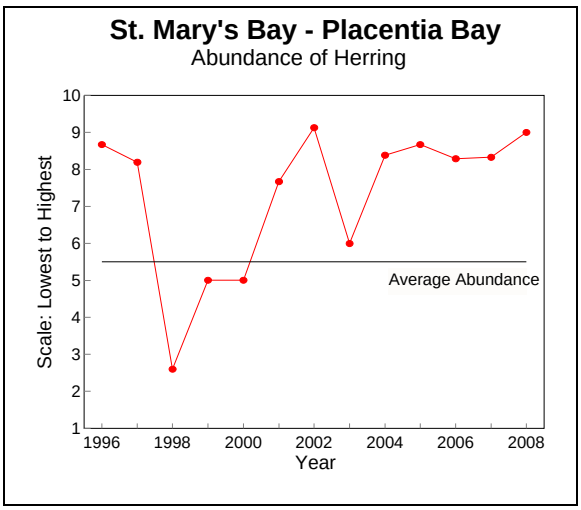
Figure 30. Left panels are the numbers of purse seine fishers who participated in the commercial fishery, by bay, by year, and by stock area. Right panels are the commercial purse seine landings, derived from the purse seine questionnaire and from Policy and Economics Branch statistics.











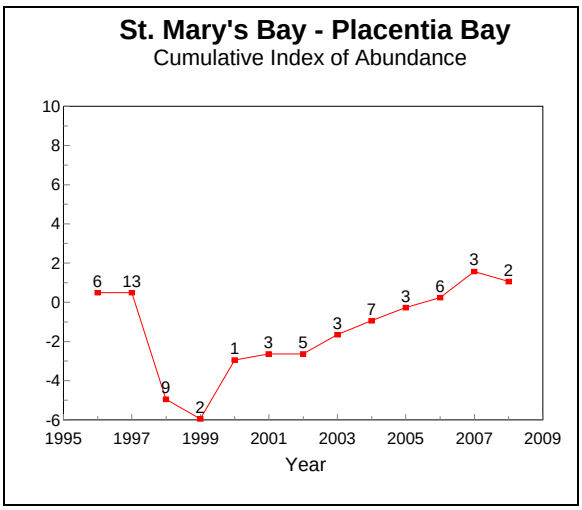


Figure 31. Comparison of purse seine fisher cumulative abundance indices (right panels), used in this assessment, and the non-cumulative indices (left panels) used in the 2006 assessment (Wheeler et al. 2006).

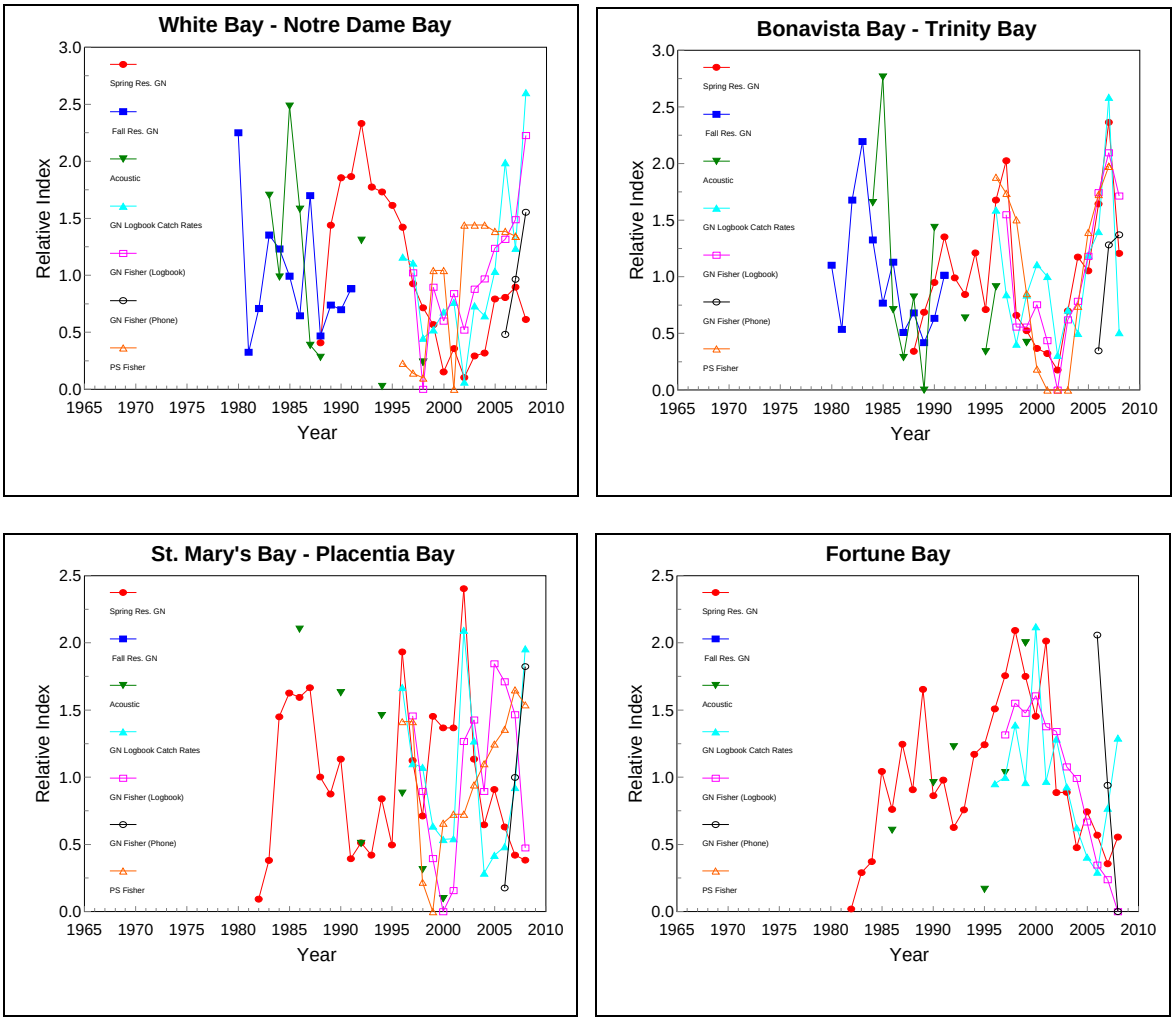


Figure 32. Comparison of all abundance indices, by stock area, 1980-2008. Each index is standardized to its mean.

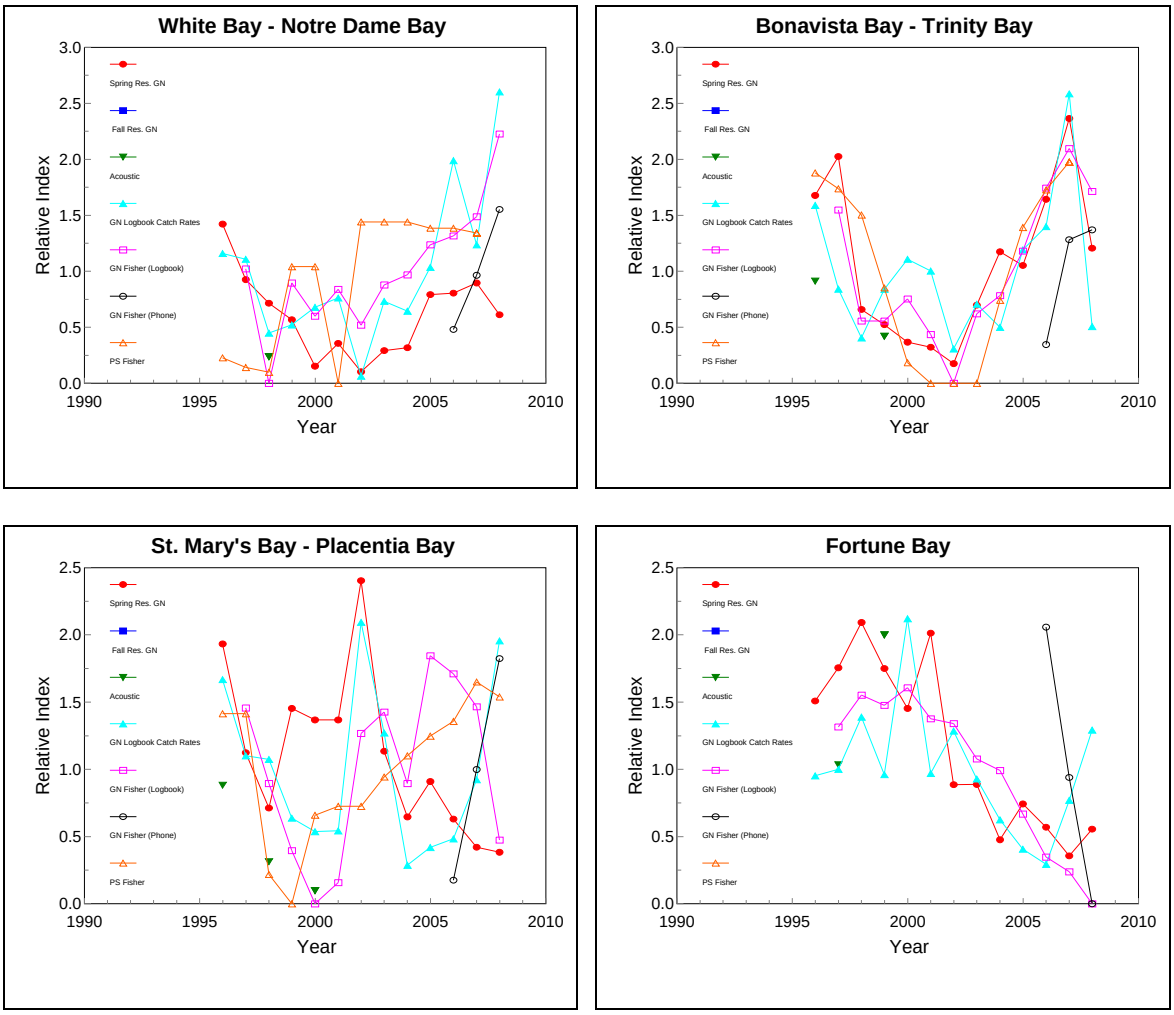


Figure 33. Comparison of all abundance indices, by stock area, 1996-2008. Each index is standardized to its mean.

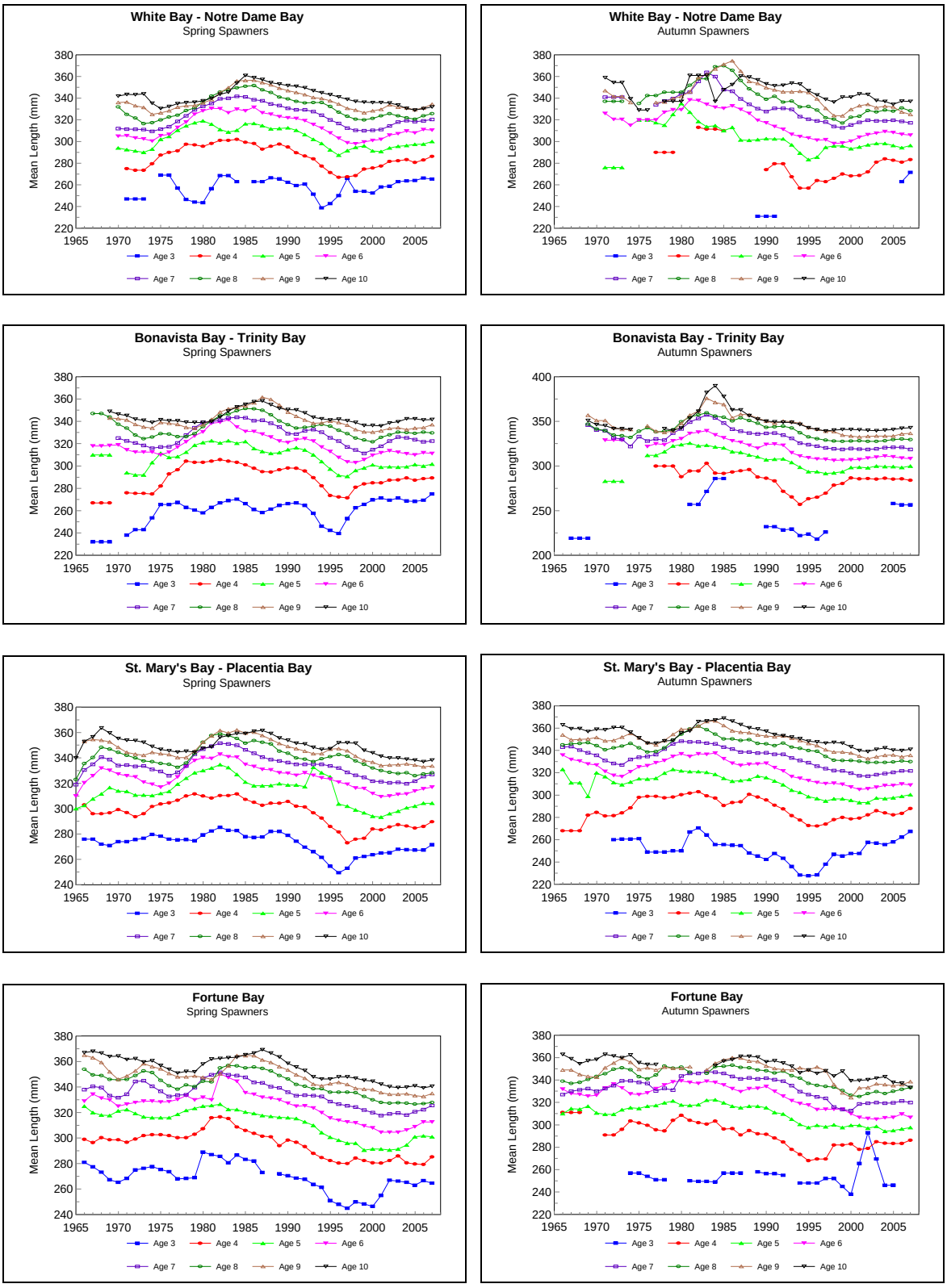
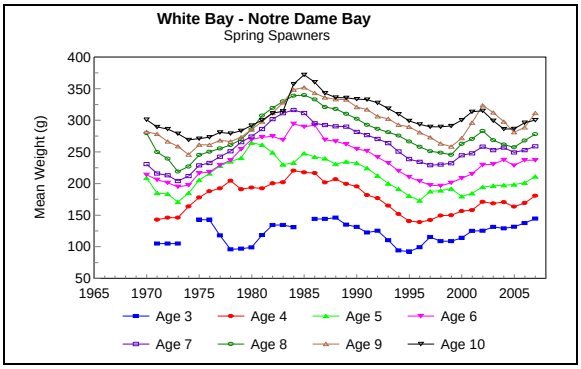
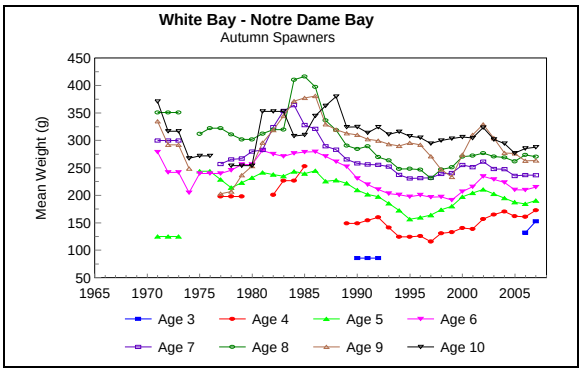
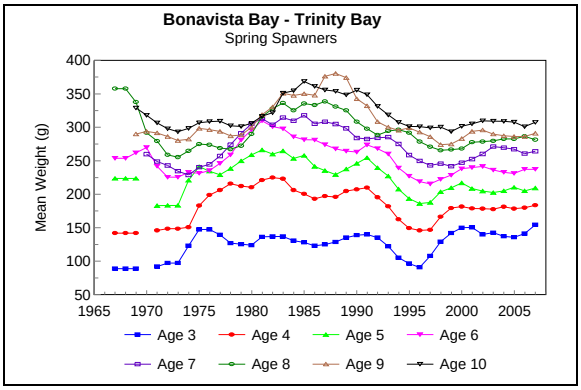
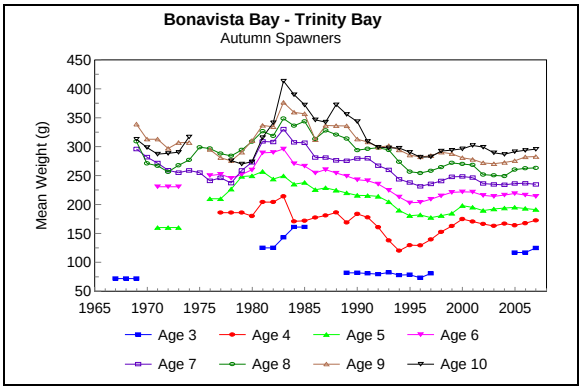


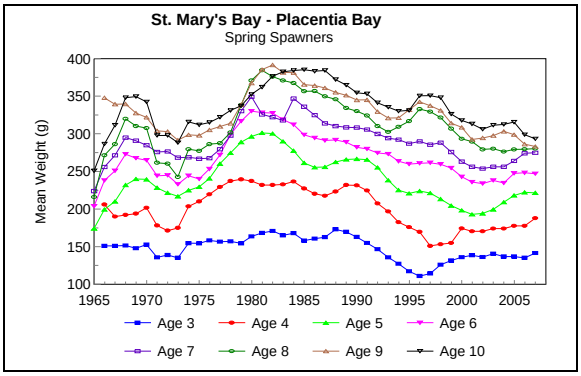
Figure 34. Mean lengths at ages 3-10 of spring and autumn spawning herring, by stock area, from samples collected January to June, 1965–2007.

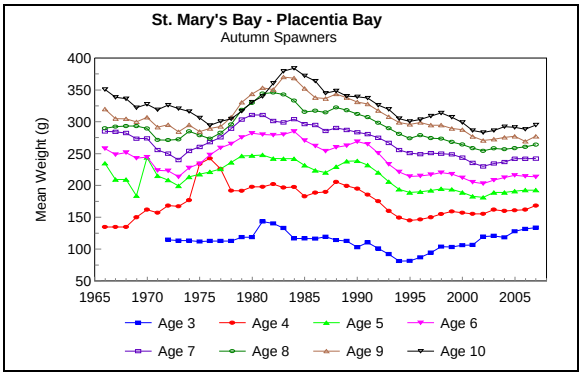


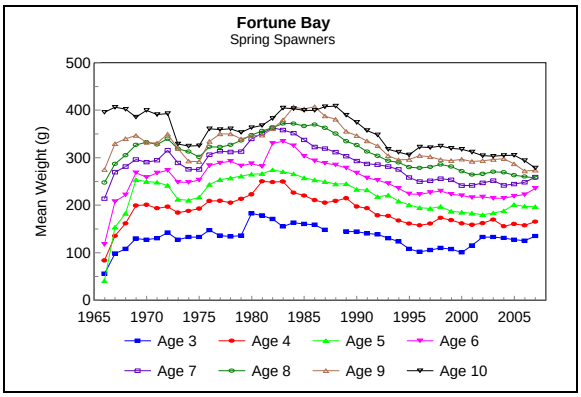












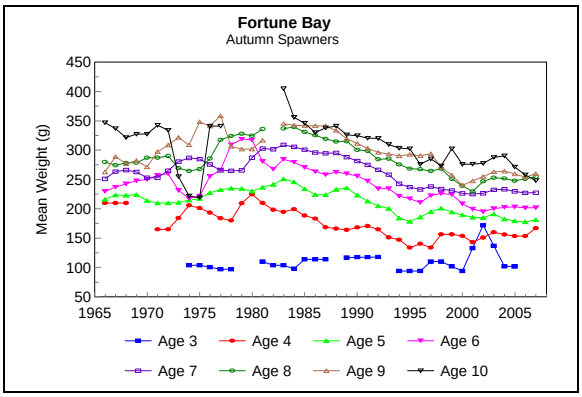


Figure 35. Mean weights at ages 3 to 10 of spring and autumn spawning herring, by stock area, from samples collected January to June, 1965–2007.

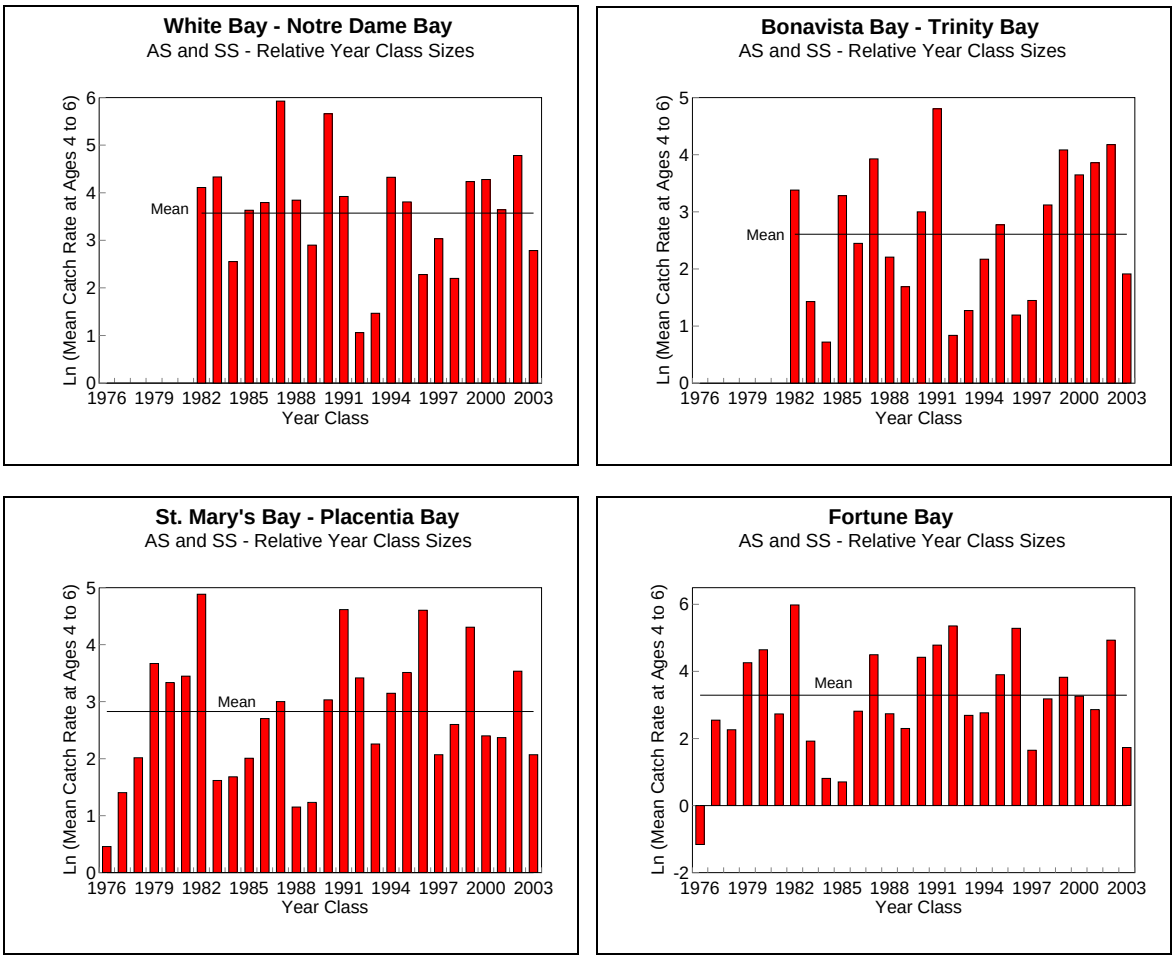


Figure 36. Relative year class sizes estimated from mean research gill net catch rates at ages 4, 5 and 6.

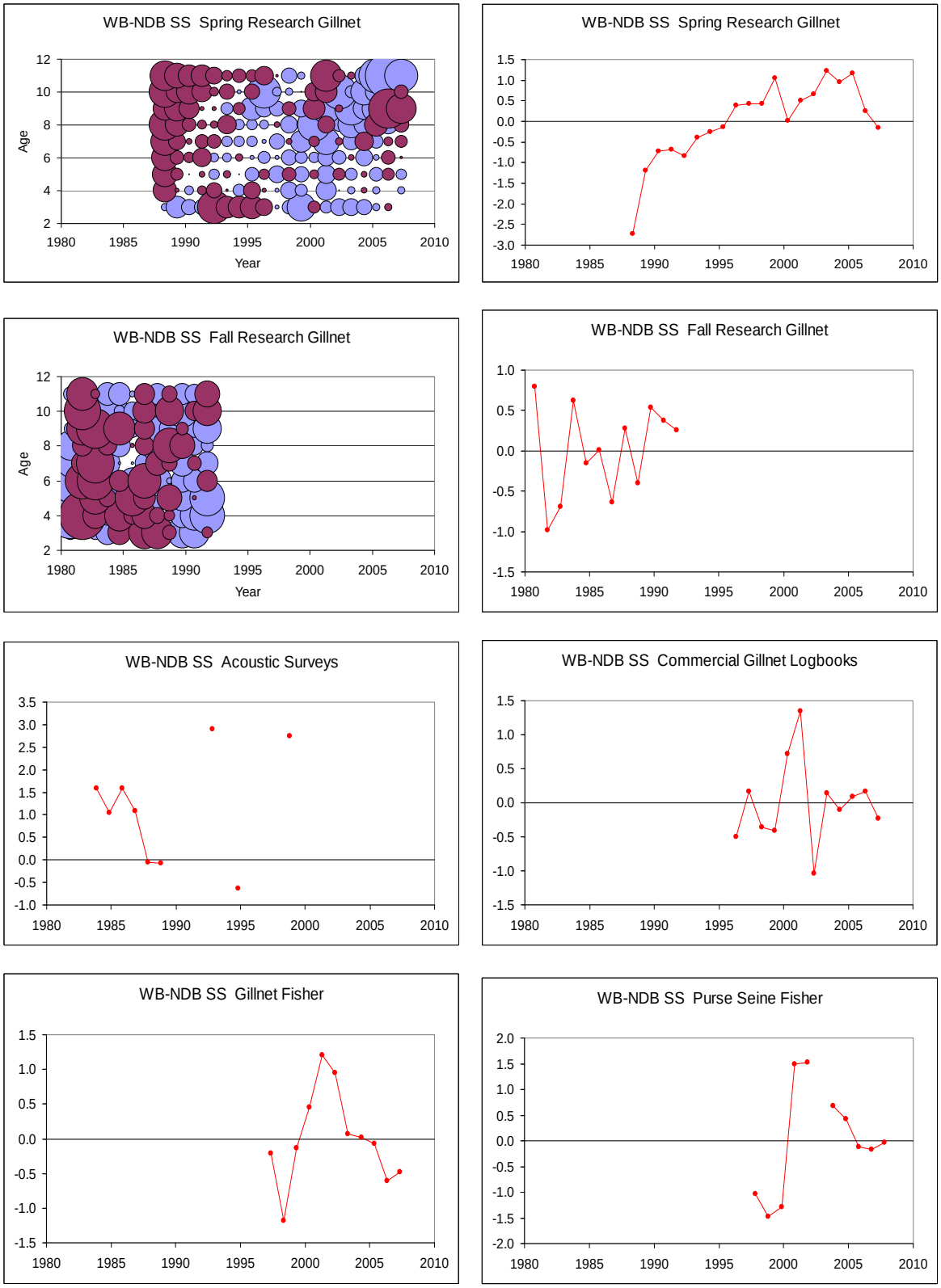


Figure 37. Residuals for the ADAPT calibration of the White Bay–Notre Dame Bay spring spawner VPA using the age disaggregated spring and fall research gill net indices, and the age aggregated acoustic, commercial gill net logbook, gill net fisher, and purse seine fisher indices.

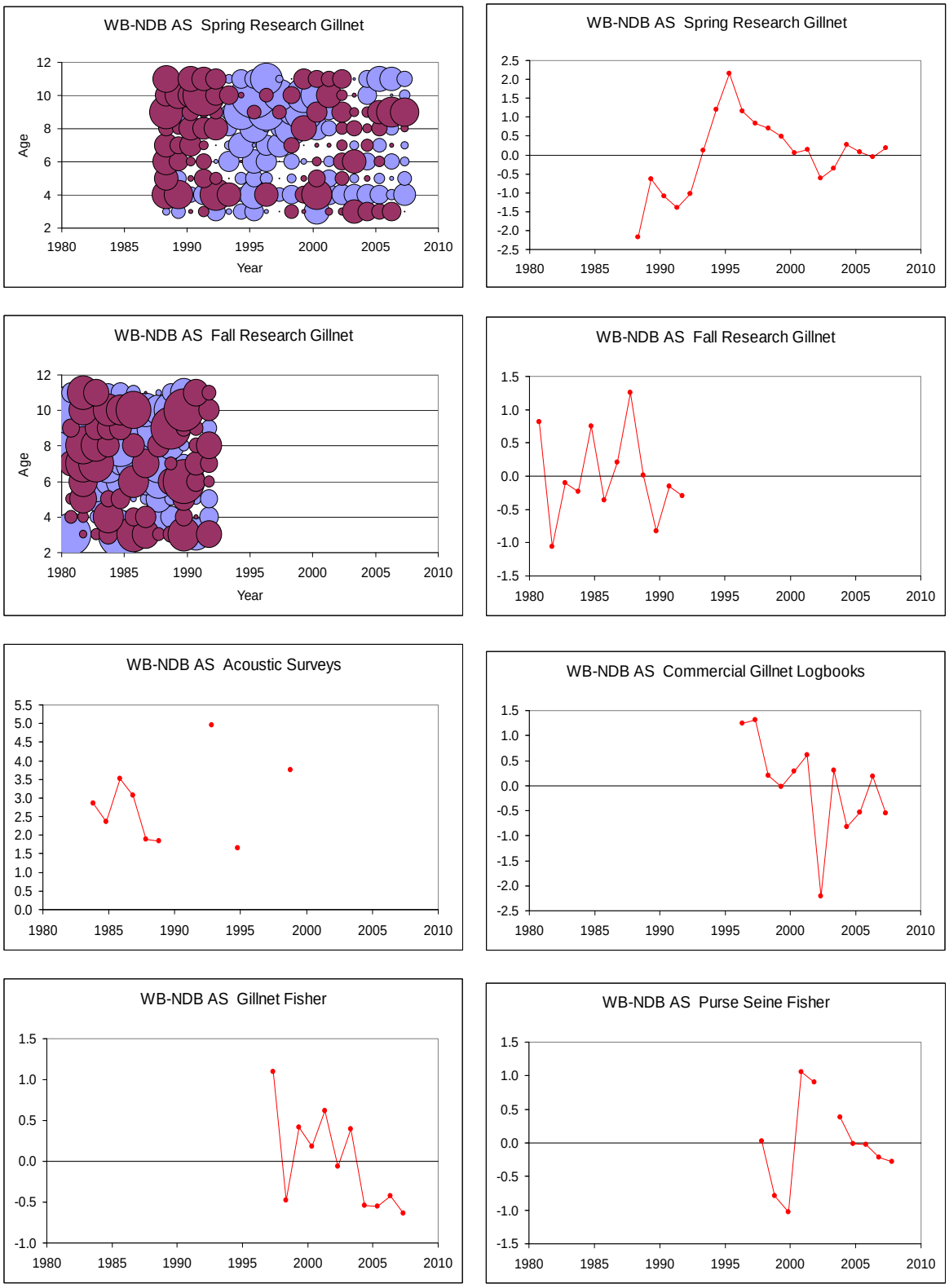


Figure 38. Residuals for the ADAPT calibration of the White Bay–Notre Dame Bay autumn spawner VPA using the age disaggregated spring and fall research gill net indices, and the age aggregated acoustic, commercial gill net logbook, gill net fisher, and purse seine fisher indices.

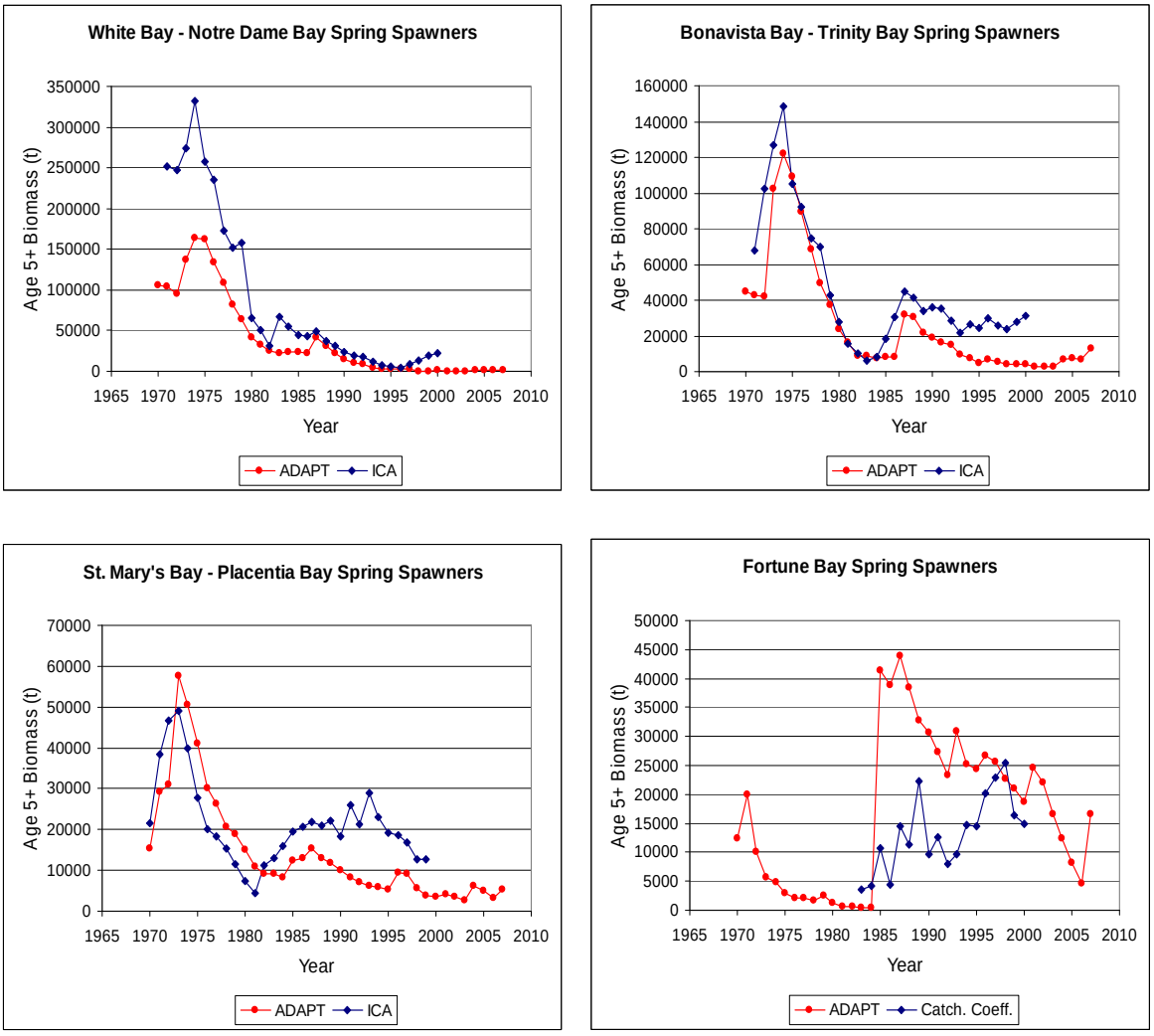


Figure 39. Comparison of biomass estimates (age 5+) from illustrative ADAPT calibration and from ICA (Wheeler et al. 2001).

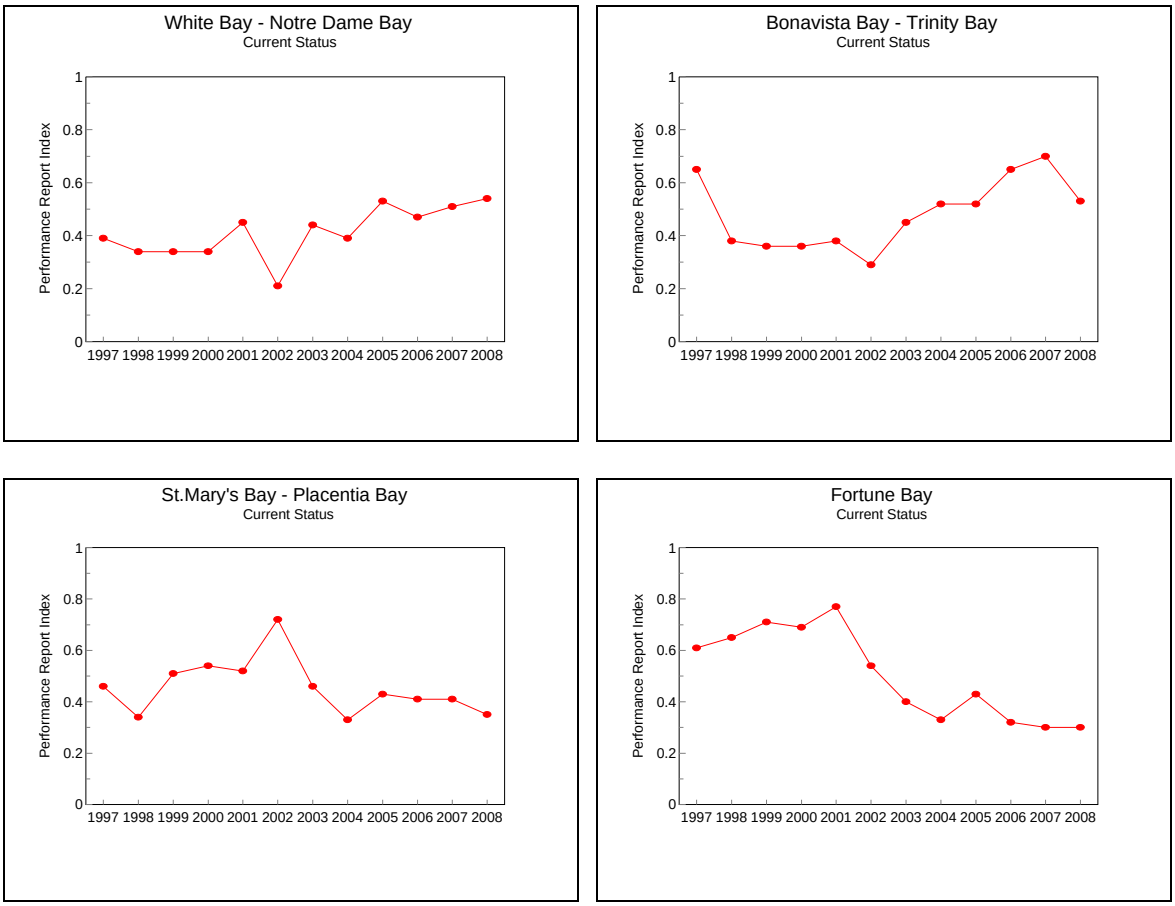


Figure 40. Performance report indices of current status, by stock area, 1997–2008.

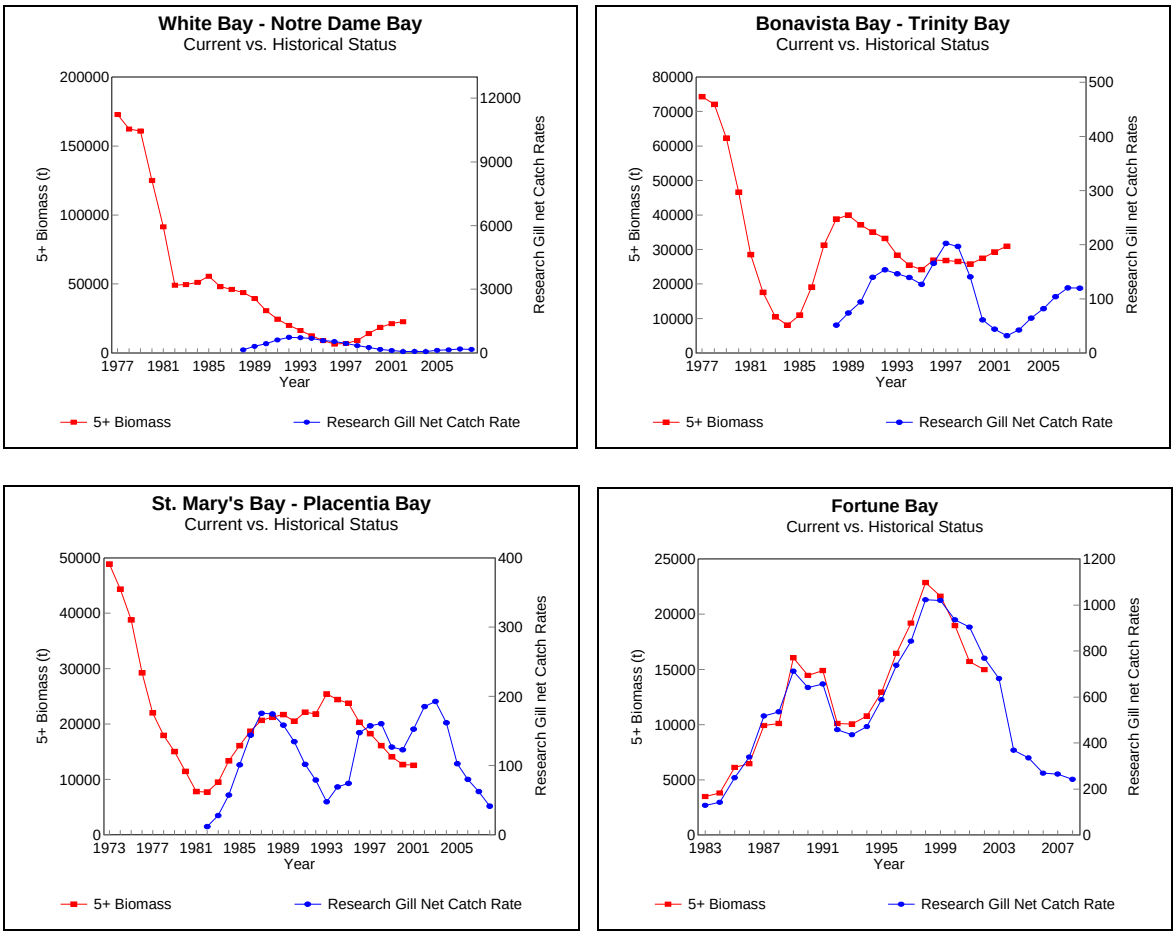


Figure 41. Comparison of research gill net catch rates and historical biomass estimates, by stock area.

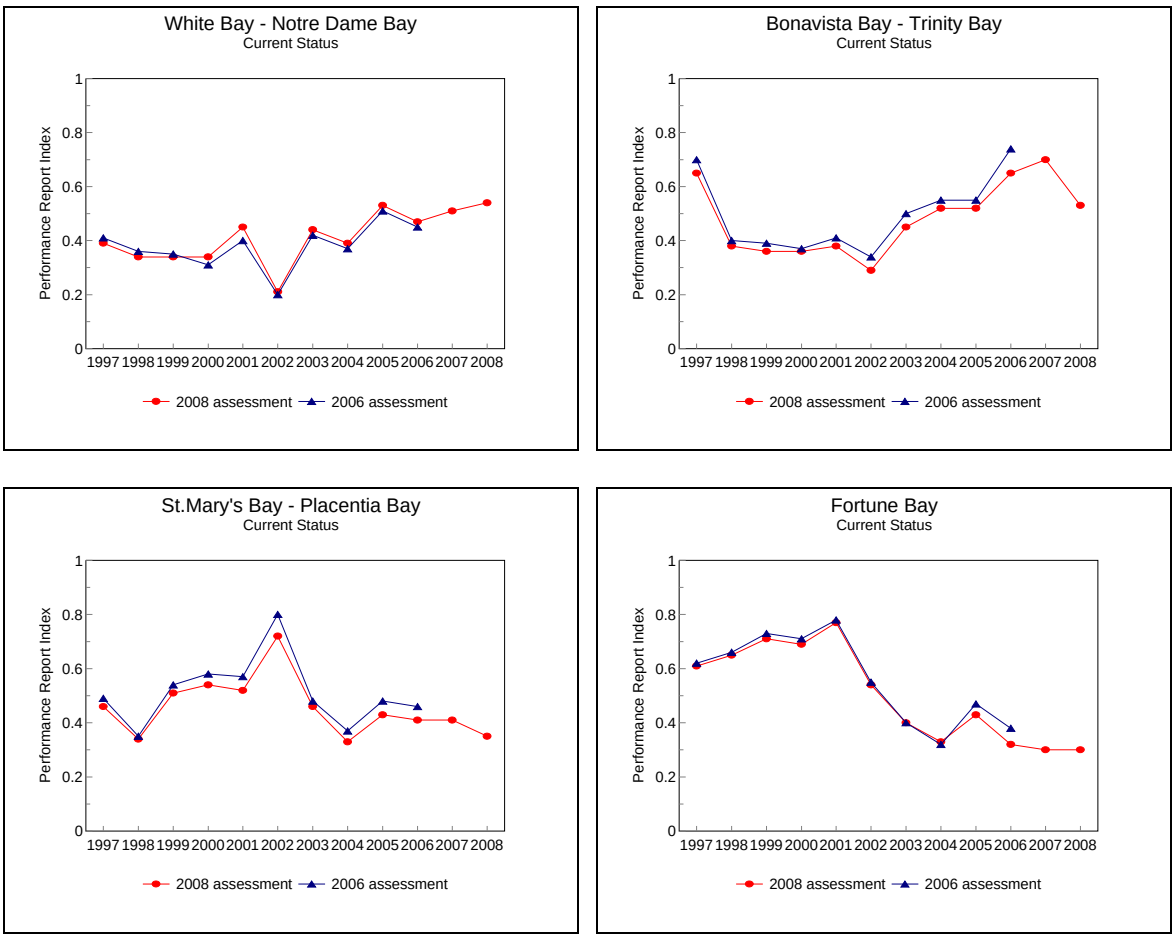


Figure 42. Comparison of performance report indices calculated for this assessment with performance report indices from the 2006 assessment (Wheeler et al. 2006).

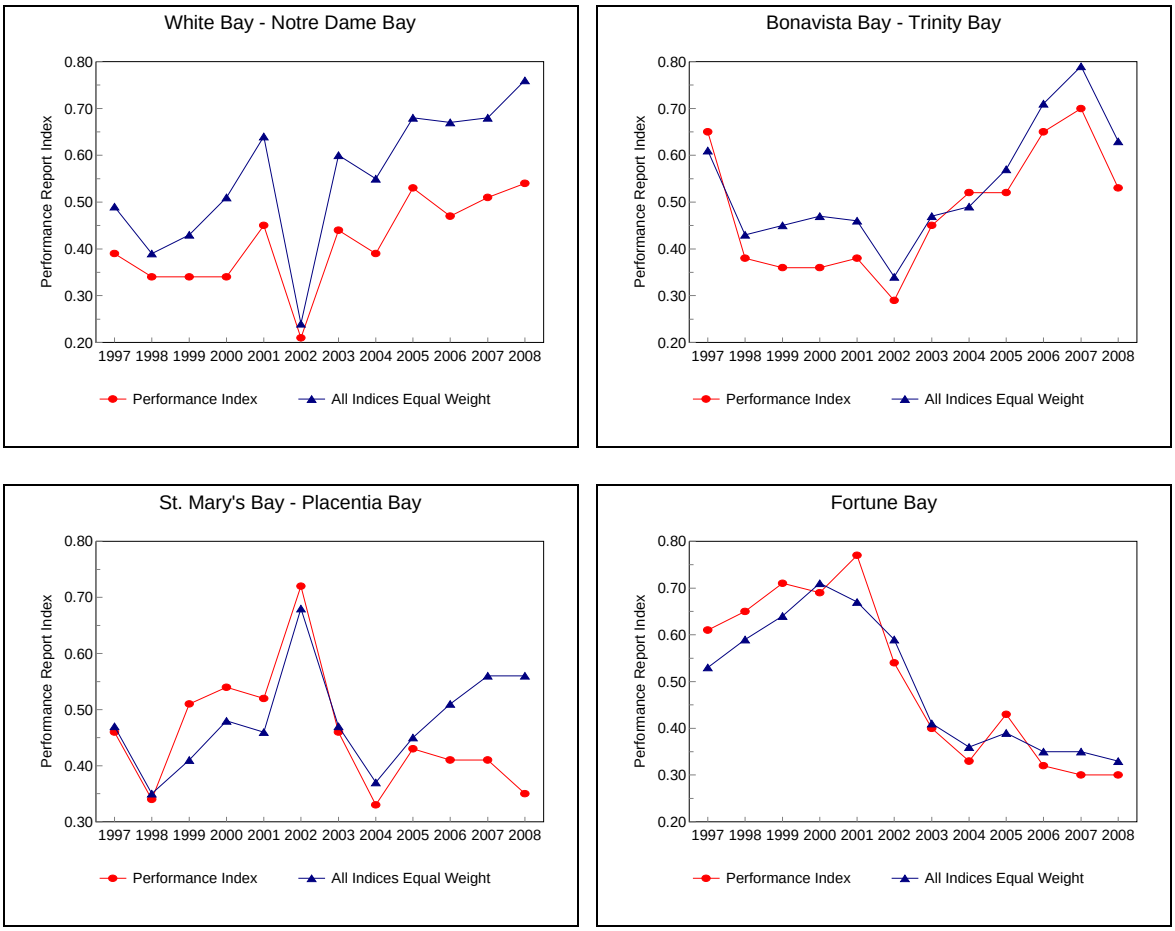


Figure 43. Comparison of weighted performance report indices calculated for this assessment with performance report indices where current status parameters were unweighted.

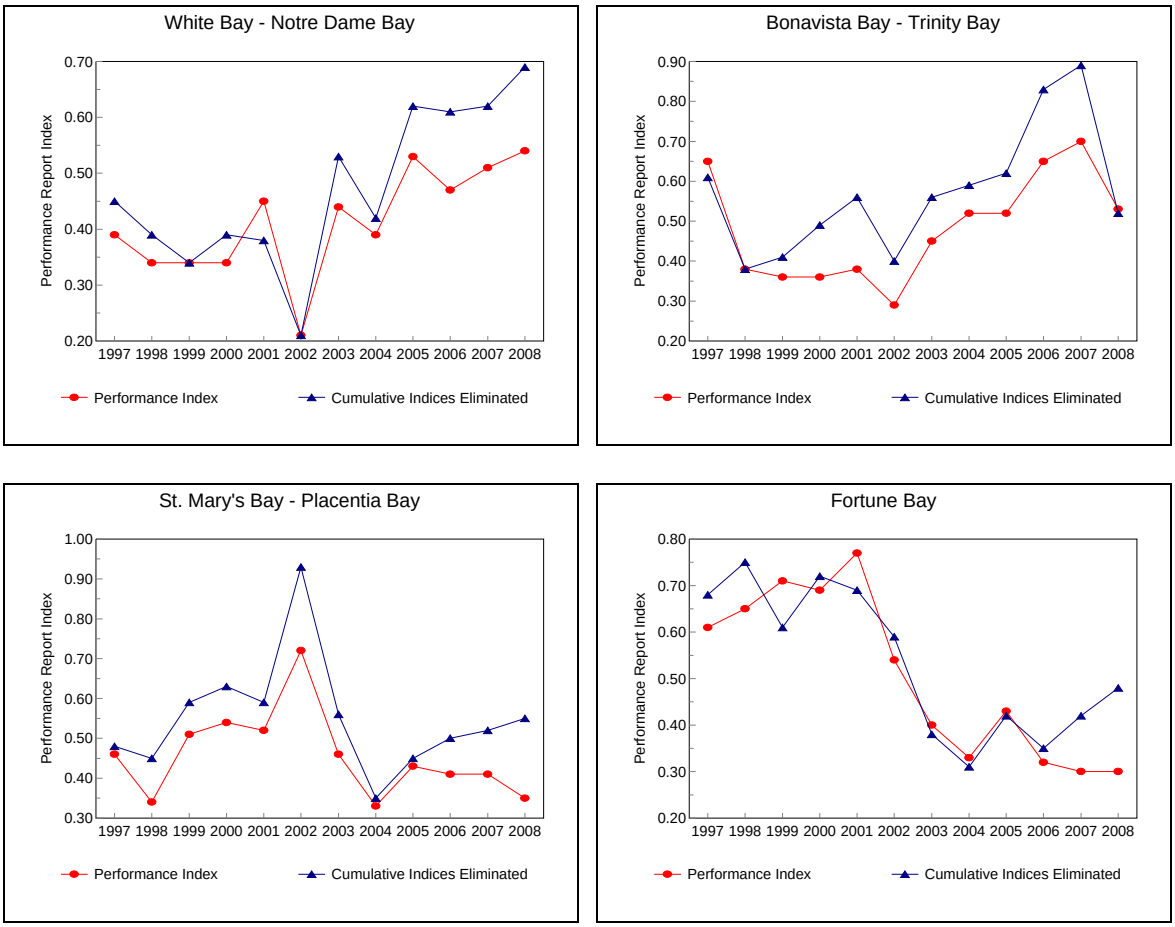


Figure 44. Comparison of weighted performance report indices calculated for this assessment with performance report indices where all cumulative indices (opinion-based) were eliminated.