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1991 4WX HERRING ASSESSMENT

by

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ABSTRACT

The 1991 4WX herring fishery was very similar to that of recent years. The purse seine fleet dominated landings, followed in importance by weirs and relatively minor landings by midwater trawl, shutoff, trap, and gillnet. The fishery continued to be dominated by the roe market which was reduced compared with recent years. The spatial and temporal distribution of the fishery was well documented by logbooks and showed only moderate differences from recent years in fishing grounds and months or seasons. Reported stock landings totalled 97,010 t but this was again shown to be an under-estimate due to under-reporting of landings. The 1987 year-class replaced the 1983 year-class in prominence in the catch by number and weight. The 1983 year-class had dominated stock catch by weight for 5 consecutive years and in 1991 it still contributed 16% by weight at age 8. Age 2 fish again dominated the non-stock New Brunswick weir and shut-off fisheries in numbers and weight.

Abundance indices (larval abundance and research vessel bottom trawl catch rates) were higher in 1991 than in 1990. The Chedabucto Bay winter acoustic survey estimate was again low but it was concluded that this estimate was not indicative of stock abundance because of changes in the availability of herring to the survey.

Preliminary reconstruction of catch records since 1985 based on purse seine vessel surveys and product back-calculations showed that landings have been considerably higher (1.2 to 1.8 times) than reported. An analytical assessment was precluded by the lack of a valid catch record. However, indications of above-average abundance based on survey indices and of strength in recent year-classes would make a fishery at the level of recent years acceptable.

RÉSUMÉ

En 1991, la pêche du hareng dans les divisions 4WX a été très comparable à celle des années antérieures. Les prises à la senne coulissante ont été les plus abondantes, suivies par celles des pêcheries à fascines et par une proportion relativement faible de prises au chalut pélagique, à la senne de plage, au parc en filet et au filet maillant. Le marché de la roque est resté prédominant, quoique moins important que les années précédentes. La distribution spatio-temporelle de la pêche, abondamment appuyée sur les journaux de bord, n'a révélé que des différences modestes par rapport aux années antérieures en ce qui concerne les lieux ainsi que les mois ou saisons de pêche. Les débarquements déclarés de poissons capturés dans le stock se sont établis au total à 97 010 t, mais il s'est avéré à nouveau que ce chiffre représentait une sous-estimation des résultats en raison des déclarations de prises inférieures à la réalité. La classe d'âge de 1987 a remplacé celle de 1983 comme classe dominante parmi les prises, en nombre et en poids. La classe d'âge de 1983 avait occupé la première place dans les prises selon le poids capturées parmi le stock pendant cinq années consécutives ; en 1991, elle représentait encore 16 % du poids des prises d'âge 8. En 1991 également, le hareng de 2 ans demeurait prédominant dans les prises des pêcheries à fascines fixes et sennes de plage hors stock du Nouveau-Brunswick, en poids et en nombre.

Les indices d'abondance (abondance larvaire et taux de prises au chalut de fond par les navires scientifiques) ont été supérieurs à ceux de 1990. Les résultats d'un relevé acoustique effectué durant l'hiver dans la baie de Chedabucto étaient à nouveau très bas, mais on a conclu que cette estimation n'était pas révélatrice de l'abondance du stock en raison de changements dans la quantité de hareng disponible pour le relevé.

Une reconstitution préliminaire des prises capturées depuis 1985, fondée sur les résultats des campagnes d'évaluation à la senne coulissante et sur des rétrocalculs du produit, a révélé que les débarquements ont été considérablement supérieurs (de 1,2 à 1,8 fois) à ceux qui ont été déclarés. Il s'est avéré impossible de procéder à une évaluation analytique en raison de l'absence de relevés de statistiques de prises valables. Toutefois, compte tenu de l'abondance supérieure à la moyenne révélée par les indices des campagnes d'évaluation et de la force des récentes classes d'âge, il apparaît acceptable d'autoriser la pêche au niveau où elle a été pratiquée ces dernières années.

INTRODUCTION

As in recent years, the 1990-91 Div 4WX herring fisheries were dominated by purse seine and weir gear components, with relatively minor landings by midwater trawl, shutoff, trap, and gillnet (Table 1). As in previous years, the purse seine fleet of 40 vessels accounted for most (over 96%) of the total reported catch of 4WX stock herring (Table 2). The remaining landings of stock herring were taken by weirs on the Nova Scotia side of the Bay of Fundy (1.5% of total stock landings for 1990-91), foreign bottom trawl and domestic midwater trawl (1.2%), gillnets (0.8%), and traps (0.1%). Significant catches of what have traditionally been considered non-4WX stock herring intercepted in the 4WX area were taken by weir and shutoff on the New Brunswick side of the Bay of Fundy (See also the section on Assessment Data; Stock Components below).

The most intensive 4WX stock herring landings occurred in the purse seine 4X summer fishery on the pre-spawning and spawning aggregations off southwest Nova Scotia (subareas 4Xq and 4Xr; Fig. 1) from June to mid-October 1991 (Table 2). During this period, 78.7% of total reported purse seine landings for the 1990-91 fishery were taken. Other major fishing activity occurred in the purse seine fisheries on overwintering aggregations of herring around Chedabucto Bay (November 1990 through February 1991; 19.1% of reported purse seine landings), and off Grand Manan Island in the 4Xs fall and winter fishery (October 1990 through January 1991; 2.2% of reported purse seine landings).

The fishery continued to be highly influenced by markets and was restricted by a major reduction in the roe market compared with the previous year. Uncertainty in the price for herring roe exports to Japan and bad weather during the roe season resulted in a decrease in landings in the 4X summer purse seine fishery (versus the 1989-90 fishery). Other significant markets continued to be the adult shore (large fish) domestic market, juvenile herring for sardines/canned herring products, and over-the-side sales (OSS) to foreign vessels (Table 3, 4).

1990-91 MANAGEMENT PLAN

The 1990-91 Herring Management Plan (Appendix) represented a continuation of 4WX herring annual management policy under the 10-Year (1983) Management Plan. Quotas for 4WX stock herring were established for: (i) the purse seine fleet of 40 vessels (141,688 t or 93.7% of the total allowable catch of 151,200 t including a bait quota total of 2,600 t), (ii) a single mid-water trawl (1,512 t or 1% of the TAC), and (iii) an allocation to "inshore" gear components: gillnets, traps and weirs (8,000 t or 5.3% of TAC).

Under the guidelines of the 10-Year (1983) Management Plan and the companion 1990-91 annual plan, individual vessel quotas were allocated to all purse seiners as a percentage of the total TAC and included fishery area, season and vessel class designations (Appendix). As in the previous year, the 1990-91 plan allowed for a maximum catch of 10,000 t in the upper Bay of Fundy (Scots Bay) as part of the 4X summer purse seine fishery, and placed a continuous 18 day closure beginning August 15, 1991 on the Trinity Ledge spawning grounds.

As in previous years, potential catches from the New Brunswick "fixed gears" fisheries (weirs and shutoffs) were excluded from the TAC under the annual plan on the grounds that they target primarily juveniles presumed to be non-4WX stock herring originating from the Gulf of Maine. The historical summaries of TACs, stock and non-stock catch totals are presented in Table 5.

DESCRIPTION OF THE FISHERIES

4WX STOCK FISHERIES

4W Chedabucto Bay Winter Purse Seine Fishery

The 1990-91 management plan allowed a fishery of up to 28,470 t (29.8% of the 4X summer purse seine fishery quota) on herring overwintering grounds around Chedabucto Bay between November 1, 1990 and March 1, 1991 (Appendix). A total of 17,878 t (19.1% of total reported purse seine landings for the 1990-91 season) was taken in this fishery (see also Tables 2 and 5). This catch is a 115% increase over the same fishery in 1989-90, and represents the largest catch there since 1981 (Table 5). It is presumed to be due to a combination of increased domestic market demand and an over-the-side sales (OSS) program of approximately 5,000 t (Table 3).

This fishery has traditionally been limited by markets. In recent years, the allocation has been set at approximately 30% of the 4X summer purse seine fishery and fished primarily by "mobile class B and C" vessels (Appendix). The difference between the allocation and the actual catch is transferable to the 4X summer purse seine fishery exploited as well by the 24 vessels from class A "non-mobile".

Log records indicate that fish were readily available and that catch rates were high in this fishery (see Purse Seine Logbooks section). The 1991 and 1992 winter acoustic surveys documented the aggregations of herring in the Chedabucto Bay area (Buerkle 1992).

4Xs Bay of Fundy Fall and Winter Purse Seine Fishery

The management plan divides the 4Xs fishery, executed primarily off Grand Manan and the southwestern New Brunswick shore, into fall (October 15, 1990 to December 31, 1990) and winter (January 1, 1991 to February 28 1991) segments. The fall fishery (the opening fishery of the 1990-91 season) was assigned a quota of 9,000 t (6% of TAC) as in previous years. The winter fishery had a quota of 6,000 t (4% of TAC) as for the 1989-90 plan which was double that of previous years. Total reported landings from the combined fall (1,710 t) and winter (314 t) 4Xs fisheries amounted to 2,024 t. These are the lowest reported landings in this fishery since 1981-82 and are comparable to the 1982-83 landings (Tables 2 and 5). The decrease reflects an apparent reduction in the availability of large, overwintering fish in the area (recent years have had unusually high availability), the high volumes taken in Chedabucto Bay, and seiners exercising transfer rights to the summer fishery for roe.

The single midwater trawler with quota which is usually active from January 1 to March 31 was not operational due to a fire.

4Xqr Southwest Nova Scotia and Bay of Fundy Summer Fisheries

a) Purse Seines

The management plan allocated the largest of the purse seine allocations (95,618 t or 63% of TAC, plus unused quota from the winter fisheries) to the 4Xqr summer fishery for the exploitation period from April 1, 1991 to October 14, 1991. This fishery was fished by purse seiners of all classes (40 vessels) and marks the end of the 1990-91 season (October 14, 1991).

Since the beginning of the 10-Year (1983) Management Plan, this fishery has exploited herring spawning aggregations in 4Xqr (including most notably Trinity Ledge, German Bank, and Seal Island grounds) for the valuable roe herring export market to Japan. The 1991 fishery was similar in spatial distribution within 4Xqr to previous years and is documented by logbook reports (see section on Purse Seine Logbooks).

Reported landings in this fishery were 73,619 or 78.7% of total purse seine landings reported for the 1990-91 season. But it is in this fishery that misreporting has been most apparent (see section on Catch Statistics).

The 4X summer purse seine fishery also included a suballocation of 10,000 t (14% of the total purse seine allocation for 1990-91) in the upper Bay of Fundy at Scots Bay. This fishery was reopened in 1987 after a closure of about 5 yr (Stephenson and Power, 1989) as a controlled roe fishery which included roe testing prior to the opening of the fishery to verify the roe yield of the spawning aggregation. In recent years, however, the fishery has been opened by date only and has been utilized for other markets besides roe. In 1991, the fishery opened on July 21, but was closed for 12 days (July 23 to August 3) at the request of Industry due to poor roe condition. Landings from this portion of the summer fishery amounted to 8,750 t. This fishery tonnage is near the historical high levels estimated to have come from this fishery (Stephenson and Power, 1989).

b) Gillnets

The gillnet segment of the 4X summer fishery recorded catches of 538 t. This total is a 121% increase over the previous year's catch of 243 t, but nevertheless one of the lowest landings on record since 1963 in this fishery (Tables 2 and 5). The result is consistent with the landings reduction trend in this fishery since 1985 primarily due to reduced effort on the part of licensed gillnet vessels stemming from an absence of markets for gillnet caught herring.

c) Weirs

Nova Scotia weirs recorded landings of 1,498 t, the lowest level of catch in this fishery since the 1982-83 season (Tables 2 and 5). This is thought to have been the result of reduced markets (including no OSS) and decreased availability of fish (fish stayed offshore).

4WX NON-STOCK FISHERIES

4Xs New Brunswick Weir and Shutoff Fishery

The New Brunswick weir and shutoff fisheries recorded landings of 23,713 t and 863 t respectively, for a combined total of 24,576 t - the lowest since the 1984 season. This marks a return to landing levels seen in 1985 to 1987 after the 25-yr high (38,788 t) experienced in 1989 (Tables 2 and 5). As in recent years, weirs from Grand Manan Island dominated, but considerable landings were made from "inner" weirs situated especially around Deer Island and the Wolves Islands. Major storms that occurred along the eastern seaboard were responsible for considerable damage to these fixed gear fisheries in 1991 and are a primary cause of the landings shortfall compared with previous years in this fishery. An OSS program was cut short due to storm damage with less than 2,000 t landed.

CATCH STATISTICS

Reported landings for the 1991 fisheries (DFO, Scotia-Fundy Region, Statistics Div. records) are listed by month and gear segment in Table 2, and the amounts reported for domestic and OSS markets are recorded in Table 3. Statistics for recent years were shown previously to be underestimates (Stephenson et al 1991) and precluded an analytical assessment in 1991.

As proposed during the last assessment an attempt was made to determine actual landings since 1984 (when a previous correction was made, Mace 1985; Stephenson et al 1985) through a combination of three initiatives:

- i) Interviews with purse seine captains to determine individual vessel landings over the past 7 yr.
- ii) Back calculation from production using Departmental records and updated conversion factors with industry guidance on the amount of "reprocessing" of roe carcasses which typically are used for fish meal.
- iii) A processor survey to determine the amount of fish received over the past 7 yr.

It was hoped that two or preferably all three of these could be undertaken so that the results could be compared. The first two initiatives were completed and the processor survey is ongoing.

PURSE SEINER SURVEY

Purse seiner interviews resulted in revised data for 25 to 36 vessels active in each of the past 7 yr. Most of the responses were based on estimates from records of fish sold ("stocked"), and resulted in confident statements from captains/owners about actual landings. Some, however, were from even more detailed records of fish caught per night and a few were only rough estimates. Survey estimates for each year were compared with Statistics Division totals for the same vessels for that year to calculate a ratio (survey/Stats), which was applied to the Statistics total for the year to estimate revised landings:

Year	# Vessels responding	Ratio (revised/stats)
1985	25	1.34
1986	32	1.88
1987	33	1.49
1988	34	1.46
1989	34	1.61
1990	36	1.67
1991	35	1.49

Revised purse seine landings, when added to landings for other gear, indicate landings 1.2 to 1.8 (stock landings) and 1.2 to 1.6 (entire 4WX landings) times those recorded by the Department (Table 6, 7 and Fig. 2). They also indicate that the quota has been exceeded in five of the past 7 yr:

Year	Revised stock (000's t)	Reported stock (000's t)	Revised/reported ratio
1985	134.6	112.4	1.20
1986	134.3	73.7	1.82
1987	145.9	101.2	1.44
1988	176.8	124.7	1.42
1989	136.5	84.5	1.62
1990	166.8	101.9	1.64
1991	140.1	97.0	1.44

BACK CALCULATION FROM PRODUCTION

Back-calculation of round weight from production was based upon conversion factors obtained from Industry applied to production records kept by DFO Statistics Division. These estimates of herring utilized by domestic processors were added to totals sold in OSS programs and corrected for fish transported into and out of the region to obtain estimates of round herring landed for processing. The estimate from production supports the revised estimate of landings from the purse seiner survey; both are considerably higher than nominal statistics:

Year	Reported 4WX (000's t)	Revised 4WX (000's t)	Estimate from product (000's t)
1985	141.9	164.1	196.5
1986	101.8	162.5	138.2
1987	130.2	174.2	185.4
1988	159.9	218.7	246.8
1989	129.4	191.2	156.6
1990	141.4	206.3	222.4
1991	121.6	176.1	162.0

Prior to accepting the estimates from production, it is considered desirable to interview processors to determine the validity of and the possible impact of annual variability in conversion factors. In addition, it is anticipated that the results of the processor survey of fish acquired may be forthcoming. Pending refinement of the production estimates and the processor survey, it is proposed that the Revised (survey) estimate be considered the best estimate of landings.

The historical series of TAC's, 4WX stock reported, adjusted 4WX stock landings and total 4WX landings are as shown in Table 7.

ASSESSMENT DATA

STOCK COMPONENTS

As in previous assessments (e.g. Sinclair and Iles 1981; Stephenson et al. 1987), the 4WX fishery was divided into "stock" and "non-stock" components (Table 2). Stock fish were considered to belong primarily to the major SW Nova Scotia spawning groups, but this assessment unit also encompasses smaller local stocks (e.g. Grand Manan, Scots Bay). The non-stock component for the last decade has been comprised of:

- 4Xs N.B. weirs - considered to be migrants from Division 5Y stocks
- 4Xs N.B. shutoffs - same argument as for N.B. weirs
- 4X miscellaneous - small localized Nova Scotia south shore stocks caught in 4Xm gillnet, 4Xm trap and by-catches in other fisheries
- 4W miscellaneous - 4W fish taken in gear other than purse seine, on the assumption that the fish are from local stocks.

In previous assessments (since 1978) 4W and 4X miscellaneous catches have been small (< 2.5% of stock catch). In 1991 foreign vessels, which would normally be included as misc., landed a significant amount (1149 t or 1.5% of stock catch) in a Foreign Charter Vessel

Domestic Quota Catch fishery. These fish are considered to be stock fish and a decision was made to include this as well as all other miscellaneous catches in the stock catch at age.

In recent years, increasing amounts of herring have been taken from the N.B. weir fishery (Grand Manan) and sold to foreign factory ships in an OSS program. These are generally larger fish than have been taken historically by the weir fishery for domestic processing. The exclusion of weir fish from the stock was on the basis that they were predominantly juveniles from other stocks, which were known to migrate along the coast of Maine into the area. There has been debate regarding the validity of this assumption, and the presence of large fish which were resident in the area throughout much of the year raises further questions of stock structure.

During the last assessment it was proposed that the large fish sold to OSS vessels should be included in the stock landings for the assessment. We propose that the (small amounts of) large fish taken in weirs prior to the OSS market should also be considered to have been of 4WX stock origin, and that a revised stock catch matrix which includes NB weir landings of fish older than 3 yr of age should be evaluated. This will be incorporated into the final catch revision for the next assessment.

As in previous assessments, those segments of the fishery which span the winter months (4W and 4Xs purse seine), are considered on a quota year basis (Oct. 15, 1990-Oct. 14, 1991). All other segments are considered for the calendar year 1991.

BIOLOGICAL SAMPLING

As in previous years, sampling of commercial catches was stratified by area, gear segment and month (Hunt 1987) by:

- 1) obtaining as many length frequencies from individual catches as practical during routine port sampling in N.B. and N.S. and by observers on foreign vessels; and
- 2) collection of stratified "detail" samples (two fish per half cm size-class above 24 cm; one per half cm size-class at 24 cm and less) to a level of at least 200 fish per area, gear and month.

Sampling in 1991 resulted in 577 length frequencies and 9,671 fish analyzed in detail (including ages). The spatial distribution of sampling is shown in Fig. 3.

Biological samples were matched to landings by gear component on a monthly basis as in previous assessments (Table 8). Numbers at age from commercial catches were generated on the St. Andrews VAX-6210 in the traditional manner, using programs HERNLWO2 and HERNAGO9. For all gear components, length frequency samples were applied on a monthly basis. Separate keys were applied for OSS and domestic markets because of the differences in fish size.

As in the past, a correction of 2% was applied to length measurements to account for shrinkage due to freezing. This is within the range of values observed in several studies in the Scotia-Fundy and Gulf Regions (Hunt et al. 1986).

CATCH AT AGE

The age composition of landings in stock and non-stock segments of the 1991 fishery and the proportion by age for each fishery (based on reported, unadjusted landings) are presented in Tables 9 and 10 and in Fig. 4. The 1987 year-class (age 4) was dominant in major stock fisheries in number (23%) and weight (20%), but the 1983 year-class was still strong at age 8 contributing 16% by weight (Table 9). Age 2 fish again dominated the non-stock fisheries on the New Brunswick side of the Bay of Fundy in number (78%) and weight (50%) (Table 10).

The historical series of catch at age in number and weight for 4WX herring which was compiled by Sinclair and Iles (1981) has been extended with the reported (unadjusted) landings for 1991 (Table 11, 12).

LENGTH AND WEIGHT AT AGE

Average weight and length at age has been calculated by gear segment in Table 13. Recent assessments (e.g. Stephenson and Power 1988, 1989; Stephenson et al. 1990b, 1991) have used fishery weighted, weights at age (mean for stock fish weighted by gear) and this series has been extended in Table 14.

PURSE SEINE LOGBOOKS

The detailed purse seine logbook introduced in 1985 (Power and Stephenson 1986, 1987, 1991) was used for the seventh consecutive year. Coverage was again high (98 % of Statistics Division landings for summer fishery) as logbook submission remained a condition of license, and information was of good quality as in previous years. The 1991 logbook information was used to document various aspects of the Div. 4WX purse seine fishery, including the distribution of effort and catches by fishing grounds and areas (Figs 5-9). Table 15 shows the importance of various fishing grounds. In 1991 there was a substantial increase on German Bank (approximately double the effort and catch over 1990), with a corresponding decrease in the importance of Seal Island and Long Island areas. There was a moderate increase in the catch with the same effort on Trinity Ledge, outside of the 18 day closure.

Table 16 lists the incidence of comments and anecdotal information. The comment "lots of small fish", which appeared for the first time in 1990 (22 reports), appeared 36 times in 1991 and is thought to reflect relatively strong recruiting year-classes. An increase in comments about "feed" is thought to reflect the concern over markets. There was an increase in comments "small bunches" and "fish thinned out", but a decrease in incidence in the comments relating to large areas of fish. Table 17 summarizes comments about releases. There were about the same number of release comments in 1991 as in 1990, but less information was provided on the tonnages involved.

RESEARCH SURVEY DATA

a) Larval Abundance

The 1991 larval herring survey was undertaken with sampling between Nov. 2 and Nov. 13 (E.E. PRINCE, Cruise P422). All 79 of the traditional larval abundance index stations were sampled (Fig. 10). The 1991 index (50.3 m⁻²) is higher than the 1990 value and the third highest in the 20-yr series (Table 18, Fig 11).

b) Acoustic Surveys

Buerkle (1992) presents results of the 1992 winter herring acoustic survey in Chedabucto Bay as well as results of experimental 1991 summer surveys of individual spawning grounds.

i) Chedabucto Bay

Annual winter acoustic surveys have documented large aggregations of herring in Chedabucto Bay since 1984, and the acoustic abundances have corresponded to large proportions of the total 4WX herring stock as estimated by analytical assessments. The timing of the surveys to coincide with the period of peak herring aggregation is of critical importance and, in response to observations over the years of herring leaving the Bay earlier, the survey starting dates have advanced from mid-January to early January. The January 1991 survey found only a small fraction of the herring abundance of previous years. Reports from seiners indicated that there had been many more herring in the area during December and it was concluded that the January survey missed the period of major herring aggregation.

For the 1991-92 winter season the survey effort was increased and included a December survey and a January survey. The December survey estimate was 55,000 t and the January survey estimate was 3,000 t. These estimates are a small fraction of the abundance estimates prior to 1991 and show that herring did not aggregate in Chedabucto Bay in large numbers during either survey period. It was concluded that these acoustic estimates are not indicative of stock abundance because of changes in availability of herring to the survey. The winter survey in 1992-93 will attempt to survey other areas of herring aggregation by locating and then surveying areas of whale aggregation. The aim is to work towards a survey of all or at least a constant proportion of overwintering aggregations.

ii) Experimental Summer Surveys

Acoustic research effort was also increased by two experimental surveys on spawning herring in the Bay of Fundy summer fishery. These were experiments in survey technique, aimed at determining whether acoustic abundance estimates could be improved in areas of commercial fishing using the purse seine fleet activity as a "pre-survey". These surveys were also considered potentially valuable in that if successful they would provide information on the relative size of various spawning aggregations. The first survey was of the Upper Bay of Fundy (Scots Bay) and, unfortunately, coincided with an unscheduled closure of that roe fishery. This survey found only one small concentration of herring in 650 nautical miles of transects. The concentration was mobile and could not be properly quantified.

The second survey was on German Bank where the fleet was active. The strategy was to observe seiners by radar as they found herring, then define a survey which covered the area of major fishing effort. This was done by placing an appropriately sized overlay which best suited boat distribution onto the radar screen, designating random survey lines, followed by relatively rapid (a few hours) survey through the fleet. Eight such surveys were completed. The results showed a very high variability among estimates. Such summer surveys would require intensive effort in that they would have to cover more spawning areas to be of use in determining the relative sizes of spawning aggregations and would have to cover a longer period of spawning to form the basis for an abundance index. There is no plan to undertake summer surveys in 1992.

c) Bottom trawl survey index

The summer bottom trawl survey of the Scotian shelf and Bay of Fundy has reflected the general increase in population size observed through the 1980's, and has been proposed as an abundance index (Stephenson et al 1990a, 1990b, 1991). A similar (stratified random) spring bottom trawl survey index has been used to tune recent U.S. assessments for the Gulf of Maine (Fogarty et al 1990, NFSC 1992).

The 1991 survey results indicate a slight increase over 1990 - consistent with the larval abundance index (Table 19, Fig 11,12).

STOCK STATUS AND ADVICE

Under-reporting precluded an analytical assessment last year. The revised catch estimates will allow an analytical assessment to be attempted but, at this point, an analytical assessment is premature. The catch revision is preliminary, and should be further evaluated by members of the Department and Industry. In addition, it is still hoped that the third part of the revision (data from processors) will be forthcoming. Finally, the structure of an analytical assessment will require thorough evaluation.

Preliminary reconstruction of the catch record (since 1985) indicates that landings have been considerably higher than reported with stock landings estimated to have been 134,000 to 176,000 t. An analytical assessment will be attempted when the catch reconstruction is completed. Abundance indices (larvae and bottom trawl surveys) were higher in 1991 than in 1990. In that the larval abundance index is considered to be a valid index of abundance, it indicates that the stock is at above average abundance. The 1987 year-class has now replaced the 1983 year-class in dominance and there is logbook evidence of potential strength in more recent year-classes. A fishery at the level that it has been in recent years is acceptable (i.e. not likely to be detrimental to the stock). This is the same conclusion reached during the last assessment which referred to recent RECORDED landings.

Recent events in this fishery demonstrate the importance of improved statistical monitoring. This is one of the few cases where the degree of discrepancy between official statistics and actual landings has been documented. The problems caused for this assessment by the under-reporting which has occurred under the current monitoring system is emphasized.

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Table 1. Landings (t; calendar year totals) by gear type in NAFO Div. 4WX herring fisheries, 1985-91.

Gear	1985	1986	1987	1988	1989	1990	1991
Purse seine	101337	67918	91625	14750	80154	96566	88838
Weirs	30786	29470	33408	40072	46783	42273	25211
Gillnet	5584	4318	2919	1151	382	457	776
Traps	1304	296	440	1284	123	183	60
Shutoffs	1139	371	698	867	637	554	863
Midwater trawl	98	28	17	423	783	871	1154
Miscellaneous	1612	103	74	1329	552	501	1
Total	141860	102504	129181	159876	129414	141405	116903

Table 2. 1990-1991 reported monthly 4VWX herring landings (t) by major fishery.
(Source: DFO Scotia-Fundy Region Statistics Division.)

4WX Stock Fisheries	1990			1991									15 mo. Totals	Quota Totals*	1990-1991 Plan Quota			
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept				Oct	Nov	Dec
1. 4W Winter Purse Seine Note 1		10327	4461	2780	310									9007	1797	28682	17878	28470
2. 4Xs Fall Purse Seine Note 2	530	625	554										636	375		2721	1710	9000
3. 4Xs Winter Purse Seine Note 3				314												314	314	6000
4. 4Xqr Summer Purse Seine Note 4	7672							269	9896	19490	15248	22555	6170			81291	73619	98218
5. 4X Midwater Trawl								2			1	1		1		5	5	1512
4X Summer Gillnet							3	17	44	209	143	116				538	538	
4Xr Summer (N.S.) Weir	46						3	23	149	719	342	262	5		1	1544	1498	
4X Trap									12	21	19	5				57	57	
4X Misc. Gears	44	1								1						46	1	
4W Gillnet			6				72	57	25	42	32	5	5			244	238	
4W Misc. Gears (Trap)											1	1	1			3	3	
4WX Russian/Cuban/Domestic OTB									244	63	660	15		167		1149	1149	
6. 4WX Gillnet, Trap, Weir, Misc Note 5	90	1	6				78	97	474	1055	1197	404	11	167	1	3581	3484	8000
Stock Totals	8292	10954	5021	3094	310		78	366	10362	20545	16446	22961	6817	9550	1798	116594	97010	151200
4WX Non-Stock Fisheries																		
1. 4X (N.B.) Weir	7306	168						57	180	4649	10319	6392	2023	93		31187	23713	
2. 4X (N.B.) Shutoff	56	8								122	129	391	192	29		927	863	
Non-Stock Totals	7362	176					57	180	4771	10448	6783	6783	2215	122		32114	24576	
Total 4WX Landings	15654	11130	5021	3094	310		78	423	10542	25316	26894	29744	9032	9672	1798	148708	121586	
4Vn Fisheries																		
1. 4Vn Winter Purse Seine Note 1		4712												4600		9312	4712	4600
2. 4Vn Gillnet							13	7								20	20	
3. 4Vn Traps and Misc Gear							84	76	1							161	161	
4Vn Totals		4712					13	91	76	1				4600		9493	4893	4600
Total 4VWX Landings	15654	15842	5021	3094	310		91	514	10618	25317	26894	29744	9032	14272	1798	158201	126479	

* Reported landings against the annual plan quotas (shaded blocks) correspond to catches made in the seasonal periods (Notes 1-5).

** Non-Stock totals are for the calendar year January 1, 1991 to December 31, 1991.

NOTES

- | | |
|--|---|
| 1. Quota period is November 1, 1990 to March 1, 1991 | 4. Quota period is April 1, 1991 to October 14, 1991 |
| 2. Quota period is October 15, 1990 to December 31, 1990 | 5. Inshore/Fixed and Miscellaneous Gear allocation is for the calendar year 1991. |
| 3. Quota period is January 1, 1991 to February 28, 1991 | |

Table 3. Monthly landings (t) to domestic (Canadian) and OSS (foreign over-the-side sales) markets for gear components involved in the 1991 OSS program.

Area 4VWX	Month	1990		1990 Totals	1991							1991 Totals	
		11	12		5	6	7	8	9	10	11		12
4X N.S. P.Seine Total					269	9886	19490	15248	22556	6170			73619
4X N.S. P.Seine OSS						4255	10143	3709	425				18532
4X N.S. P.Seine Domestic					269	5631	9347	11539	22131	6170			55087
N.B. Weirs Total		168		168	57	180	4649	10319	6392	2023	93		23713
N.B. Weirs OSS		0		0			97	1786					1883
N.B. Weirs Domestic		168		168	57	180	4552	8533	6392	2023	93		21830
4W P.Seine Fall Total		10327	4461	14788							9007	1797	10804
4W P.Seine Fall OSS		7041	3086	10127							210		210
4W P.Seine Fall Domestic		3286	1375	4661							8797	1797	10594
4Vn P.Seine Total		4712		4712							4600		4600
4Vn P.Seine OSS		3928		3928							273		273
4Vn P.Seine Domestic		784		784							4327		4327
4WX Gear Totals		10495	4461	14956	326	10066	24139	25567	28948	8193	9100	1797	108136
4WX OSS Totals		7041	3086	10127		4255	10240	5495	425		210		20625
4WX Domestic Totals		3454	1375	4829	326	5811	13899	20072	28523	8193	8890	1797	87511

Table 4. Market components of the 4X summer purse seine fishery 1988-91 from logbook analysis (Power and Stephenson, unpubl. data).

Market	1988		1989		1990		1991	
	Landings t (logged t)	%	Landings t (logged t)	%	Landings t (logged t)	%	Landings t (logged t)	%
Roe	32,509	38	13,268	21	31,523	43	29,960	42
Adult shore	29,361 ¹	34	24,201	39	25,941	35	21,664	30
Over-the-side	21,755	25	19,190	31	13,387	18	13,548	19
Bait	449	1	1,950	3	855	1	2,128	3
Fillet	410	1	805	1	50	0	924	1
Sardine ²	99	0	57	0	308	0	1,744	2
U.S. buyers	23	0	64	0	57	0	104	0
Unspecified	1,135	1	2,422	4	125	0	1,198	2

¹Includes a considerable amount of fish which actually went to the roe market.

²Sardine market was supplied predominantly by weirs and purse seine landings in other seasons.

Table 5. Historical series of annual landings (t) for major components of the 4WX herring fishery (1963-90 from Stephenson et al. 1991).

Year [^]	Stock Fisheries - Nominal Landings						4WX Stock Nominal Landings	4WX Stock Adjusted Landings**	4WX Stock TAC	Non-Stock 4Xs Weir and Shutoff	Total 4WX Adjusted Landings
	4W Winter Purse seine	4Xs Fall&Winter Purse seine	4Xqr Summer Purse seine	4X Summer Gillnet	4Xr Summer Weir	4WX Other*					
1963		6871	15093	2955	5345		30264			29366	29366
1964			15991	24894	4053	12458	57396			29432	29432
1965			15755	54527	4091	12021	86394	86394		3346	89740
1966			25645	112457	4413	7711	150226	150226		35805	186031
1967			20888	117382	5398	12475	156143	156741		30032	186773
1968			42223	133267	5884	12571	193945	196362		33145	229507
1969	25112	13202	84525	3474	10744		137057	150462		26539	177001
1970	27107	14749	74849	5019	11706		133430	190382		15840	206222
1971	52535	4868	35071	4607	8081		105162	129101		12660	141761
1972	25656	32174	61158	3789	6766		129543	153449		32699	186148
1973	8348	27322	36618	5205	12492		89985	122687		19935	142622
1974	27044	10563	76859	4285	6436		125187	149670		20602	170272
1975	27030	1152	79605	4995	7404		120186	143897		30819	174716
1976	37196	746	58395	8322	5959		110618	115178		29206	144384
1977	23251	1236	68538	18523	5213		116761	117171	109000	23487	140658
1978	17274	6519	57973	6059	8057		95882	114000	110000	38842	152842
1979	14073	3839	25265	4363	9307		56847	77500	99000	37828	115328
1980	8958	1443	44986	19804	2383		77574	107000	65000	13525	120525
1981	18588	1368	53799	11985	1966		87706	137000	100000	19080	156080
1982	12275	103	64344	6799	1212		84733	105800	80200	25963	131763
1983	8226	2157	63379	8762	918		83442	117400	82000	11383	128783
1984	6336	5683	58354	4490	2684		77547	135900	80000	8698	144598
1985	8751	5419	87167	5584	4062		110983	134600	125000	27863	162463
1986	8414	3365	56139	3533	1958		73409	134300	97600	27883	162183
1987	8780	5139	77706	2289	6786		100700	145900	126500	27320	173220
1988	8503	7876	98371	695	7518		122963	176800	151200	33421	210221
1989	6169	5896	68089	95	3308		83557	136500	151200	44112	180612
1990	8316	10705	77545	243	4049	1769	102627	166800	151200	38778	205578
1991	17878	2024	73619	538	1498	1453	97010	140100	151200	24576	164676
1992									?		

[^]Annual landings by purse seiners are defined for the annual plan period from October 15 of the preceding year to October 14 of the current year.

All landings by other gear are for the calendar year.

* Includes 4Xs stock catches taken by single midwater trawl, and 4WX stock catches by gillnets and traps, by foreign trawlers, and by miscellaneous gears.

** Adjusted totals includes misreporting adjustments for 1978-1984 (Mace 1985), and purse seine catch revisions for 1985-1991 (Stephenson 1992).

Table 6. Influence of the revised purse seine figures on 4WX "stock" and total landings data ('000 t).

Year	Stock			Total		
	Revised	Nominal	<u>Revised</u> <u>Nominal</u>	Revised	Nominal	<u>Revised</u> <u>Nominal</u>
1985	134.6	112.4	1.20	164.1	141.9	1.16
1986	134.3	73.7	1.82	162.5	101.8	1.60
1987	145.9	101.2	1.44	174.2	130.2	1.34
1988	176.8	124.7	1.42	218.7	159.9	1.37
1989	136.5	84.5	1.62	191.2	129.4	1.48
1990	166.8	101.9	1.64	206.3	141.4	1.46
1991	140.1	97.0	1.44	176.1	121.6	1.45

Table 7. TAC, reported stock, adjusted stock and total 4WX (stock + non-stock) landings ('000 t).

	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
TAC	-	-	-	-	109.0	110.0	99.9	65.0 ¹	100.0	80.2	82.0	80.0	125.0	97.6 ²	126.5	151.2	151.2	151.2	151.2
Reported stock ³ 4WX catch	122.7	149.7	143.9	115.2	117.1	95.9	59.0	79.6	87.7	84.7	84.4	78.1	112.4	73.7	101.2	124.6	84.5	101.9	97.0
Adjusted stock ⁴ 4WX catch						114.0	77.5	107.0	137.0	105.8	117.4	135.9	134.6	134.3	145.9	176.8	136.5	166.8	140.1
Reported total 4WX catch	142.6	170.3	174.7	143.9	150.7	134.7	96.2	93.2	106.8	110.7	94.1	88.7	141.9	101.8	130.2	159.9	129.4	141.4	121.6

¹TAC raised from 60.0 t to 65.0 t in mid-season.

²Excludes an allowance of 13,000 t for inshore 4Xn fixed gear.

³Excludes 4Xb weir + shutoff, 4Xn gill + trap, 4W inshore gear.

⁴Includes 1978-1984 adjustment for misreporting and omissions (from Mace 1985) and 1985-91 catch revisions (this document).

Table 8. Distribution of biological samples from the 1991 4WX herring commercial fishery by area, gear component and month.

Area Year	Gear Component Month Market	Catch ('000 t)	L.F. Samples	L.F. Fish	Detail Samples	Detail Fish	Catch Per Detail Fish	Catch Per L.F. Sample			
4W	Purse Seine, Chedabucto Bay										
1990	Nov. DOM	7041	11	2350	7	9	322	395	17.8	640.1	
	Nov. OSS	3286	40	10362	2	9	73	395	8.3	82.2	
	Dec. DOM	3086	7	1771	5	12	263	553	5.6	440.9	
	Dec. OSS	1375	13	2937	7	12	290	553	2.5	105.8	
1991	Jan. DOM	2780	14	3157	6		308		9.0	198.6	
	Feb. DOM	310	5	1272	4		184		1.7	62.0	
	Nov. DOM	8797	24	4187	14		651		13.5	366.5	
	Nov. OSS	210	1	309	0			651	0.3	210.0	
	Dec. DOM	1797	4	888	4		199		9.0	449.3	
4Xqr	Purse Seine, Nova Scotia										
1991	May Jun. DOM	5900	24	5449	17	31	586	1139	5.2	245.8	
	Jun. OSS	4255	76	12423	14	31	553	1139	3.7	56.0	
	Jul. DOM	9347	29	5304	21	41	761	1519	6.2	322.3	
	Jul. OSS	10143	118	21505	20	41	758	1519	6.7	86.0	
	Aug. DOM	11539	14	2734	12	22	570	1015	11.4	824.2	
	Aug. OSS	3709	41	6597	10	22	445	1015	3.7	90.5	
	Sept. DOM	22131	8	1584	8	9	405	436	50.8	2766.4	
	Sept. OSS	425	3	424	1	9	31	436	1.0	141.7	
	Oct. DOM	6170	4	735	20		717		8.6	1542.5	
4Xs	Purse Seine, New Brunswick										
1990	Oct.	530	4	1147	3	8	129	381	1.4	132.5	
	Nov.	626	9	2541	5		252		2.5	69.6	
	Dec.	554	8	1997	6		278		2.0	69.3	
1991	Jan.	314	4	947	4		134		2.3	78.5	
	Oct/Nov.	1011	19	4537	16		565		1.8	53.2	
4Xr	Weir, Nova Scotia										
1991	Apr/May/June	175	6	1152	5		242		0.7	29.2	
	Jul.	719	12	2864	10		349		2.1	59.9	
	Aug/Sept	604	7	1438	5		157		3.8	86.3	
4Xs	Weir, New Brunswick										
1991	May	57	5	1224	5	11	69	197	0.3	11.4	
	Jun.	180	8	2185	6		128		1.4	22.5	
	Jul. DOM	4552	34	6975	14	16	414		11.0	133.9	
	Jul. OSS	97	1	196	2	16		414	0.2	97.0	
	Aug. DOM	8533	30	6013	16		398	516	16.5	284.4	
	Aug. OSS	1786	20	6242		16	118	516	3.5	89.3	
	Sept. DOM	6392	25	5881	20		529		12.1	255.7	
	Oct/Nov.	2116	17	3647	12		225		9.4	124.5	
4Xs	Shutoff, New Brunswick										
1991	Jul./Aug.	251	2	369	34		965		0.3	125.5	
	Sept.	391	6	1286	26		614		0.6	65.2	
	Oct/Nov.	221	3	668	14		256		0.9	73.7	
4WX	Misc.										
1991	Apr.-June.	476	<Key created from "All Gears" for Apr.-June>								
	Jul.	336	<Key created from "All Gears" for July>								
	Aug.	856	<Key created from "All Gears" for Aug.>								
	Sept.	143	<Key created from "All Gears" for Sept.>								
	Oct./Nov.	180	<Key created from "All Gears" for Oct./Nov.>								

Table 9. Catches by age in numbers (thousands) and weight (t) for stock gear components of the 1991 4WX herring fishery.

Catch Nos.	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11 +	Total
4W Purse Seine	0	546	8,940	19,367	16,048	9,136	10,396	17,922	9,114	3,203	3,607	98,279
4X N.S. P.Seine	0	53,495	112,098	106,157	43,814	18,616	24,204	36,916	22,317	9,637	6,019	433,273
4X N.B. P.Seine	0	41	4,010	2,748	2,427	1,426	1,051	2,238	644	127	37	14,749
4X N.S. Weirs	0	14,515	2,018	1,530	548	232	334	557	418	97	23	20,272
4WX Misc.	0	1,722	3,087	3,385	1,296	580	552	917	517	201	122	12,379
Total Nos. by Age	0	70,319	130,153	133,187	64,133	29,990	36,537	58,550	33,010	13,265	9,808	578,952

% Numbers	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11 +	Total
4W Purse Seine	0	1	9	20	16	9	11	18	9	3	4	100
4X N.S. P.Seine	0	12	26	25	10	4	6	9	5	2	1	100
4X N.B. P.Seine	0	0	27	19	16	10	7	15	4	1	0	100
4X N.S. Weirs	0	72	10	8	3	1	2	3	2	0	0	100
4WX Misc.	0	14	25	27	10	5	4	7	4	2	1	100
Overall % Nos. by Age	0	12	22	23	11	5	6	10	6	2	2	100

Catch Weight (t.)	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11 +	Total
4W Purse Seine	0	17	653	2,284	2,538	1,662	2,212	4,190	2,319	883	1,120	17,878
4X N.S. P.Seine	0	2,757	11,699	16,277	8,694	4,402	6,498	10,713	7,241	3,260	2,079	73,619
4X N.B. P.Seine	0	0	212	277	366	263	219	492	150	33	11	2,023
4X N.S. Weirs	0	519	170	231	103	53	87	162	132	33	8	1,498
4WX Misc.	0	82	327	514	253	134	146	262	164	67	42	1,991
Totals Catch t. by Age	0	3,376	13,061	19,581	11,953	6,514	9,162	15,819	10,005	4,276	3,260	97,009

% Catch Weight (t.)	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11 +	Total
4W Purse Seine	0	0	4	13	14	9	12	23	13	5	6	100
4X N.S. P.Seine	0	4	16	22	12	6	9	15	10	4	3	100
4X N.B. P.Seine	0	0	10	14	18	13	11	24	7	2	1	100
4X N.S. Weirs	0	35	11	15	7	4	6	11	9	2	1	100
4WX Misc.	0	4	16	26	13	7	7	13	8	3	2	100
Overall % by Age	0	3	13	20	12	7	9	16	10	4	3	100

Table 10. Catches by age in numbers ('000) and weight (t) for non-stock gear components of the 1991 4WX herring fishery.

Catch Nos.('000s)	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11+	Total
4X N.B. Weirs	4,086	314,871	44,038	23,611	9,532	3,154	2,620	3,436	1,461	267	150	407,226
4X N.B. Shutoffs	1,444	23,392	412	7	0	0	0	0	0	0	0	25,255
Total Nos. by Age	5,530	338,263	44,450	23,618	9,532	3,154	2,620	3,436	1,461	267	150	432,481

% Catch Nos.	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11+	Total
4X N.B. Weirs	1	77	11	6	2	1	1	1	0	0	0	100
4X N.B. Shutoffs	6	93	2	0	0	0	0	0	0	0	0	100
Total Nos. by Age	1	78	10	5	2	1	1	1	0	0	0	100

Catch Weight (t.)	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11+	Total
4X N.B. Weirs	60	11,483	4,113	3,394	1,828	717	669	892	420	86	50	23,712
4X N.B. Shutoffs	20	815	27	0	0	0	0	0	0	0	0	863
Total Catch t. by Age	80	12,299	4,140	3,394	1,828	717	669	892	420	86	50	24,575

% Catch Weight (t.)	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11+	Total
4X N.B. Weirs	0	48	17	14	8	3	3	4	2	0	0	100
4X N.B. Shutoffs	2	94	3	0	0	0	0	0	0	0	0	100
Totals Catch t. by Age	0	50	17	14	7	3	3	4	2	0	0	100

Table 11. 4WX herring stock catch at age in numbers (thousands).

	1965	1966	1967	1968	1969	1970	1971	1972	1973	
1	270378	154323	722208	164703	108875	699720	87570	0	754	
2	1084719	914093	613970	2389061	290329	576896	404224	649254	126421	
3	34835	448940	153626	224956	531812	76532	183896	71984	595992	
4	234383	73382	266454	83109	132319	286278	106630	148516	109530	
5	49925	321857	110051	290285	162439	201215	113566	77207	34422	
6	10592	45916	159203	73087	112631	120280	75593	75384	25562	
7	1693	13970	57948	90617	62506	111937	93620	49065	19361	
8	561	7722	4497	31977	22595	41257	50022	48700	17604	
9	54	1690	409	15441	6345	21271	36618	26055	19836	
10	37	215	296	5668	2693	7039	7536	13792	9661	
11	1	1	148	1175	722	2674	5695	11679	11120	
1+	1687178	1982109	2088810	3370079	1433266	2145099	1164970	1171636	970263	
2+	1416800	1827786	1366602	3205376	1324391	1445379	1077400	1171636	969509	
3+	332081	913693	752632	816315	1034062	868483	673176	522382	843088	
	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
1	14151	2870	240	1164	35381	311	1623	0	3589	3367
2	596153	264491	48470	140494	346719	170523	9566	75713	72591	128378
3	72381	180898	176226	28659	36177	226442	60559	33174	122380	101017
4	616622	92487	130598	192958	11338	47200	359484	68816	17756	168379
5	53199	384646	72334	106061	107627	4639	21958	306716	73025	16946
6	15254	50599	219788	55066	60431	19695	3583	21728	154542	41607
7	8120	9357	18960	150588	27286	15521	3507	1631	10910	63468
8	5313	3238	4967	12466	96741	9981	4951	1914	1535	7334
9	10964	3481	3556	2873	9838	35386	2009	1366	977	1351
10	5787	2842	1835	1253	2169	3834	8179	361	886	434
11	7359	4599	3071	3448	1499	2042	2105	1442	719	895
1+	1405303	999508	680045	695030	735206	535574	477524	512861	458910	533176
2+	1391152	996638	679805	693866	699825	535263	475901	512861	455321	529809
3+	794999	732147	631335	553372	353106	364740	466335	437148	382730	401431
	1984	1985	1986	1987	1988	1989	1990	1991		
1	0	5762	40	1398	91	6	0	0		
2	72301	138419	80019	50422	89298	77698	96902	70319		
3	141067	215599	176197	76865	68122	87092	70656	130153		
4	131251	193369	186983	320651	117398	47206	93118	133187		
5	84920	94308	36361	147483	261272	60647	48807	64133		
6	13633	27081	20180	27924	142065	129020	54856	29990		
7	13803	8989	6878	11843	25594	58535	109586	36537		
8	16299	11609	2759	4433	12762	13971	63389	58550		
9	5418	5107	1879	2043	2519	6313	17079	33010		
10	1263	767	866	1897	2285	2911	5738	13265		
11	5207	300	223	395	1712	2333	3717	9808		
1+	485162	701310	512385	645354	723118	485732	563848	578952		
2+	485162	695548	512345	643956	723027	485726	563848	578952		
3+	412861	557129	432326	593534	633729	408028	466946	508633		

Table 12. 4WX herring stock catch weight (t) at age.

	1965	1966	1967	1968	1969	1970	1971	1972	1973
1	2704	1543	7222	0	0	0	0	0	0
2	44473	37478	25173	78122	10800	18288	26719	28762	3641
3	3902	50281	17206	25195	56106	9123	26224	9905	62996
4	40314	12622	45830	12300	21475	48295	21230	28560	15696
5	10884	70165	23991	53587	33657	42376	26132	17333	7731
6	2690	11663	40438	17862	27234	30888	19170	19751	6429
7	484	3995	16573	24983	17627	32708	27403	14302	5404
8	181	2494	1453	12759	6910	13697	16447	15667	5830
9	19	598	145	5216	2117	7840	13256	8989	7139
10	14	84	115	2321	1051	2740	2922	5246	3757
11	0	0	58	481	282	1041	2208	4443	4325
1+	105666	190923	178203	232827	177260	206996	181710	152958	122948
2+	102962	189380	170981	232827	177260	206996	181710	152958	122948
3+	58489	151902	145808	154704	166460	188709	154991	124196	119307
	1974	1975	1976	1977	1978	1979	1980	1981	1982
1	0	0	0	0	0	3	16	0	36
2	28436	5501	1585	9160	9812	6991	392	3104	2976
3	7976	17059	20107	3247	4055	25362	6783	3715	13707
4	108155	16555	20778	33613	2050	8118	61831	11836	3054
5	10938	82930	16883	22665	24604	1011	4787	66864	15919
6	3659	12124	54815	15099	15627	5003	910	5519	39254
7	2251	2503	5256	44122	8243	4439	1003	466	3120
8	1711	1079	1576	4055	31944	3224	1599	618	496
9	3754	1246	1360	943	3453	12527	711	484	346
10	2037	1077	742	521	861	1491	3182	140	345
11	2590	1743	1241	1433	595	794	819	561	280
1+	171509	141816	124343	134859	101245	68964	82033	93309	79532
2+	171509	141816	124343	134859	101245	68960	82017	93309	79496
3+	143073	136315	122758	125699	91433	61969	81625	90204	76520
	1983	1984	1985	1986	1987	1988	1989	1990	1991
1	34	0	0	0	17	1	0	0	0
2	5263	2713	7313	4400	2539	1856	2531	2990	3376
3	11314	18630	25442	21781	7501	6006	6869	6482	13061
4	28961	25122	39432	34032	48975	18026	7644	14971	19581
5	3694	19418	23516	8704	29294	51108	12541	9750	11953
6	10568	3533	7536	5469	6843	34340	30699	12851	6514
7	18152	3863	2833	2102	3245	7201	16019	27929	9162
8	2369	4828	3879	907	1287	3878	4234	18206	15819
9	478	1674	1757	677	650	817	2048	5447	10005
10	169	460	337	346	664	785	1026	1928	4276
11	348	1895	132	89	138	635	850	1357	3260
1+	81351	82135	112177	78507	101153	124654	84462	101912	97009
2+	81317	82135	112177	78507	101136	124652	84462	101912	97009
3+	76053	79422	104864	74107	98597	122796	81931	98922	93633

Table 13. Average weight (g) and length (cm) at age for stock and non-stock gear components of the 1991 4WX herring fishery.

STOCK GEAR COMPONENTS											
Average Wt. at Age	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11+
4W Purse Seine	0	31	73	118	158	182	213	234	254	276	310
4X N.S. P.Seine	0	52	104	153	198	236	268	290	324	338	345
4X N.B. P.Seine	0	10	53	101	151	185	208	220	233	261	283
4X N.S. Weirs	0	36	84	151	187	230	261	292	315	341	332
4WX Misc.	0	48	106	152	195	231	264	286	316	334	348
Average for Stock Gears	0	48	100	147	186	217	251	270	303	322	332

Average Length at Age	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11+
4W Purse Seine	0.0	17.0	22.5	26.3	28.9	30.2	31.8	32.7	33.6	34.5	35.8
4X N.S. P.Seine	0.0	19.3	23.9	27.1	29.3	31.0	32.3	33.0	34.1	34.7	34.9
4X N.B. P.Seine	0.0	11.6	20.2	24.9	28.2	30.1	31.3	31.8	32.4	33.5	34.4
4X N.S. Weirs	0.0	17.1	22.4	27.0	28.9	30.8	32.0	33.1	33.7	34.8	34.5
4WX Misc.	0.0	18.7	24.2	27.0	29.2	30.8	32.1	33.0	34.0	34.6	35.3
Average for Stock Gears	0.0	18.8	23.7	26.9	29.2	30.7	32.1	32.9	34.0	34.6	35.3

NONSTOCK GEAR COMPONENTS											
Average weight	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11+
4X N.B. Weirs	15	36	93	144	192	227	255	260	287	324	331
4X N.B. Shutoffs	14	35	66	61	0	0	0	0	0	0	0
Average for nonstock	14	36	93	144	192	227	255	260	287	324	331

Average length	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11+
4X N.B. Weirs	13.2	17.3	23.4	26.8	29.2	30.8	31.8	32.1	32.9	34.1	33.5
4X N.B. Shutoffs	12.9	17.2	21.2	20.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Average for nonstock	13.1	17.3	23.3	26.8	29.2	30.8	31.8	32.1	32.9	34.1	33.5

Table 14. Average weights at age for the 4WX herring fishery (stock gear components) for 1965-91.

	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978
1	10	10	10	0	0	0	0	0	0	0	0	0	0	0
2	41	41	41	33	37	32	66	44	29	48	21	33	65	28
3	112	112	112	112	105	119	143	138	106	110	94	114	113	112
4	172	172	172	148	162	169	199	192	143	175	179	159	174	181
5	218	218	218	185	207	211	230	224	225	206	216	233	214	229
6	254	254	254	244	242	257	254	262	252	240	240	249	274	259
7	286	286	286	276	282	292	293	292	279	277	268	277	293	302
8	323	323	323	399	306	332	329	322	331	322	333	317	325	330
9	354	354	354	338	334	369	362	345	360	342	358	382	328	351
10	389	389	389	410	390	389	388	380	389	352	379	404	416	397
11	389	389	389	410	390	389	388	380	389	352	379	404	416	397
	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	
1	10	10	0	10	10	0	0	0	12	13	7	0	0	
2	41	41	41	41	41	38	53	55	50	21	33	31	48	
3	112	112	112	112	112	132	118	124	98	88	79	92	100	
4	172	172	172	172	172	191	204	182	153	154	162	161	147	
5	218	218	218	218	218	229	249	239	199	195	207	200	186	
6	254	254	254	254	254	259	278	271	245	242	238	234	217	
7	286	286	286	286	286	280	315	306	274	281	274	255	251	
8	323	323	323	323	323	296	334	329	290	304	303	287	270	
9	354	354	354	354	354	309	344	360	318	327	324	319	303	
10	389	389	389	389	389	364	440	400	350	341	353	336	322	
11	389	389	389	389	389	364	440	400	350	371	365	364	332	

Table 15. Changes in the relative importance of key fishing grounds in the 4X N.S. summer purse seine fishery.

Fishery	Grounds	Total Catch in Tons							Total Searching in Sonar Hours						
		1985	1986	1987	1988	1989	1990	1991	1985	1986	1987	1988	1989	1990	1991
4Xa	Long Island	857	3060	7309	10892	21915	18755	10139	149	292	771	827	2406	1775	1437
4Xa	Trinity	35800	13419	18851	18586	266	1113	3255	2110	1650	1700	1506	97	260	277
4Xa	Seal Island	13745	8894	11560	18947	23420	25321	13153	718	542	1086	1133	1517	2035	1042
4Xa	German Bank	15502	13346	16434	17692	8087	11744	24548	679	873	985	789	644	885	1519
4Xa	Scots Bay		36	3649	3949	6583	8925	8750		5	256	184	310	352	602
4Xa	Yankee Bank				194	196	3646	967				21	35	331	104
	Total	83323	51626	68259	88503	64206	74907	71922	5161	4517	5778	5859	5338	6097	6042
Fishery	Grounds	Percentage of Total Catch							Percentage of Total Searching						
		1985	1986	1987	1988	1989	1990	1991	1985	1986	1987	1988	1989	1990	1991
4Xa	Long Island	1	6	11	12	34	25	14	3	6	13	14	45	29	24
4Xa	Trinity	43	26	28	21	0	1	5	41	37	29	26	2	4	5
4Xa	Seal Island	16	17	17	21	36	34	18	14	12	19	19	28	33	17
4Xa	German Bank	19	26	24	20	13	16	34	13	19	17	13	12	15	25
4Xa	Scots Bay		0	5	4	10	12	12		0	4	3	6	6	10
4Xa	Yankee Bank				0	0	5	1				0	1	5	2
4Xa	Total	79	75	85	79	94	88	83	71	74	83	76	93	87	81

Table 16. Summary of comments coded from 1987 to 1991 in 4X N.S. summer purse seine fishery logbooks.

Year Comment code	Occurrence on logs									
	1987 Number of records	1988	1989	1990	1991	1987 Percent all records	1988	1989	1990	1991
Not specified	1971	1991	1319	1730	1883	82.7	75.5	68.8	77.2	72.8
Fish thinned out	50	44	21	16	39	2.1	1.7	1.1	0.7	1.5
Small bunches/schools	26	30	16	28	59	1.1	1.1	0.8	1.3	2.3
Large area of fish	194	172	144	115	90	8.1	6.5	7.5	5.1	3.5
Little or no fish	14	17	7	10	11	0.6	0.6	0.4	0.4	0.4
Poor bottom	15	13	3	6	10	0.6	0.5	0.2	0.3	0.4
Whales	16	3	6	3	7	0.7	0.1	0.3	0.1	0.3
Brit sighting	1		1			0.0	0.0	0.1	0.0	0.0
Large bunches/schools	40	41	17	28	43	1.7	1.6	0.9	1.3	1.7
Hard to catch	25	39	31	40	44	1.0	1.5	1.6	1.8	1.7
Fish on surface	5	6	12	3	5	0.2	0.2	0.6	0.1	0.2
Fish in shallow water	1	37	14	19	35	0.0	1.4	0.7	0.8	1.4
No feed in fish	21	122	152	72	82	0.9	4.6	7.9	3.2	3.2
Pooling of catch	3	66	34	19	74	0.1	2.5	1.8	0.8	2.9
Fish deep		21	23	37	49		0.8	1.2	1.7	1.9
Some feed in fish		30	35	25	80		1.1	1.8	1.1	3.1
Fish very fat		1		1			0.0	0.0	0.0	0.0
Gave fish away		3					0.1	0.0	0.0	0.0
F.O. hail			8					0.4	0.0	0.0
Split market			9	4				0.5	0.2	0.0
Catch not recorded			18	52	12			0.9	2.3	0.5
Warmer water than normal			5	3				0.3	0.1	0.0
Poor weather			17	1	18			0.9	0.0	0.7
Carrying			24					1.3	0.0	0.0
Too many boats				1	3				0.0	0.1
Lots of small fish				22	36				1.0	1.4
Received fish				5	6				0.2	0.2
Total number of records	2382	2636	1916	2240	2586	100.0	100.0	100.0	100.0	100.0

Table 17. Reasons for releases and release tonnage from 1985 to 1991 from 4X N.S. summer purse seine logbooks.

Reason for release	Occurrence on Logs % of total sets							Reported Releases % of released tonnage						
	1985	1986	1987	1988	1989	1990	1991	1985	1986	1987	1988	1989	1990	1991
No release code	78.8	80.4	72.5	74.2	74.8	77.5	75.3	4.5		11.1	2.6	0.9		
Size of fish	3.0	1.0	1.6	1.3	4.2	3.5	3.7	41.7	2.9	8.1	13.1	42.5	43.2	32.8
Feed	1.1	0.1	1.1	2.1	0.8	1.3	0.2	6.2		2.2	4.6	2.1	1.1	
Condition	0.9	2.5	3.1	2.5	1.7	1	1.4	0.6	41.2	26.1	38.6	6.1	7.1	40.4
Dogfish	1.7	0.6	0.8	1.0	4.0	2	1.5	6.9	2.0	1.9	3.4	12.2	1.9	0.3
Tore up	1.3	1.3	1.9	1.5	0.8	1.3	1	3.1	2.7	4.1	0.8		0.3	10.4
Set too large	0.4	0.4	0.9	0.9	0.3	0.4	0.2	16.2	3.7	31.9	18.5	0.9	1.6	
Market filled	1.3	0.2	0.6	0.3	0.2		0.1	6.9	10.1	0.5	5.7	1.5		3.1
Skunk set	1.8	1.8	1.5	2.2	1.8	4.1	3		0.3	0.2	0.1			
Other Species	0.1	0.4	0.3	0.1	0.2	0.3	0.3	0.8					1.4	
Set too small	0.4	0.1	0.2	0.4	0.4	0.7	0.8	0.1	0.1	0.2	1.1	0.3	1.6	5.5
No fish found	3.3	3.7	2.7	3.4	0.1	0.1	3.6							
Fish too deep	0.9	1.8	2.4	1.4	1.2	1.2	1	0.1	0.1		0.3			
Poor weather	0.9	0.8	1.9	0.9	0.2	0.2	1.5							
Gear/crew problems	0.6	0.9	1.4	1.4	1.9	1.3	1.9	0.1	7.8	3.0		0.6	0.1	6.1
Fish too shallow	1.1	0.4	1.9	1.3	0.2	0.2	1							
Fish dove		0.2	0.5	0.2	0.3	0.6	0.2		2.7	9.2	3.0		40.8	
Net sunk	0.3	0.6	0.1	0.5	0.6	0.2	0.1	12.5	26.4		3.0	24.4		
Fish thinned out		0.4	0.3	0.8	1.3		0.3					0.2		
Fish moving fast		0.6	0.5	0.2	0.2	0.2	0.5							
Fish inside box/line		0.3	0.3	0.2										
Gave fish away				0.0	1.9	1.6	0.3					1.5		
Pooling; no set made						0.1	0.6							
Carrying; no set made							0.7							
Unknown reason	2.2	1.6	2.3	2.0	3.2	2.2	0.9			1.5	5.2	65.9	1	1.4
Total No. of Observations	2471	1964	2382	2636	1916	2240	2586							
Total Released Catch (t.)								2968	1341	3330	3012	2969	1669	651

Table 18. Larval index (LAI)¹ for the 1990 4WX herring assessment.

Cruise	Year	LAI ¹	SE	CV
P109	1972	9.4	1.8	
P127	1973	6.6	1.3	
P147	1974	49.5	10.9	
P160	1975	8.6	1.8	
P175	1976	13.5	2.9	
P190	1977	6.3	1.0	
P207	1978	4.5	1.8	
P232	1979	7.1	2.1	
P246	1980	26.2	6.7	
P263	1981	2.7	0.4	
P280	1982	12.4	2.1	
P298	1983	13.1	2.8	
P315	1984	12.6	2.1	
P329	1985	41.8	7.2	
P344	1986	21.3	4.0	
P361	1987	31.2	9.3	
P377	1988	98.2	22.3	.229
P391	1989	54.5	11.2	.205
P408	1990	27.0	7.5	.278
P422	1991	50.3	8.6	.170

¹Arith. mean (number of larvae m⁻²) of 79 stations as used in previous assessment (Stephenson and Power 1990).

Table 19. An index of herring by-catch (stratified mean number per tow) in summer groundfish research surveys of 4WX, strata 52-95, 1970-1990; (N = number per set for all sets) (N^h = number per set for sets with herring).

Year	Cruise	Date	Total sets (n)	No. sets with herring	Total herring	No./set (N)	No./set (N ^h)	Stratified mean no./tow	SE
1970	A175-176	06-30/07	95*	23	383.82	4.13	16.69	4.07	1.54
1971	A188-189	29/06-22/07	86*	23	296.88	3.49	12.91	3.97	1.87
1972	A200-201	23/06-19/07	105	23	117.41	1.12	5.10	1.37	0.62
1973	A212-213	09/07-02/08	96	20	77.08	0.80	3.85	0.92	0.31
1974	A225-226	09/07-03/08	102*	15	54.77	0.54	3.65	0.72	0.25
1975	A236-237	15/07-06/08	104	12	131.09	1.26	10.92	0.89	0.36
1976	A250-251	12/07-05/08	103*	10	53.43	0.52	5.34	0.36	0.20
1977	A265-266	09/07-30/08	106	9	81.54	0.77	9.06	0.54	0.30
1978	A279-280	09-31/07	103*	4	32.03	0.31	8.01	0.34	0.32
1979	A292-293	06-27/07	106*	5	71.06	0.68	14.21	0.64	0.46
1980	A306-307	07-27/07	105	3	93.51	0.89	31.17	0.54	0.51
1981	A321-322	04-25/07	104	4	195.05	1.88	48.76	1.51	1.35
1982	H080-081	10-30/07	108	14	130.44	1.21	9.32	1.54	0.90
1983	N012-013	05-27/07	106	25	230.95	2.18	9.24	2.36	0.80
1984	N031-032	01/07-02/08	102	31	678.06	6.65	21.87	6.98	3.53
1985	N048-049	04-25/07	111	19	418.58	3.77	22.03	3.38	1.83
1986	N065-066	07-17/07	118	36	2152.13	18.24	59.78	23.20	14.92
1987	N085-087	29/07-06/08	135	33	2118.70	15.69	64.20	10.35	5.56
1988	N105-106	04-27/07	127	31	280.90	2.21	9.06	2.08	0.62
1989	N123-124	05-27/07	124	46	939.52	7.58	20.42	8.35	1.78
1990	N139-140	03/07-31/08	156*	46	779.44	5.03	16.94	5.56	1.88
1991	N154/H231	04-28/07	137	45	1149.95	8.39	25.55	10.64	5.81

*Total includes strata with only one set.

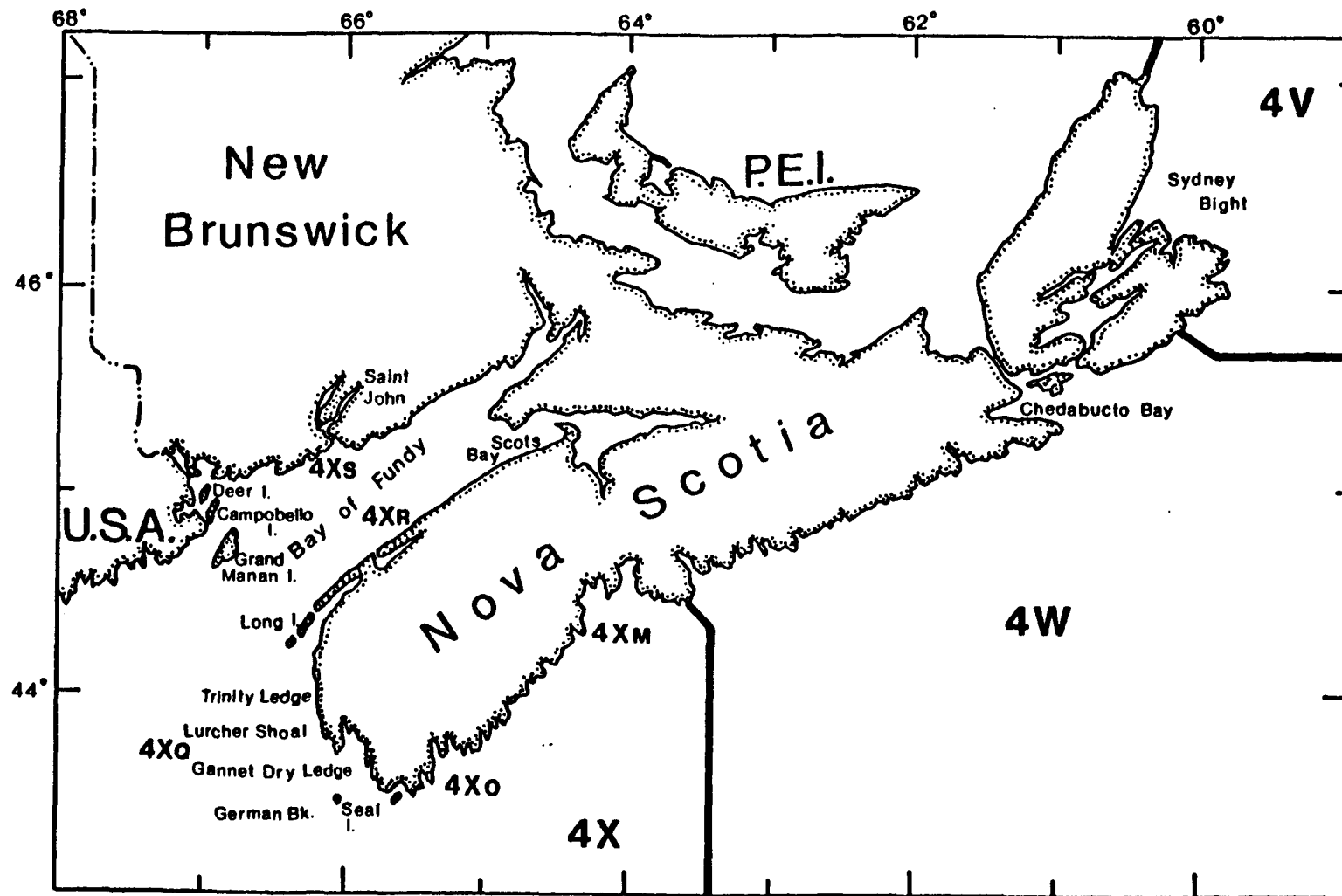


Fig. 1. Map of division 4WX showing major locations mentioned in text.

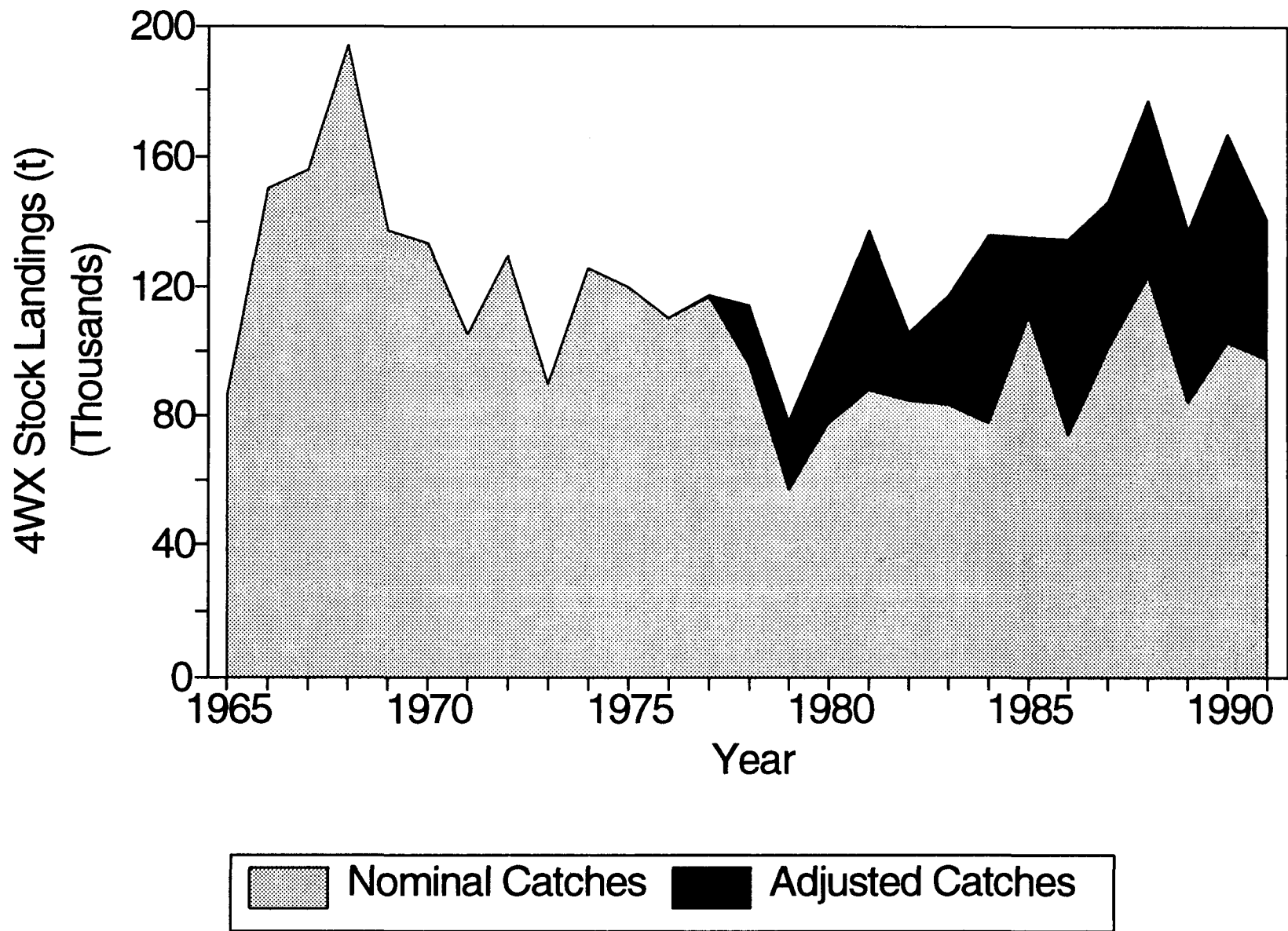


Fig. 2. Historical series of nominal and adjusted landings for the "stock" portion of the 4WX herring fishery, 1965-91.

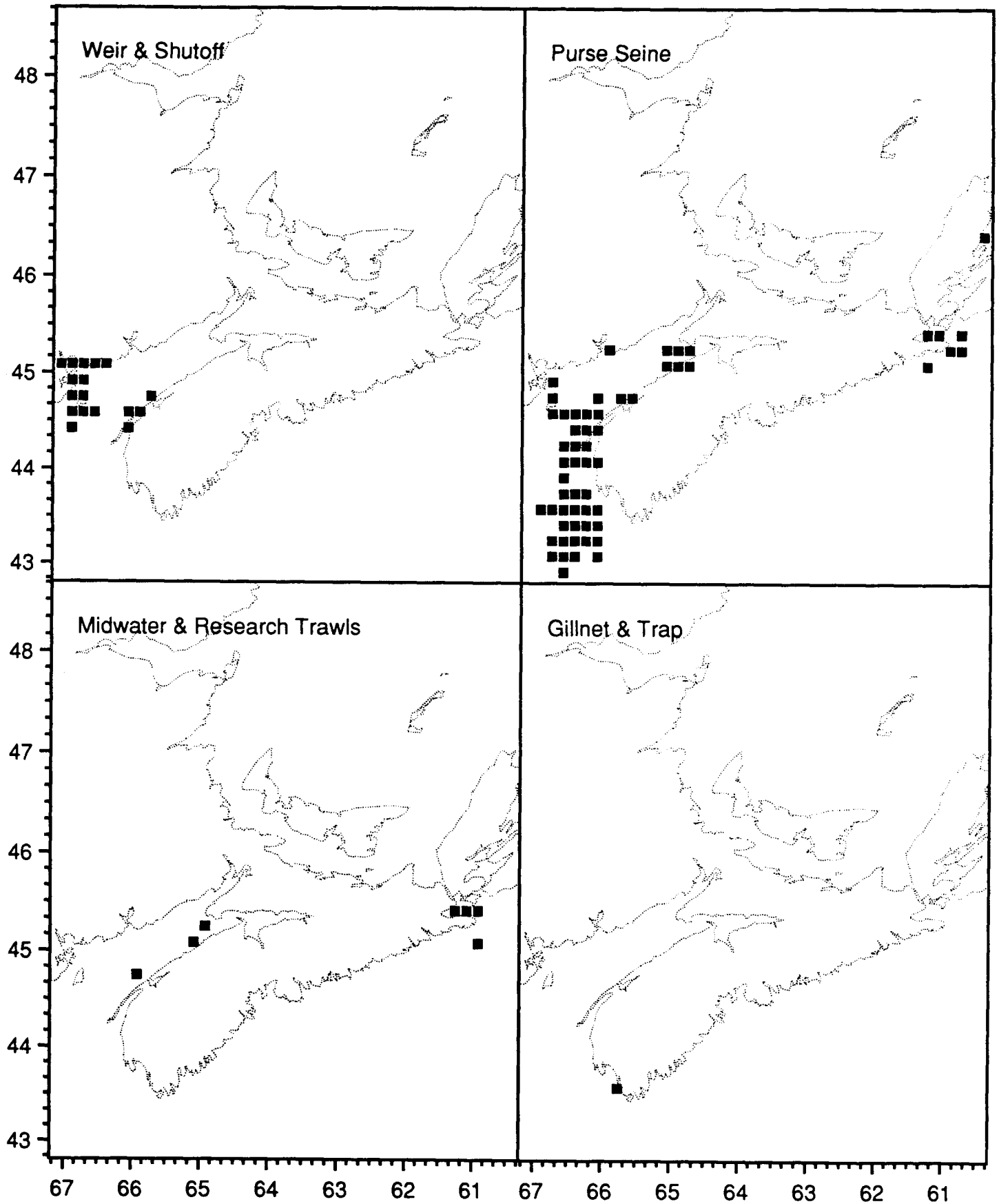
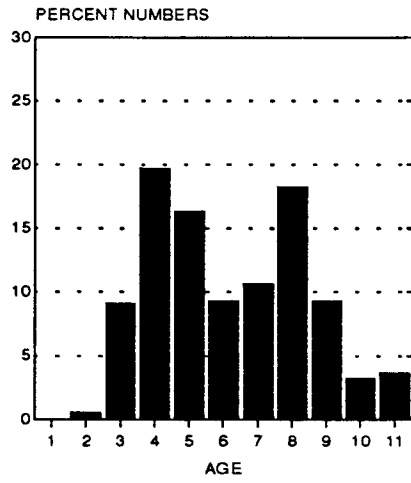
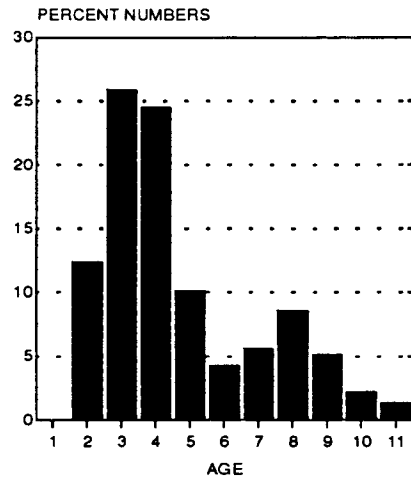


Fig. 3. Geographical distribution of biological sampling of the 1991 4WX herring fishery by gear component (resolution = 10 minutes square).

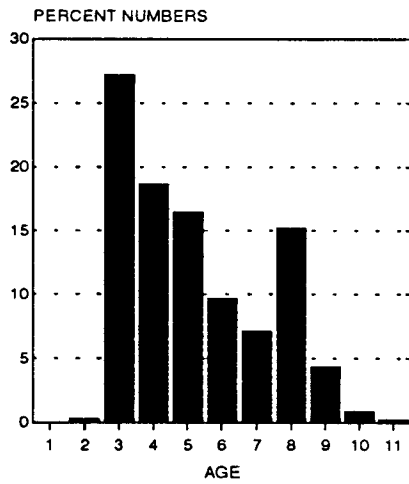
4W PURSE SEINE



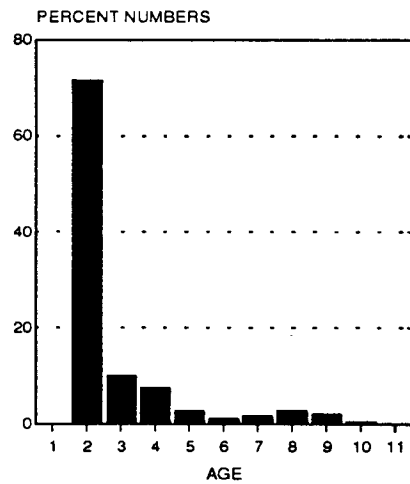
4X N.S. P. SEINE



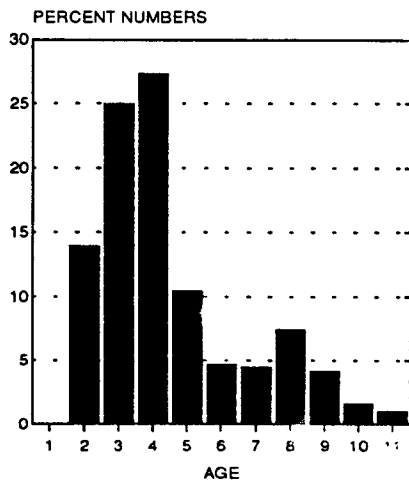
4X N.B. P. SEINE



4X N.S. WEIRS



4WX MISC. GEARS



4WX STOCK GEARS COMBINED

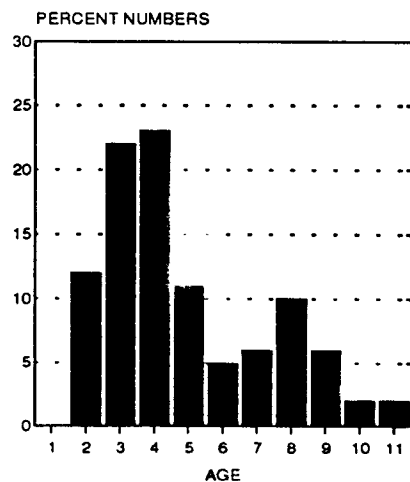


Fig. 4a. Catch at age (% numbers) for stock gear components of the 1991 4WX herring fishery.

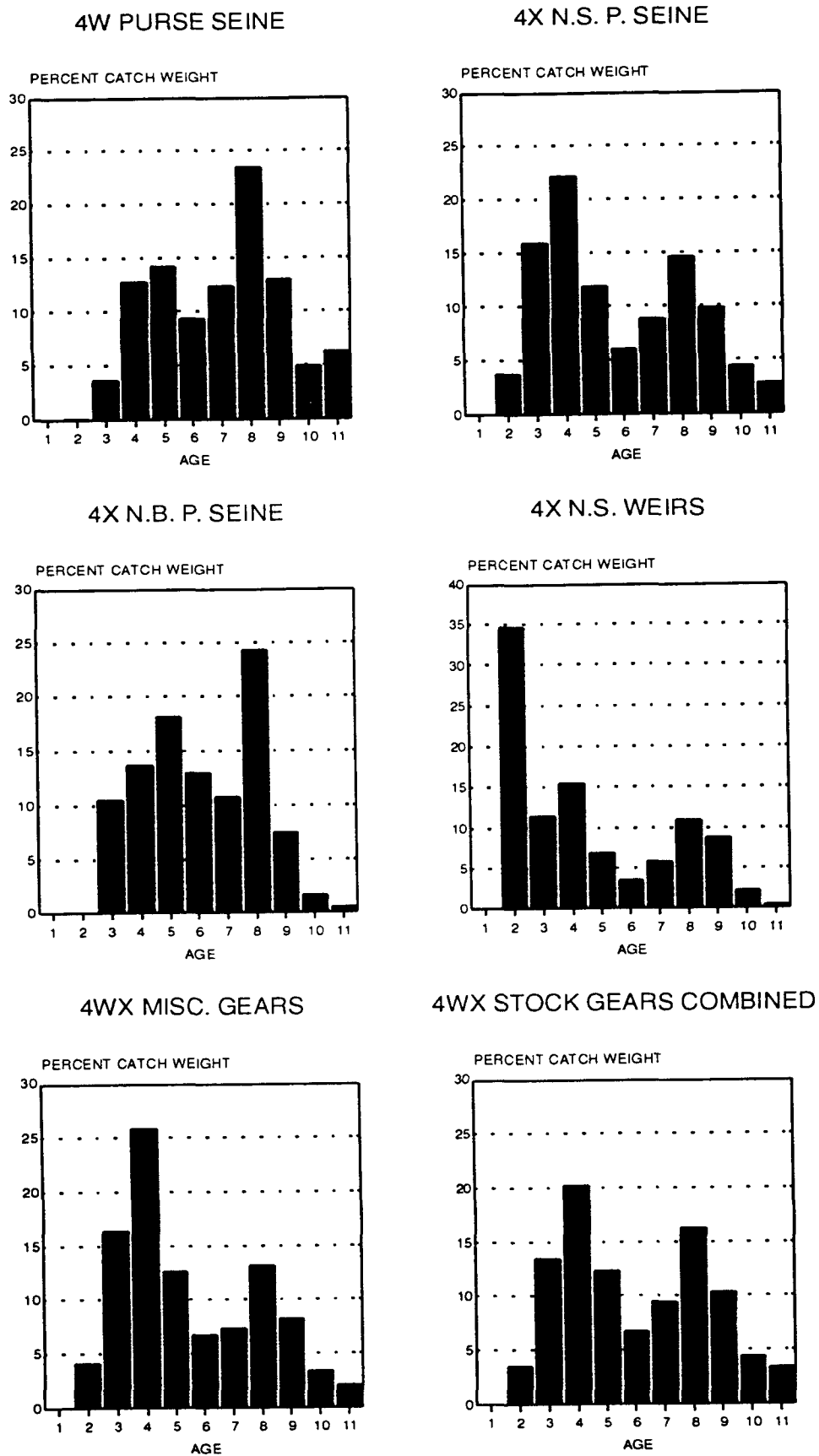
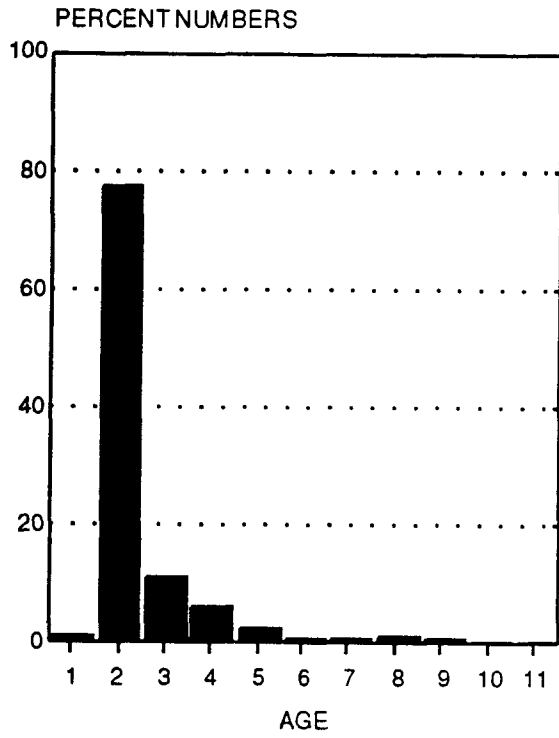
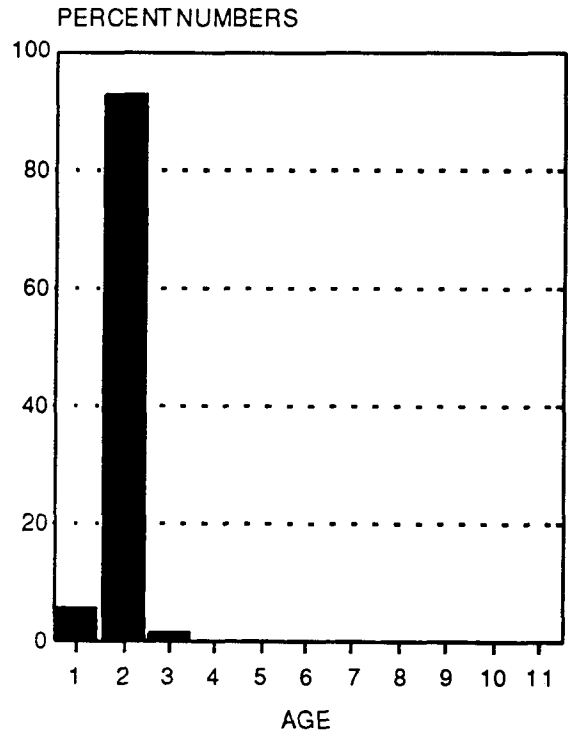


Fig. 4b. Catch at age (% catch weight t.) for stock gear components of the 1991 4WX herring fishery.

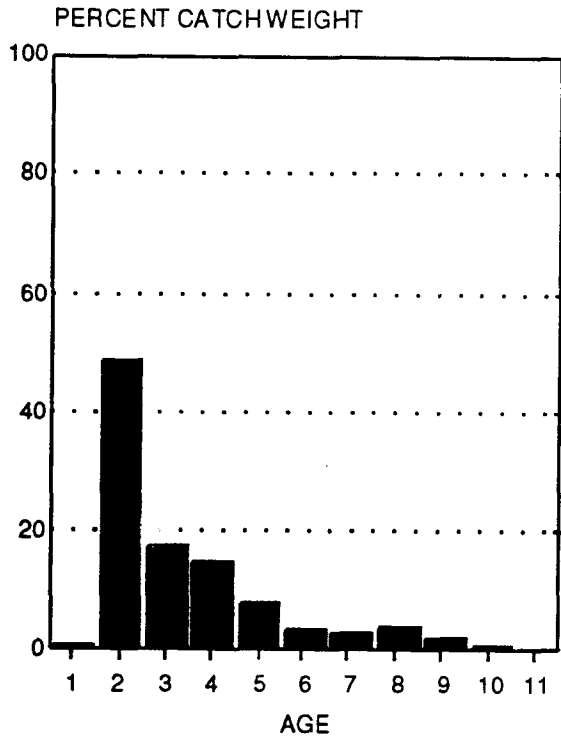
4X N.B. WEIR



4X N.B. SHUTOFF



4X N.B. WEIR



4X N.B. SHUTOFF

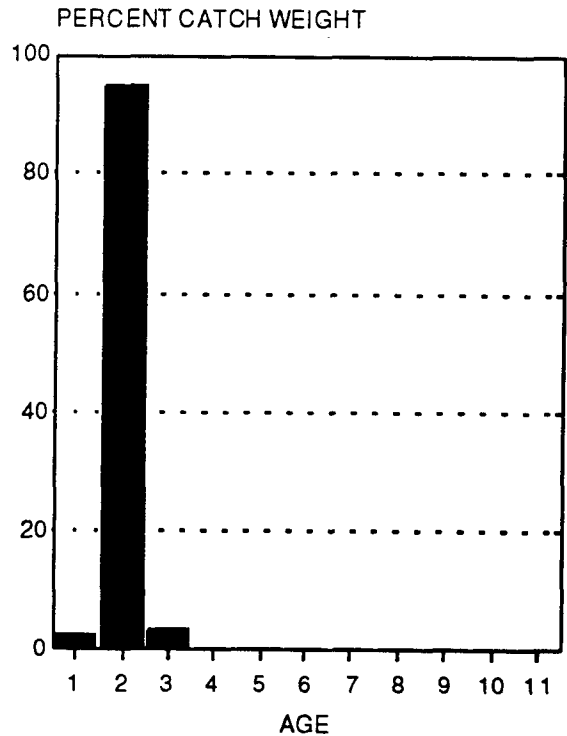


Fig. 4c. Catch at age in number (upper) and catch weight (lower) for non-stock gear components of the 1990 4WX herring fishery.

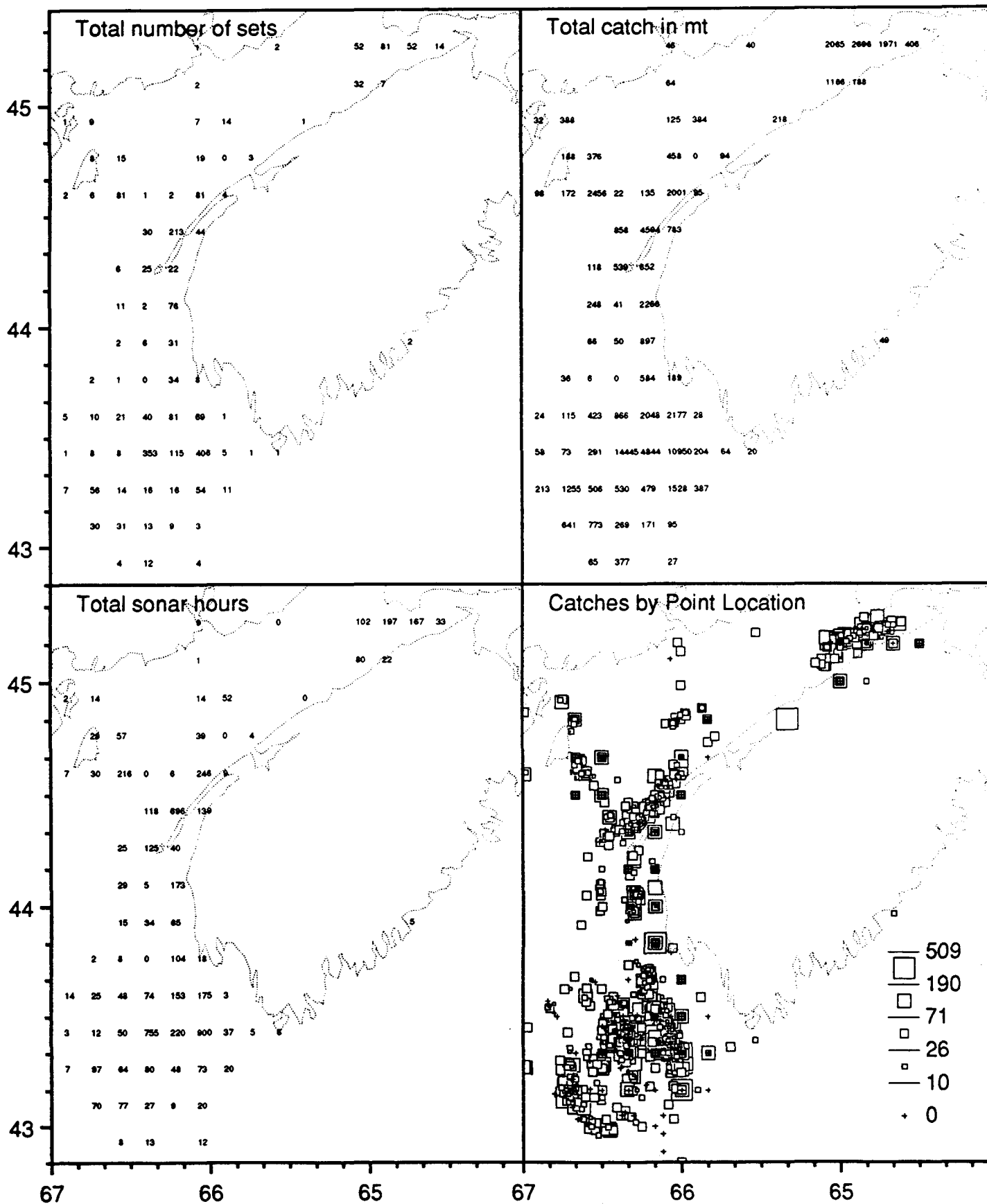


Fig. 5. 1991 4X N.S. summer purse seine fishery catch and effort distribution by 10 mile square and individual catches by point location.

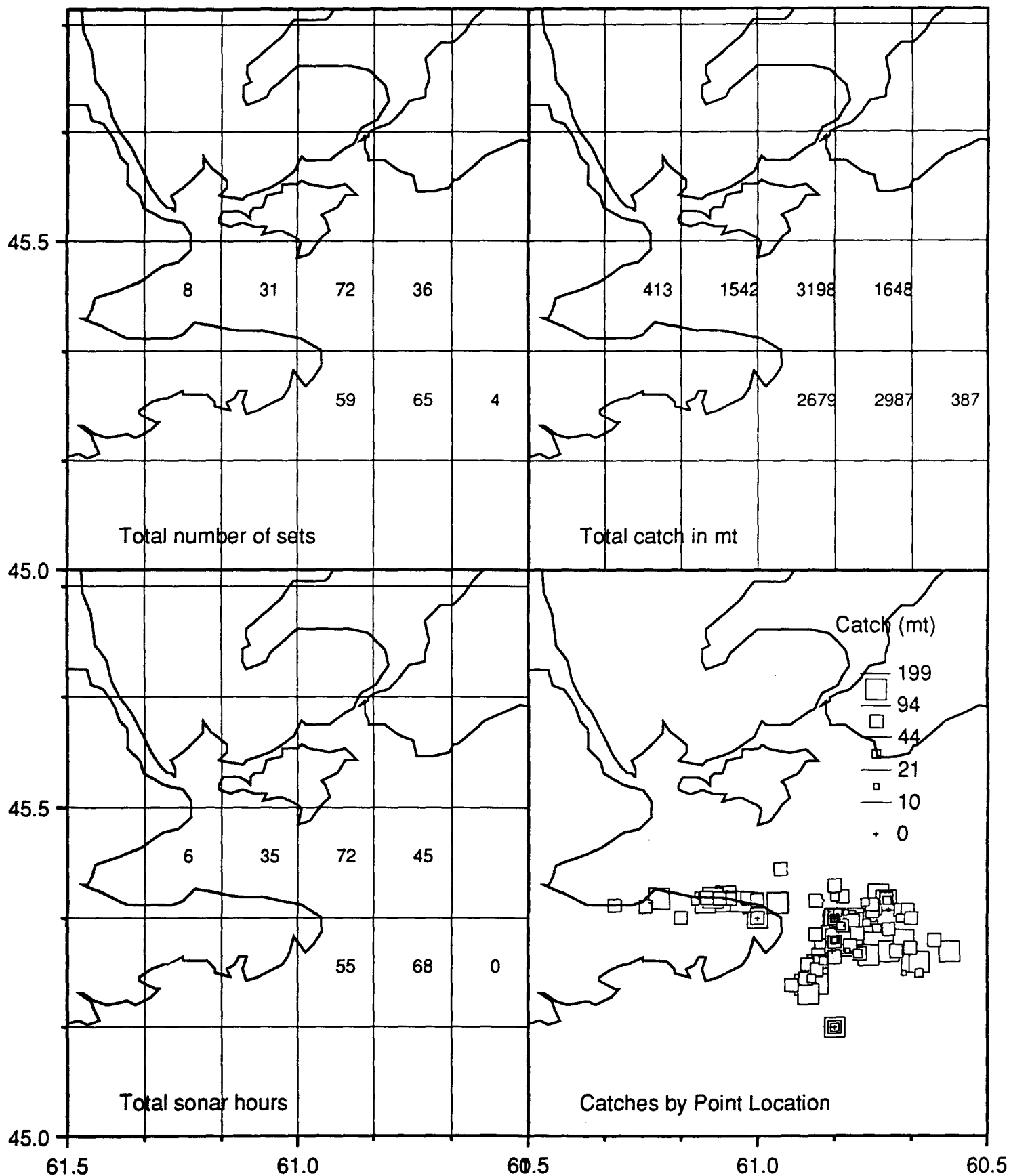


Fig. 6. 1991 4W Chedabucto Bay purse seine fishery (winter plus fall) catch and effort distribution by 10 mile square and individual catches by point location.

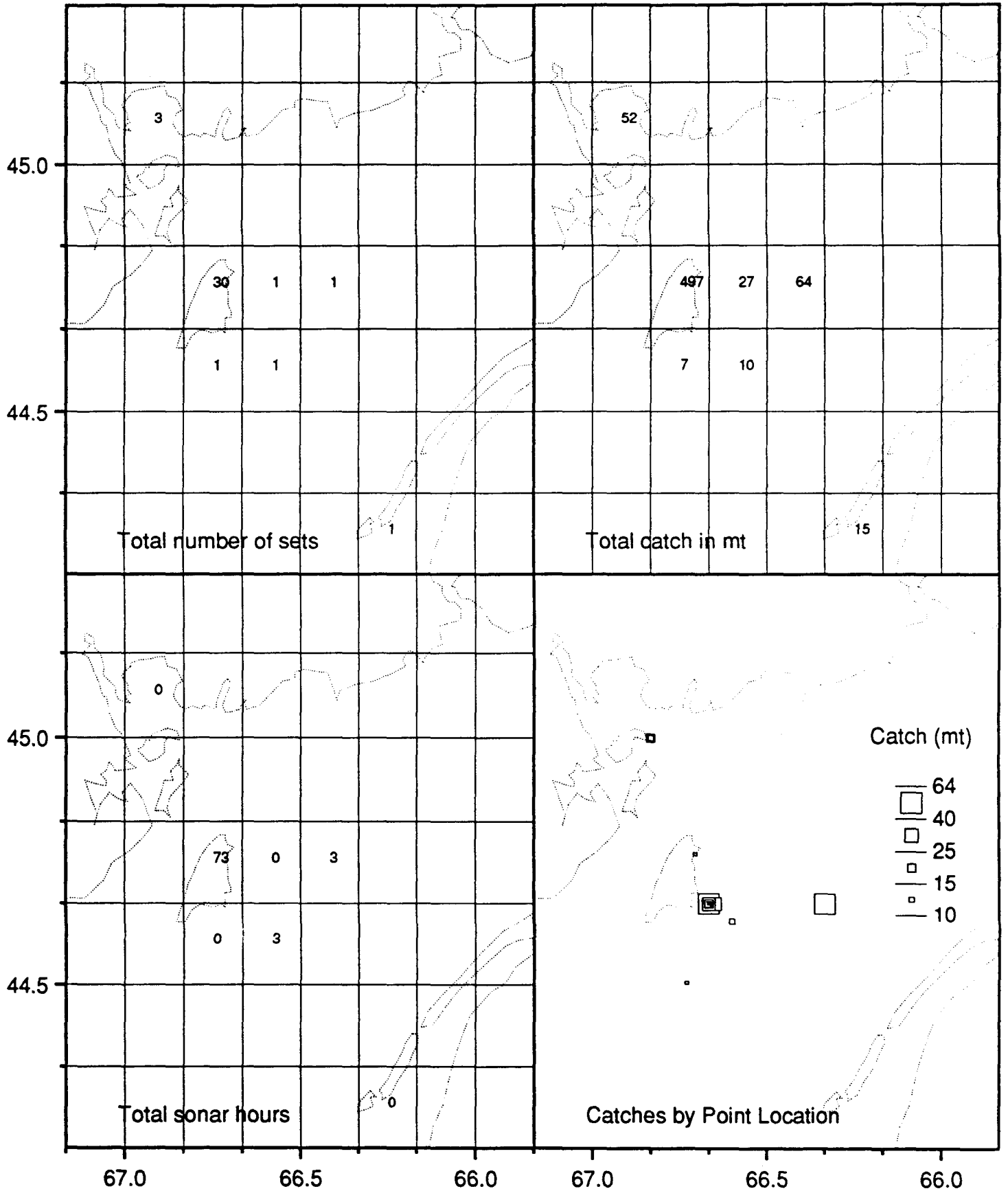


Fig. 7. 1991 4X N.B. purse seine fishery (winter plus fall) catch and effort distribution by 10 mile square and individual catches by point location.

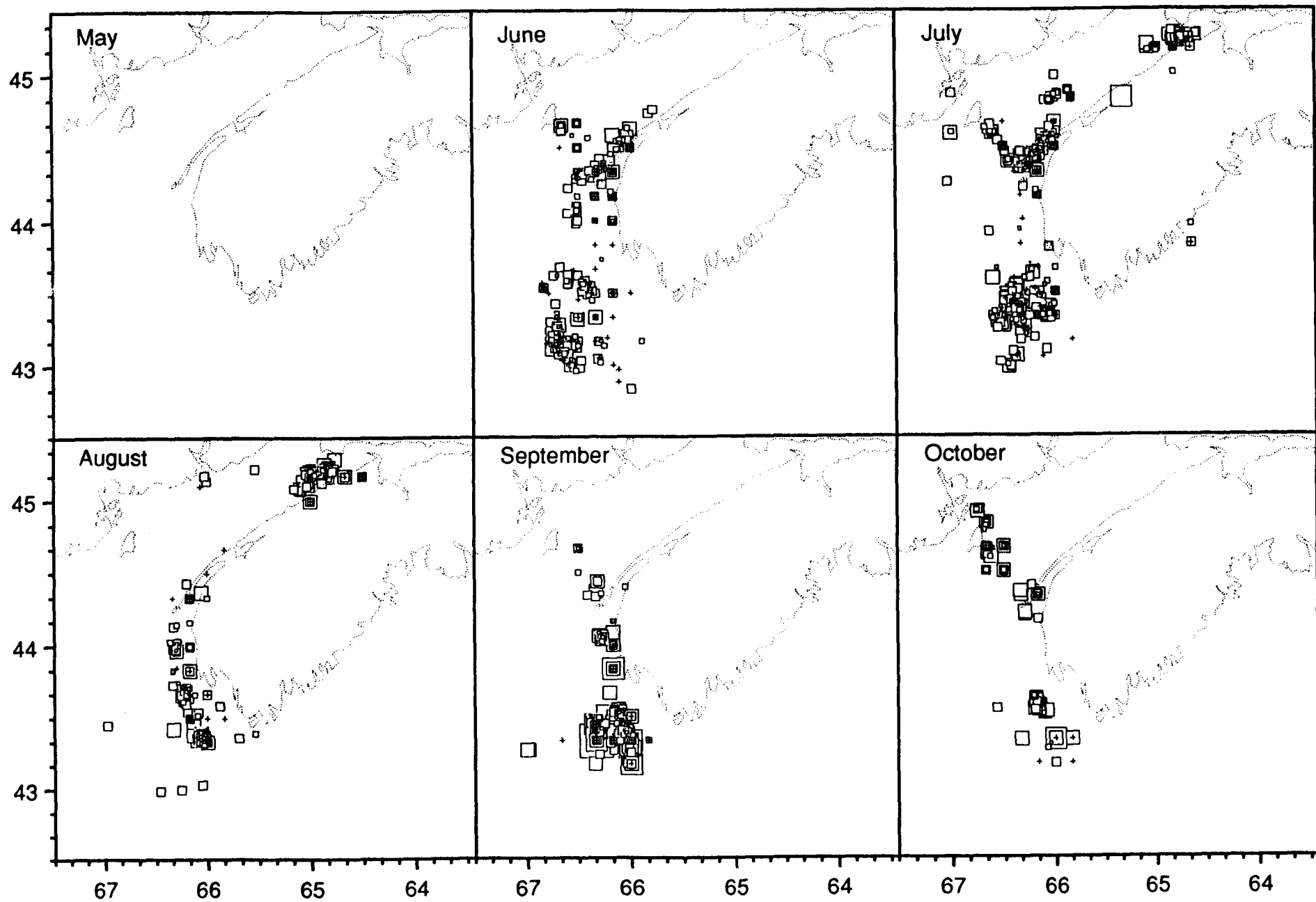


Fig. 8. 1991 4X N.S. summer purse seine fishery monthly catch distribution by point location of catch.

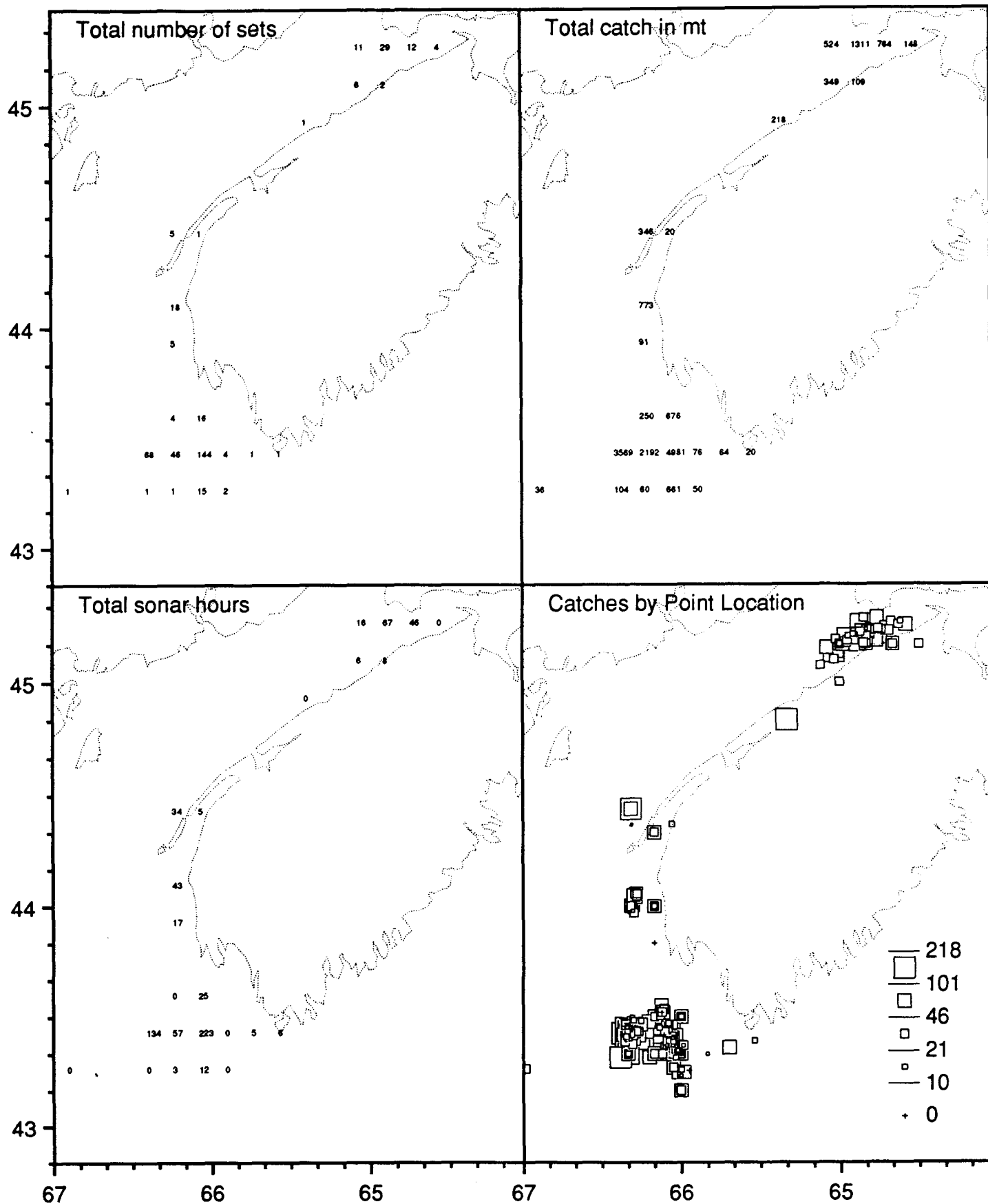


Fig. 9. 1991 4X N.S. summer purse seine fishery catch and effort distribution by 10 mile square and individual catches by point location for all records where fish roe condition was specified as ripe or spawning (roe stages 5 and 6).

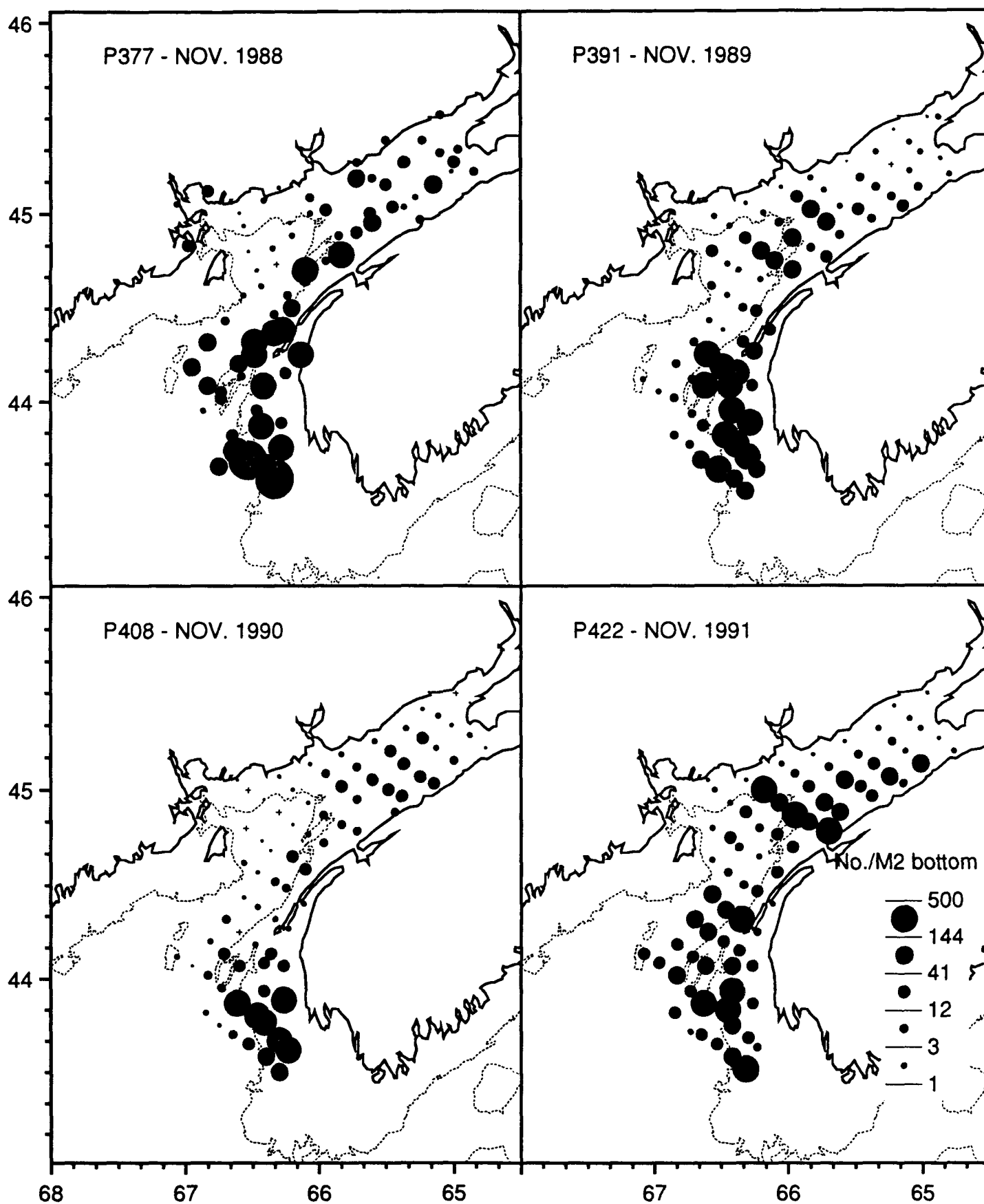
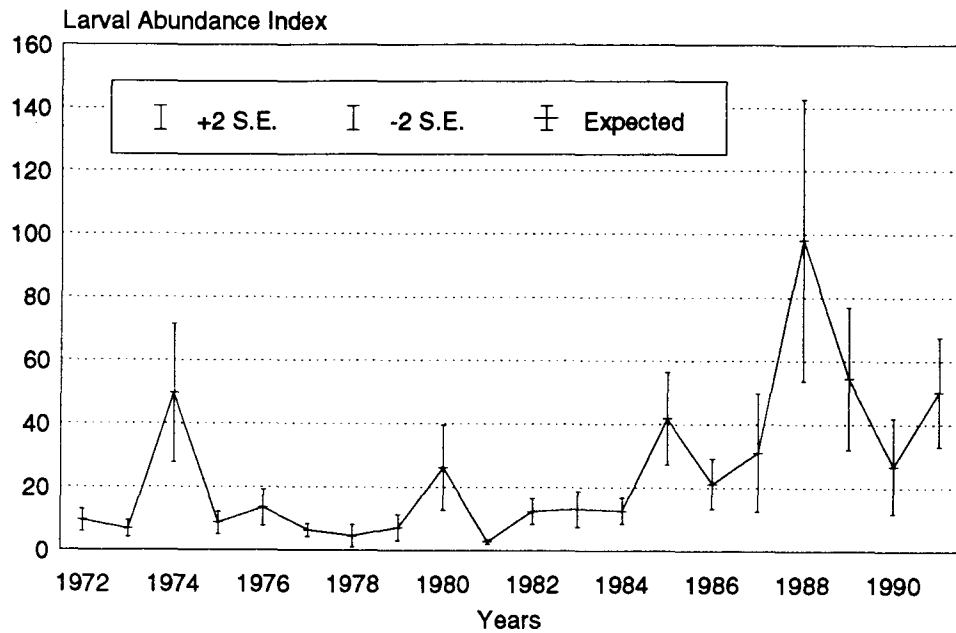


Fig. 10. Larval herring abundance (numbers per m^2 to bottom) by station on November larval herring surveys, 1988-91.

4WX Herring Abundance Larval Indices



4WX Herring Abundance Bottom Trawl Indices

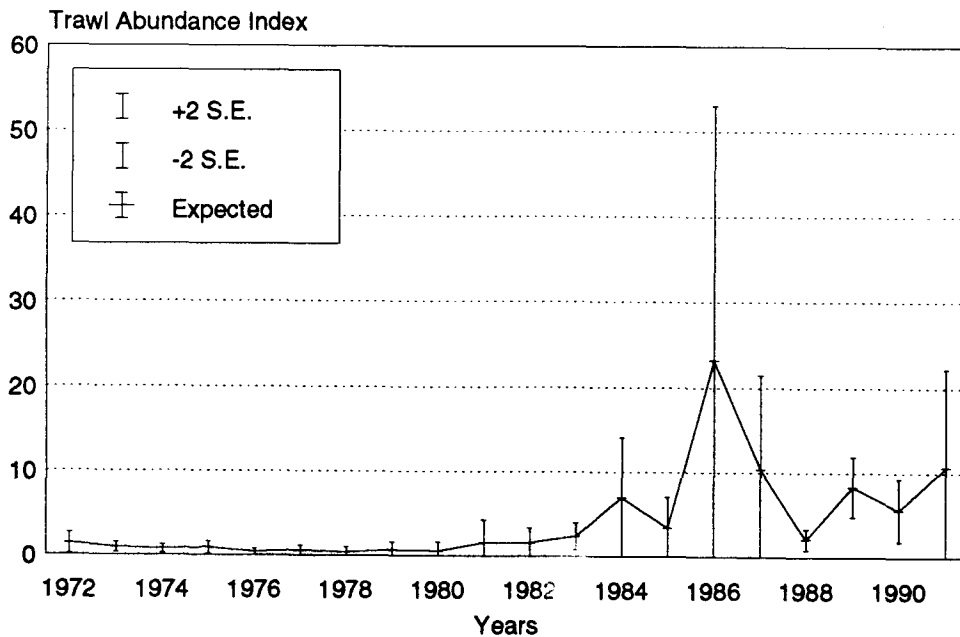


Fig. 11. Larval herring abundance index (mean number of larvae per m² to bottom for the 79 index stations sampled in November) and bottom trawl abundance index (stratified mean number per tow) for 4WX herring, 1972-91.

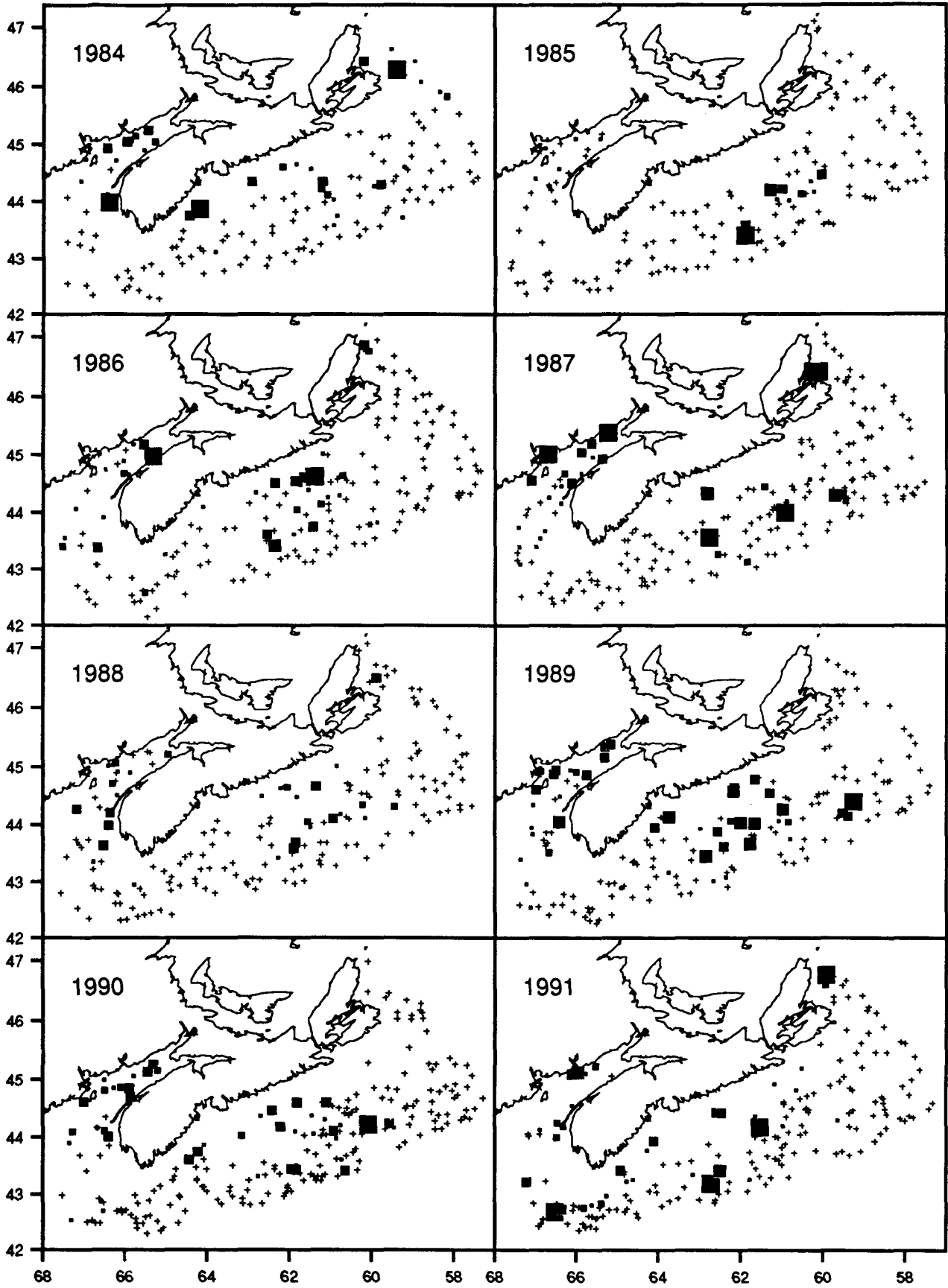


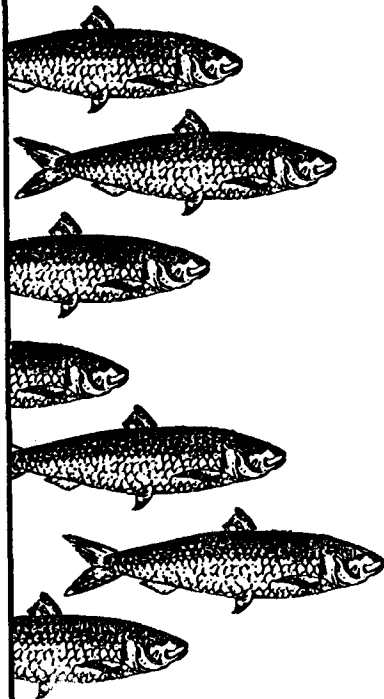
Fig. 12. Distribution of sets and herring catches in summer bottom trawl series, 1984-91.

Appendix A. 1990-91 Herring Management Plan Summary and Reported Catches

Gear	Fishery	Season	Quota (t)	% of TAC	Reported Catch (t)	% of Total 4WX Catch
4WX Purse Seine	4X Fall	Oct 15 Dec 31	9,000	6 %	1,710	1.8 %
	4X Winter	Jan 1 Feb 28	6,000	4 %	314	0.3 %
	4W Cheda-bucto	Nov 1 Mar 1	28,470	19 %	17,878	18.4 %
	4X Summer	Apr 1 Oct 14	95,618	63 %	73,619	75.9 %
Total 4WX Purse Seine			139,088	92 %	93,521	96.2 %
Bait	4WX		2,600	1.7 %		
Total 4WX + Bait			141,688	93.7 %		
Mid-Water Trawl	4WX		1,512	1 %	986	1.0 %
Gillnet + Trap + Weir	4WX		8,000	5.3 %	2,498	2.6 %
4WX TAC	4WX	Oct 15 Oct 14	151,200	100 %	97,005	100 %
4V Purse Seine	4Vn Fall	Nov 1 Mar 1	4,200	2.8 %	4,712	4.6 %



HERRING FISHING PLAN 1990-91



Fisheries
and Oceans

Pêches
et Océans

1991 SCOTIA-FUNDY PURSE SEINE VESSEL QUOTA ALLOCATIONS

CLASS A (NON-MOBILE)	(% SHARE)
1. CAPE SHOAL	1.6%
2. CHELTOM	1.6%
3. CLELAND G.	1.6%
4. CRAIG & DIANE	1.6%
5. DAUGHTERS THREE	1.6%
6. FIVE LADIES	3.2%
7. FLYING SWAN VI	1.6%
8. FUNDY MISTRESS	1.6%
9. GAIL & TROY	1.6%
10. GOLDEN DAWN	1.6%
11. INGALLS SANDS	1.6%
12. LISA ANNE	3.2%
13. ARON & KATE	1.6%
14. OCEAN SUPREME	1.6%
15. POLLY B.	1.6%
16. PUBNICO VIRGO	1.6%
17. RICHARD B.	1.6%
18. LADY CAVELLE	1.6%
19. ATLANTIC MARINER	1.6%
20. SEA FOAM I	1.6%
21. 7 L'S	1.7%
22. SEVEN SONS	1.6%
23. TODD AND CARLA	1.6%
24. TOMMIE & ARNIE	3.2%
CLASS B (MOBILE)	(% SHARE)
25. CANADA 100	4.0%
26. CENTENNIAL III	3.0%
27. DUAL VENTURE	4.0%
28. EASTERN FISHER	2.7%
29. ISLAND PRIDE #1	4.0%
30. LEROY AND BARRY NO. II	4.0%
31. MARGARET ELIZABETH #1	4.0%
32. MARI-LYNNE ANITA	4.0%
33. LADY NOREEN	4.0%
34. PUBNICO GEMINI	2.7%
35. SEALIFE II	4.0%
36. SEALIFE NO. III	2.8%
CLASS C (PROCESSOR-OWNED)	(% SHARE)
37. NOVA STAR - non-mobile	1.9%
38. EASTERN PHOENIX	4.0%
39. LADY MEUSSA	4.0%
40. CANADA 100	4.0%

For 1991, the percentage share of the purse seine TAC and the separate bait quota equates to the following tonnages:

PURSE		BAIT	
%	SEINE (139,088)	%	BAIT (2,808)
1.6%	= 2225.4 t	2.8%	= 3894.5 t and 72.8 t bait
1.7%	= 2364.5 t	3.0%	= 4172.6 t and 78.0 t bait
1.9%	= 2642.7 t and 49.4 t bait	3.2%	= 4450.8 t and 83.2 t bait
2.7%	= 3755.4 t and 70.2 t bait	4.0%	= 5563.5 t and 104.0 t bait

INSHORE QUOTA - 1612 (M.A. MOONE)

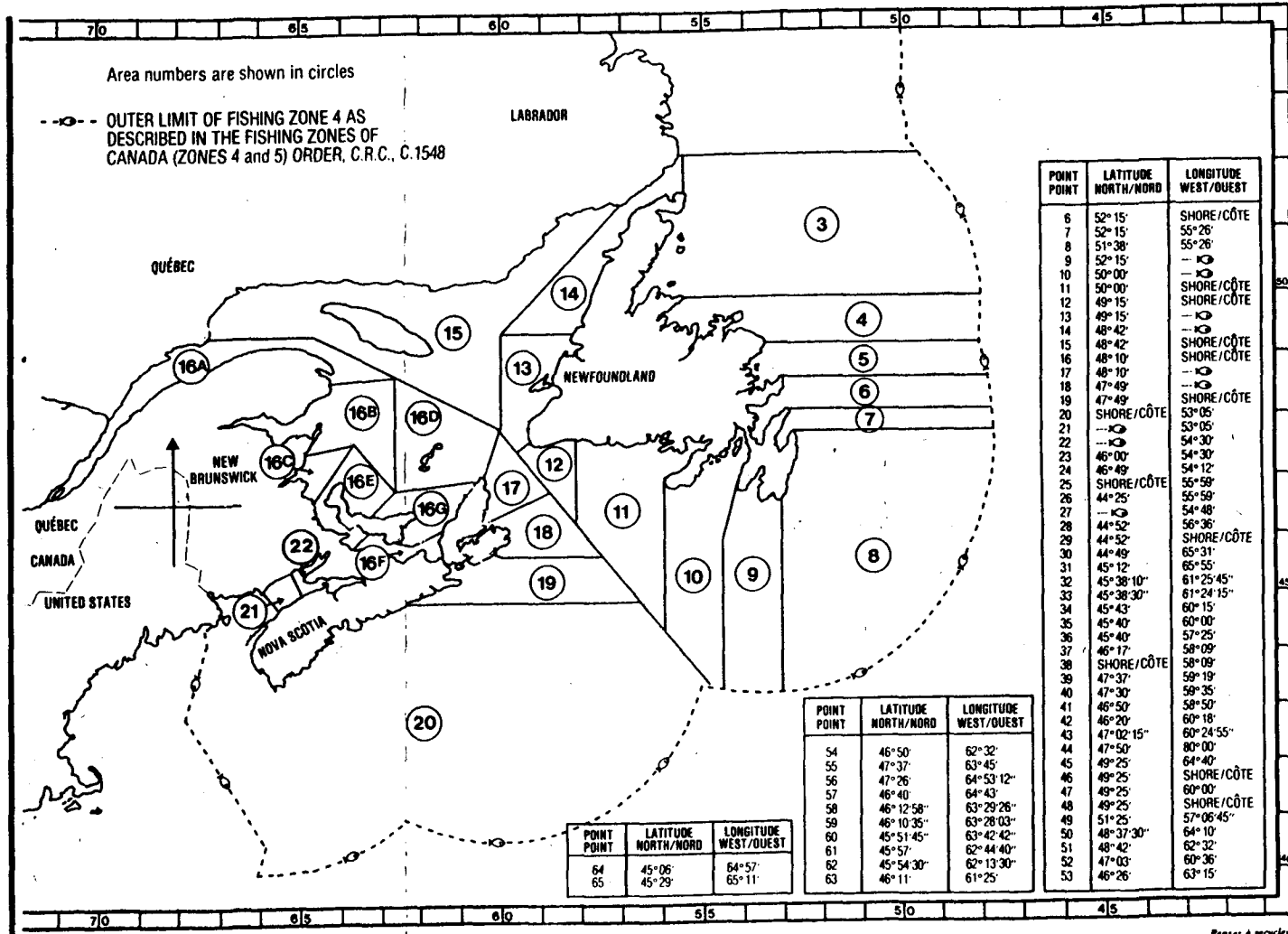
FOOTNOTES TO THE 1990-91 HERRING FISHING PLAN

1. Not more than 500 t of the winter fishery quota will be taken north of a straight line drawn due east from Bliss Island Light, Charlotte County, New Brunswick.
2. The winter reference figure of 8000 t is an estimated catch from the area and may be increased by transfer from the summer fishery. Similarly, any unused quota would be transferred to the summer quota.
3. The quota for the summer fishery will be the balance of any uncaught quotas and overruns from the Fall, Winter, Chedabucto Bay and Upper Bay Fundy fisheries within the 1991 fishery year only.
4. The division of this quota between the three areas will be resolved at the spring meeting of the Scotia-Fundy Herring Advisory Committee.
5. The 2600 t bait quota will be allocated to each purse seiner based on their existing percentage share of the purse seine quota, i.e. 1.6%, 2.7%, etc.
6. Allowances are applied only to the inshore gear licenced for waters adjacent to Nova Scotia. Fixed gear catch by the New Brunswick inshore sector is not considered to be part of the 4VW stock but rather related to NAFO area 5. Therefore, no quotas or allowances are applied by this Plan to inshore gear licenced for the waters adjacent to New Brunswick.
7. To be fished by Gulf purse seiners only, the 4200 t does not count toward the 151,200 t TAC for the Herring Fishing Area 19 and 22.

The information contained in this leaflet is a summary, for information purposes. For up-to-date information, or more details, contact a fishery officer.

1990-91 HERRING FISHING PLAN

GEAR TYPE	FISHERY	AREA	SEASON	QUOTA	FOOT NOTES
PURSE SEINE	FALL	20 & 21	OCT 15 TO DEC 31	9000	
	WINTER	20 & 21	JAN 1 TO FEB 28	6000	1, 2
	CHEDABUCTO	AREA 19	NOV 1 TO MAR 1	28470	
	SUMMER	20 & 21 & 22	APR 1 TO OCT 14	95618	3, 4
TOTAL PURSE SEINE VESSEL QUOTAS MINUS BAIT				139088	
	BAIT	19 & 20 & 21		2600	5
TOTAL PURSE SEINE VESSEL QUOTAS				141688	
MID-WATER TRAWL	WINTER	20 & 21	JAN 1 TO MAR 31	1512	
GILLNETS, TRAPS AND WIERS		17, 18, 19, 20, 21, 22		8000	6
TOTAL ALLOWABLE CATCH				151200	
PURSE SEINE	FALL	17	NOV 1 TO MAR 1	4200	7
	FALL	18	CLOSED ALL YEAR	0	



HERRING FISHING AREAS

