DFO Atlantic Fisheries
Research Document 94/76

MPO Pêches de l'Atlantique
Document de recherche 94/76

Survey Update

for

Selected Scotia-Fundy Groundfish Stocks

12 September 1994

by

R.N. O'Boyle [Ed.]*

and

C. Annand, R. Branton, P. Hurley,
R. Mohn, and K. Zwanenburg
*Bedford Institute of Oceanography
P.O. Box 1006, Dartmouth
Nova Scotia, B2Y 4A2
Canada

D. Clark, J. Neilson,
and E. Trippel
St. Andrews Biological Station
Brandy Cove Road, St. Andrews
New Brunswick, E0G 2X0
Canada

[1]This series documents the scientific basis for the evaluation of fisheries resources in Atlantic Canada. As such, it addresses the issues of the day in the time frames required and the documents it contains are not intended as definitive statements on the subjects addressed but rather as progress reports on ongoing investigations.

Research documents are produced in the official language in which they are provided to the secretariat.

[1]La présente série documente les bases scientifiques des évaluations des ressources halieutiques sur la côte atlantique du Canada. Elle traite des problèmes courants selon les échéanciers dictés. Les documents qu'elle contient ne doivent pas être considérés comme des énoncés définitifs sur les sujets traités, mais plutôt comme des rapports d'étape sur les études en cours.

Les Documents de recherche sont publiés dans la langue officielle utilisée dans le manuscrit envoyé au secrétariat.

Abstract

A synopsis of the results of the 1994 summer bottom trawl survey is provided. This information will be used in upcoming assessment meetings as a key source of information on trends for the selected groundfish stocks.

Résumé

On trouvera ici un sommaire des résultats du levé de recherche au chalut de fond réalisé en été 1994, qui servira de source fondamentale de renseignements sur certains stocks de poisson de fond lors des prochaines réunions concernant l'évaluation de ces stocks.

Introduction

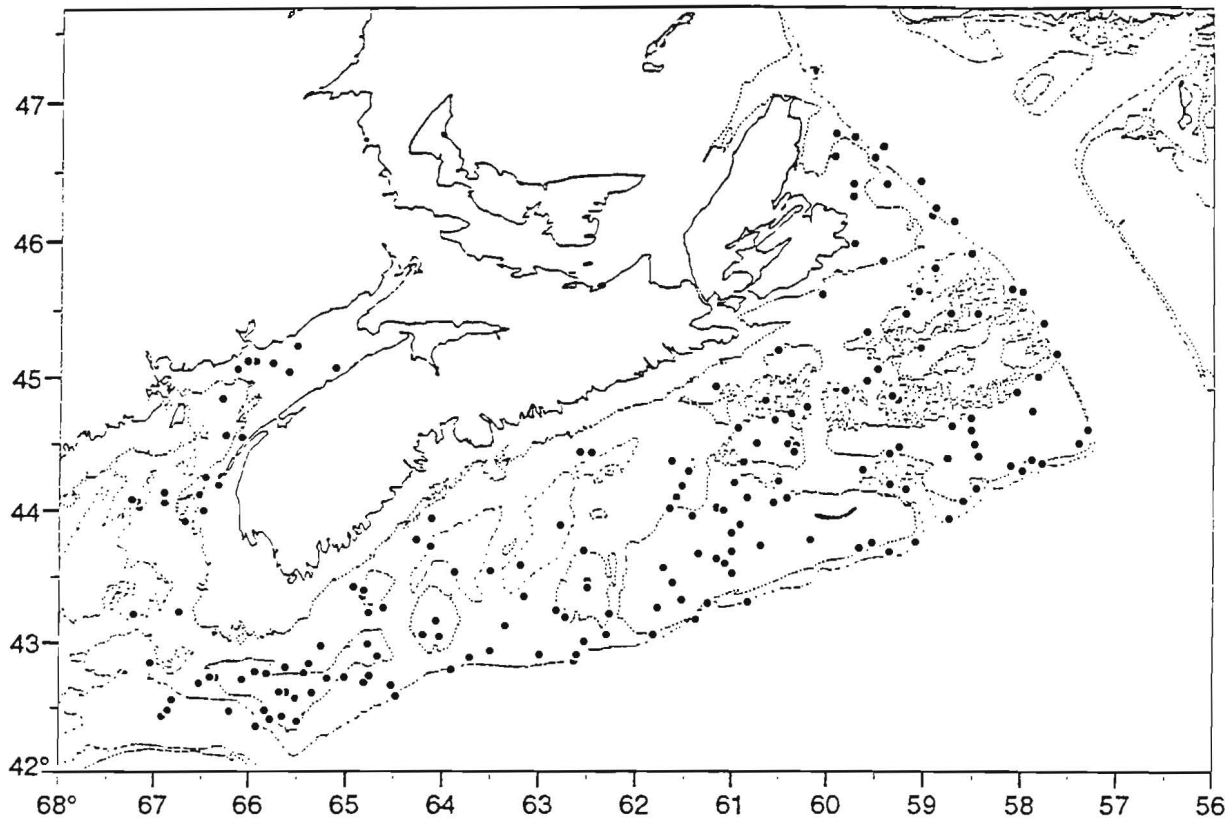
The annual groundfish bottom trawl survey was conducted on the Scotian Shelf as planned during 4-29 July 1994. The results of this survey were compiled to provide clients with a preliminary view of the resource trends as determined by this survey. Stock assessments incorporate information such as commerical fishery catch rates and other survey results when available. Therefore, the abundance trends reported herein, which are based on only the survey information, are not directly comparable to those given in recent assessments. Stock assessments for these resources are planned for early in 1995 and would use the information from the 1994 summer survey.

A number of staff at the Bedford Institute of Oceanography (BIO) and the St. Andrews Biological Station (SABS) were responsible for compiling the information. They are identified with each stock. They should be contacted for further information on these results.

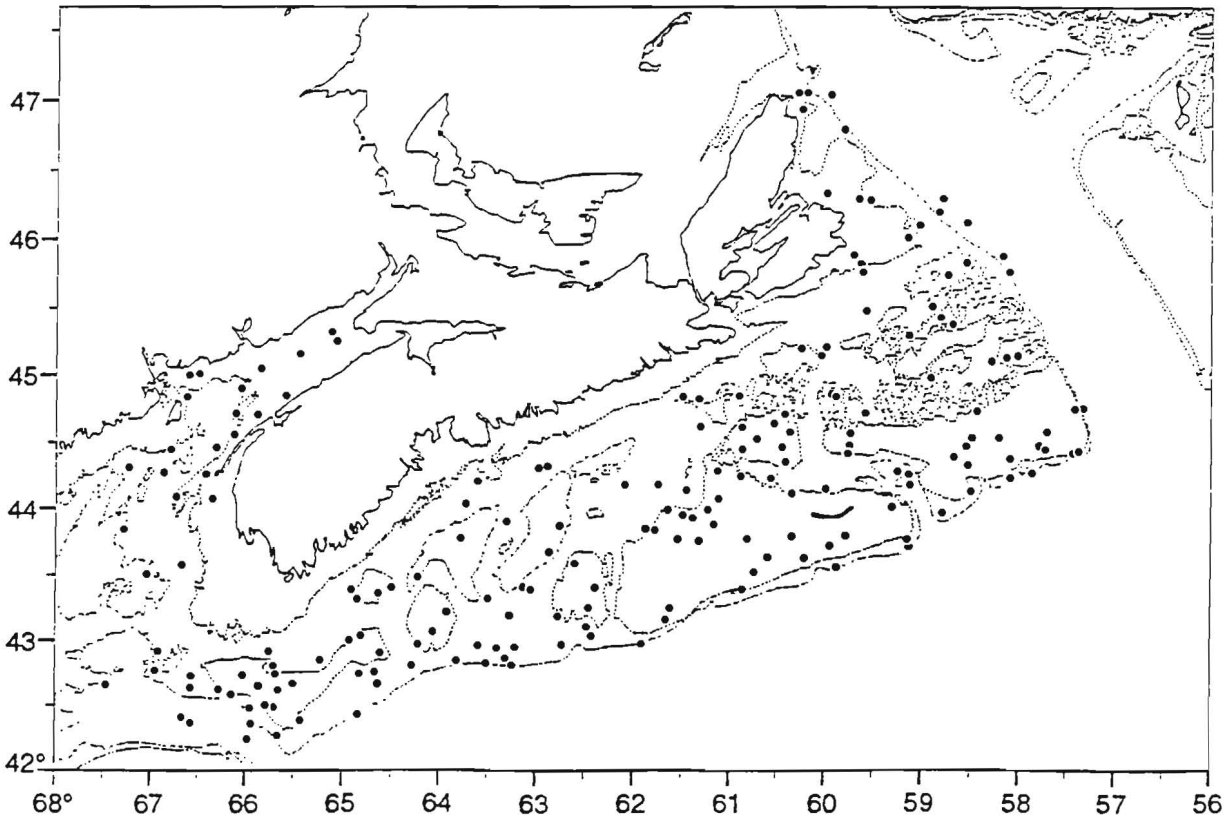
Survey Description

The survey was conducted from the research vessel CSS *Alfred Needler* out of the Bedford Institute of Oceanography, Dartmouth, N.S. on two trips, N221 (4-15 July 1994) covering the western shelf and N222 (18-29 July 1994) covering the eastern shelf, with scientific staff from both the Bedford Institute and St. Andrews Biological Station, St. Andrews, N.B. The survey uses a standardized procedure to allow comparison of catches between stations and previous surveys. 209 tows were made with a Western IIA bottom trawl. The Western IIA trawl has a 106-foot roller-rigged footrope and 2000 pound Portuguese doors. The codend is lined with 3/4 inch mesh to retain smaller fish. The survey uses standard 30-minute tows and stations selected to represent the entire Scotian Shelf, so catches are frequently smaller than commercial catches and sometimes are located in areas fishermen regard as not productive.

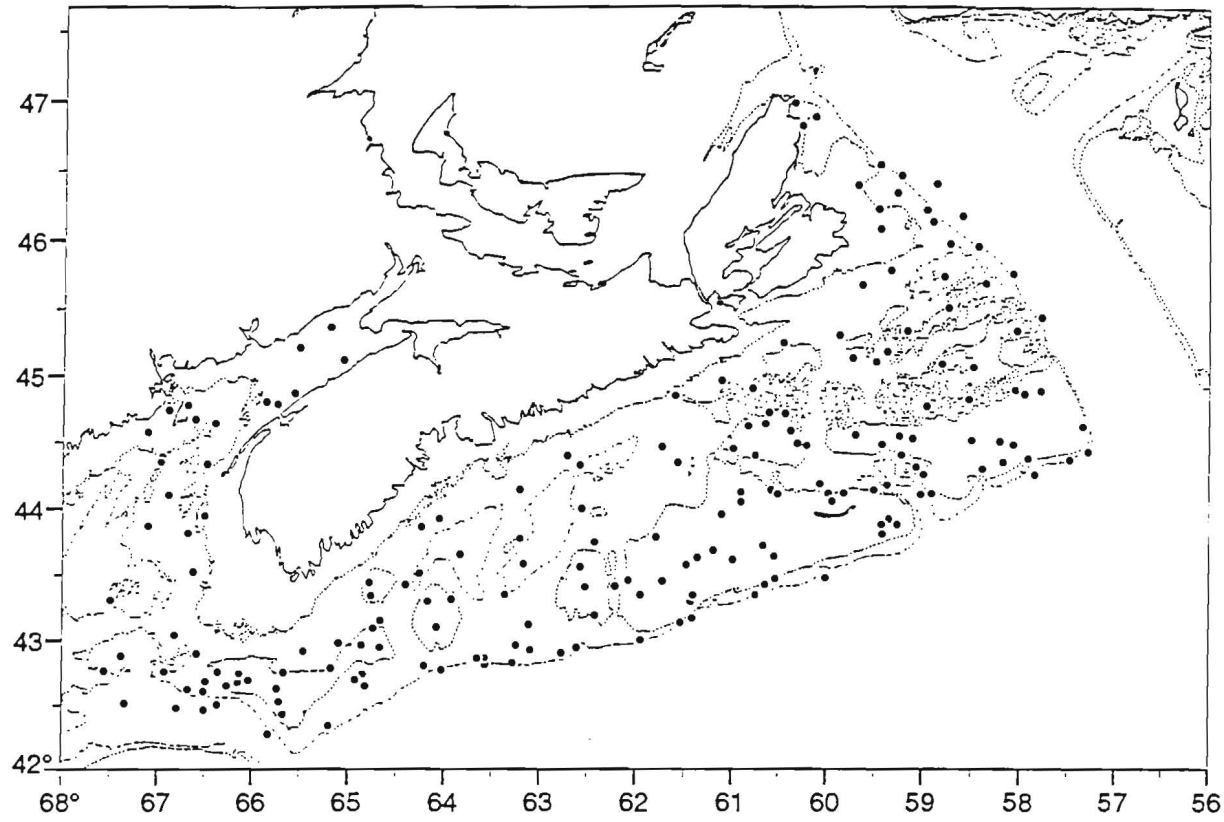
Set locations for Scotia Fundy SUMMER 91 Groundfish survey.



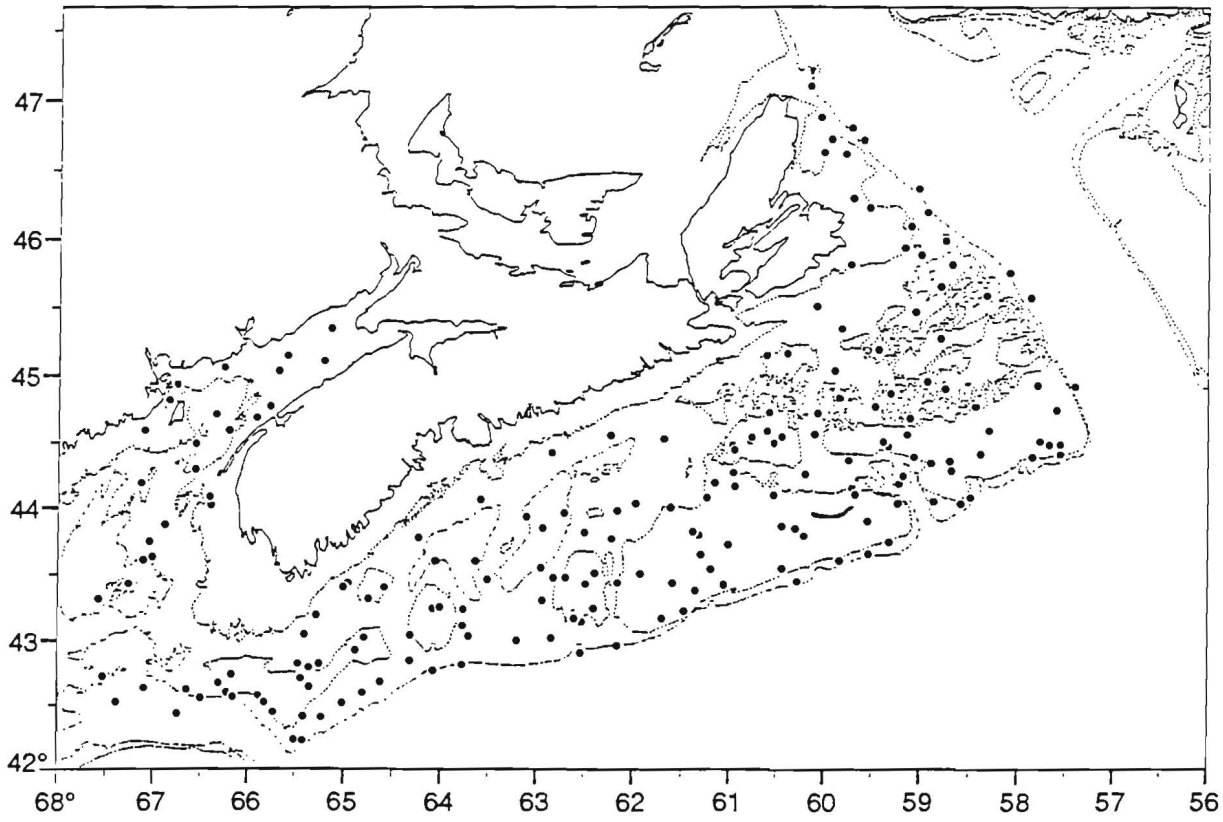
Set locations for Scotia Fundy SUMMER 92 Groundfish survey.



Set locations for Scotia Fundy SUMMER 93 Groundfish survey.



Set locations for Scotia Fundy SUMMER 94 Groundfish survey.



4VsW Cod (R. Mohn, BIO)

1. Abundance

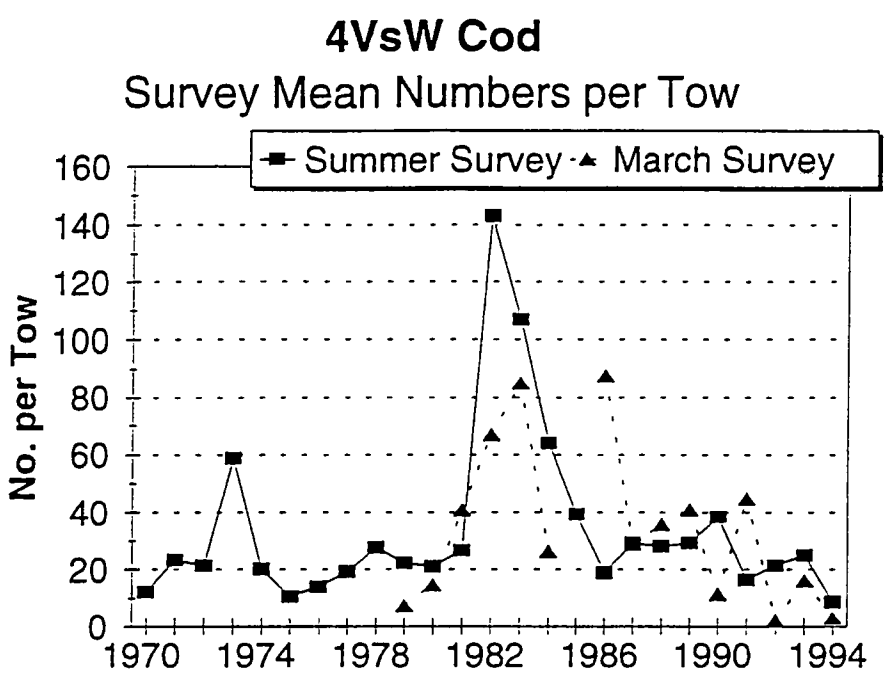
Cod caught in the 1994 summer survey have not yet been aged so only aggregated indices of weight and numbers are available at this time. The average numbers per tow for both the March and summer survey for 1970-94 are shown in Fig. 1. The 1994 summer estimate is about 20% of the recent long-term average (1980-94) and is the lowest since the summer survey was initiated in 1970. The 1994 March point is less than 10% of the average over the same period. The 1992 and 1994 March values are respectively the lowest and second lowest since this survey was initiated in 1979.

2. Recruitment and Size Composition

Length frequencies for both the 1994 March and summer survey are shown in Fig. 2 for the years 1992-94. The minimum legal size of 43 cm is shown for reference. The summer series showed the relatively strong 1990 yearclass as the mode at approximately 20 cm in the 1992 survey and at approximately 30 cm in the 1993 survey. Even though the fishery was closed in September, 1993, this yearclass is not evident in the 1994 survey. In the March survey, two modes are seen in the plot for 1993. The mode at 25 cm is the aforementioned 1990 yearclass. The March series is inconsistent over the last three years which may reflect availability rather than abundance as the resource declines.

3. Distribution

Fig. 3 shows the distribution of catches for the last four years. The general pattern remains the same with diminution in all areas. However, the abundance in 4Vs and especially on the Eastern tip of Banquereau appears to have fallen relatively more rapidly.


4VsW Cod
Survey Mean Numbers per Tow
Summer Survey
March Survey
No. per Tow
160
140
120
100
80
60
40
20
0
1970
1974
1978
1982
1986
1990
1994

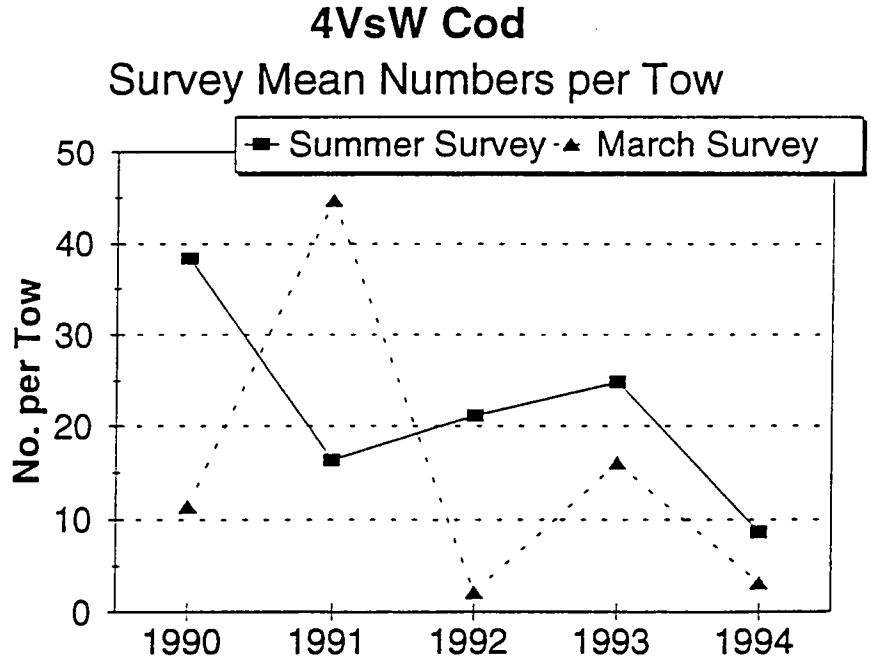
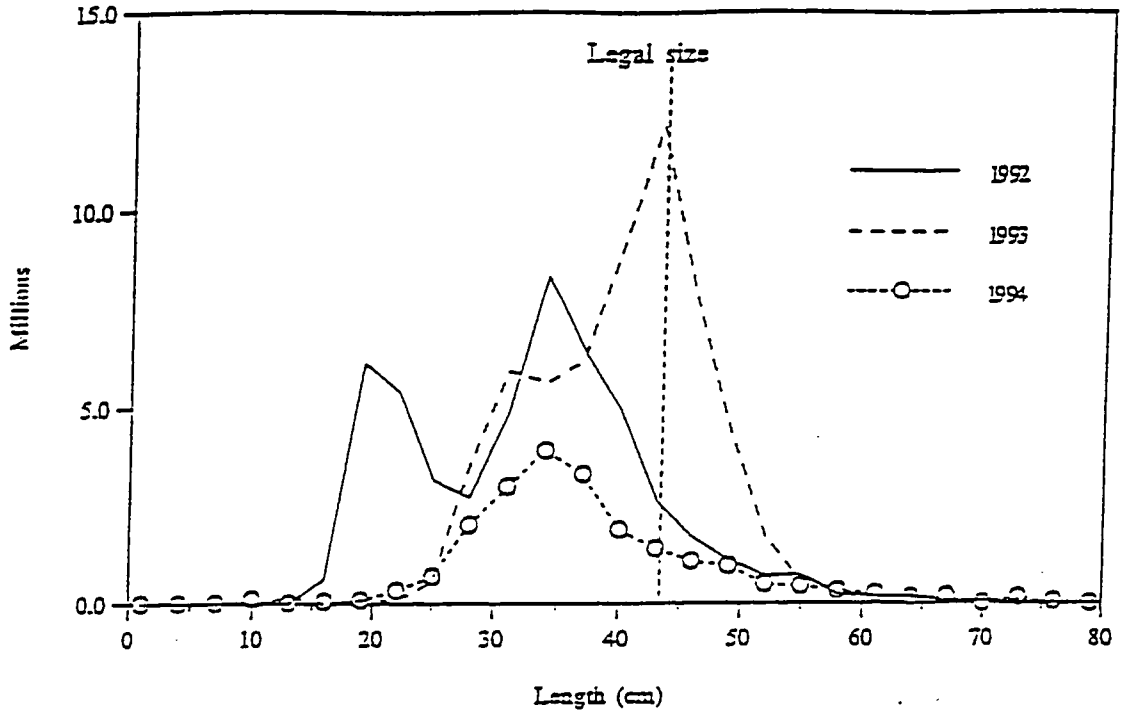

4VsW Cod
Survey Mean Numbers per Tow
Summer Survey
March Survey
No. per Tow
50
40
30
20
10
0
1990
1991
1992
1993
1994

Figure 1.

4VsW cod summer survey length frequencies 1992 - 94.



4VsW cod March survey length frerquencies 1992 - 94.

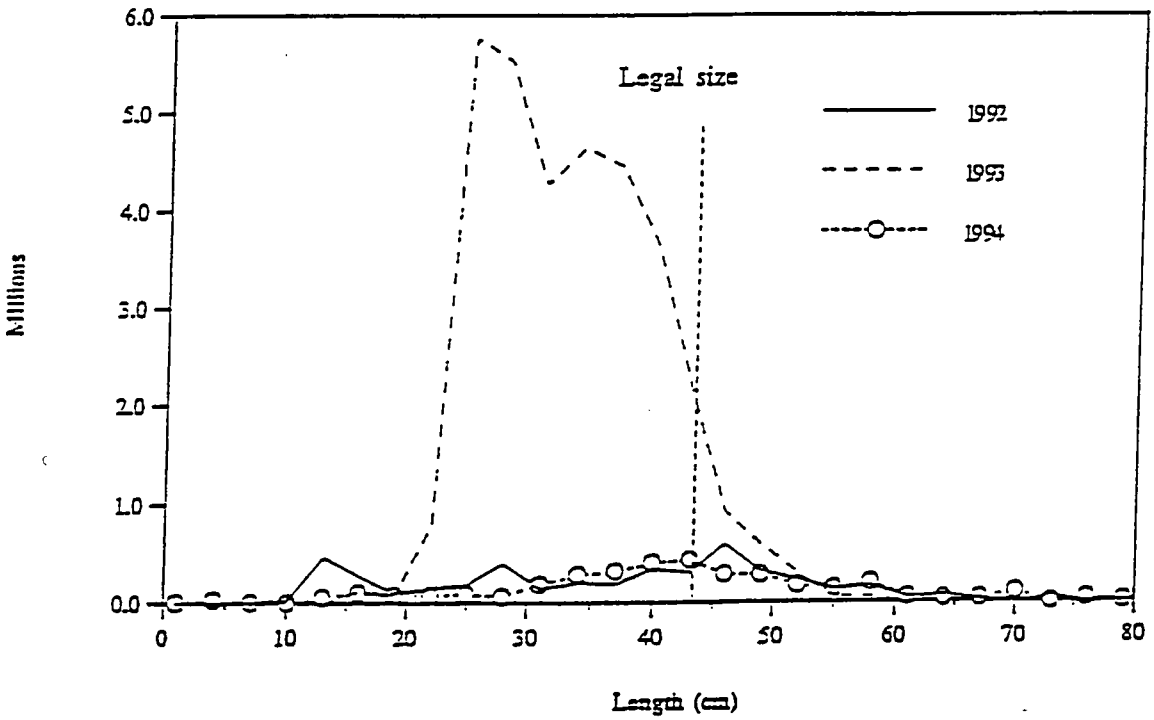
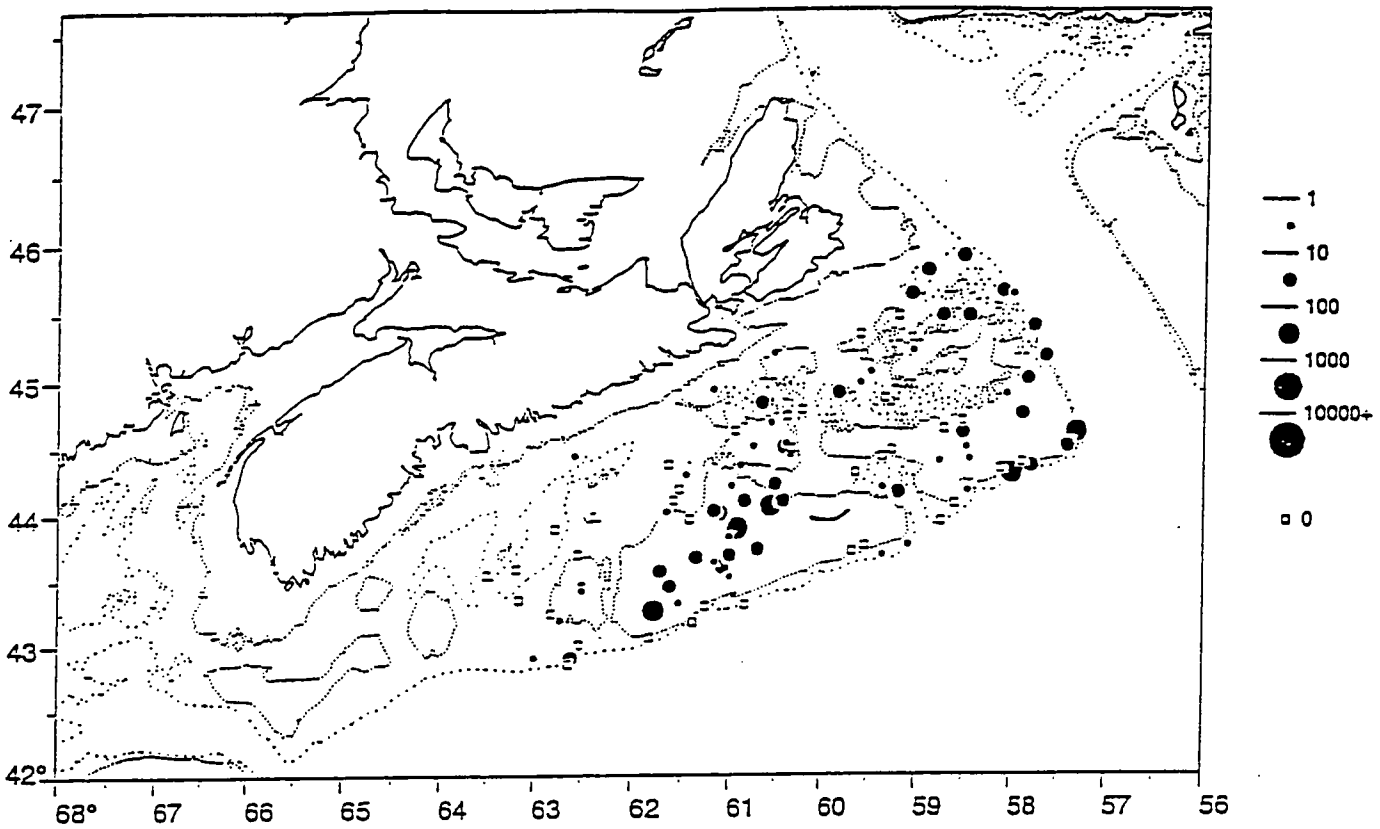


Figure 2.

4VSW SUMMER COD CATCHES (KG) IN SCOTIA FUNDY SUMMER 91 GROUNDFISH SURVEY.



4VSW SUMMER COD CATCHES (KG) IN SCOTIA FUNDY SUMMER 92 GROUNDFISH SURVEY.

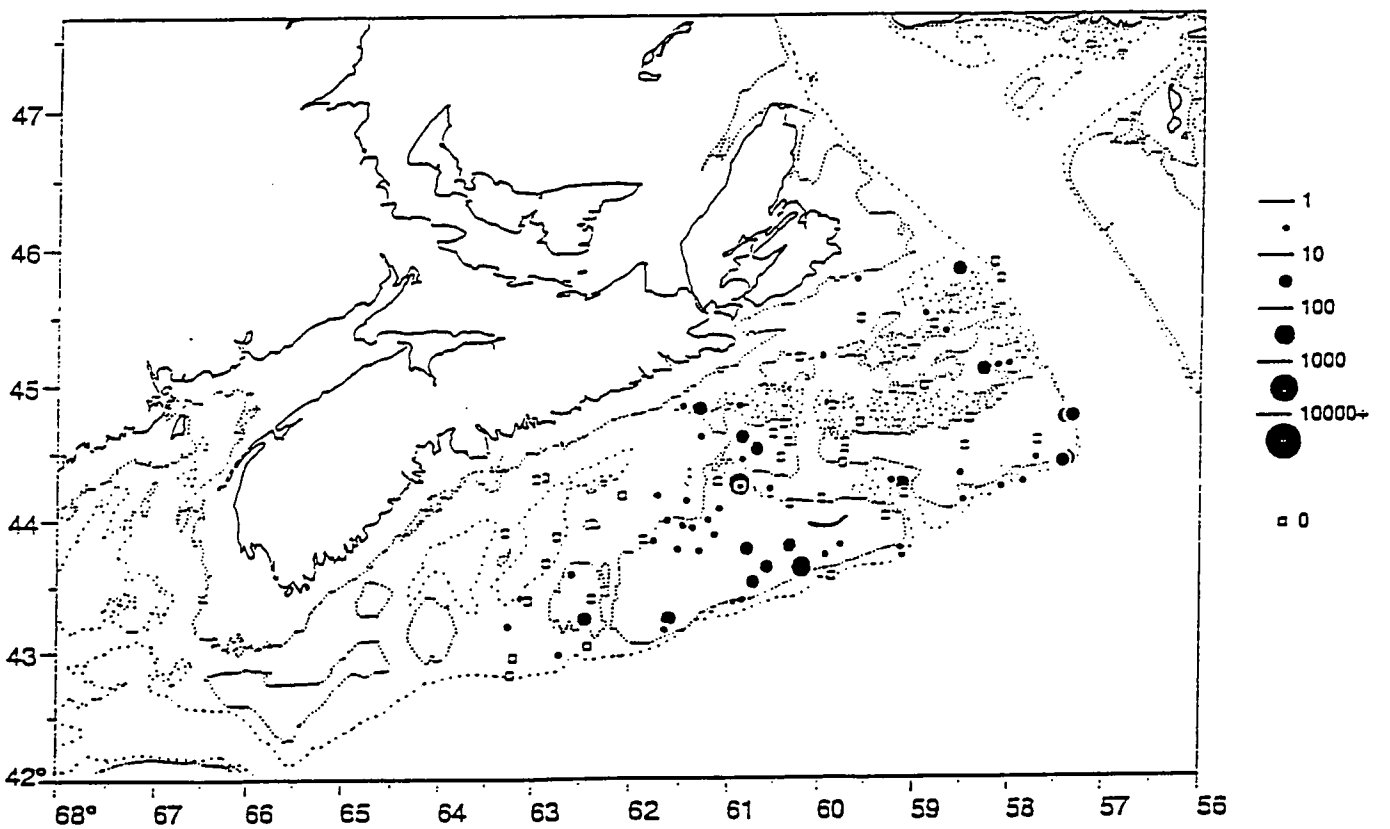
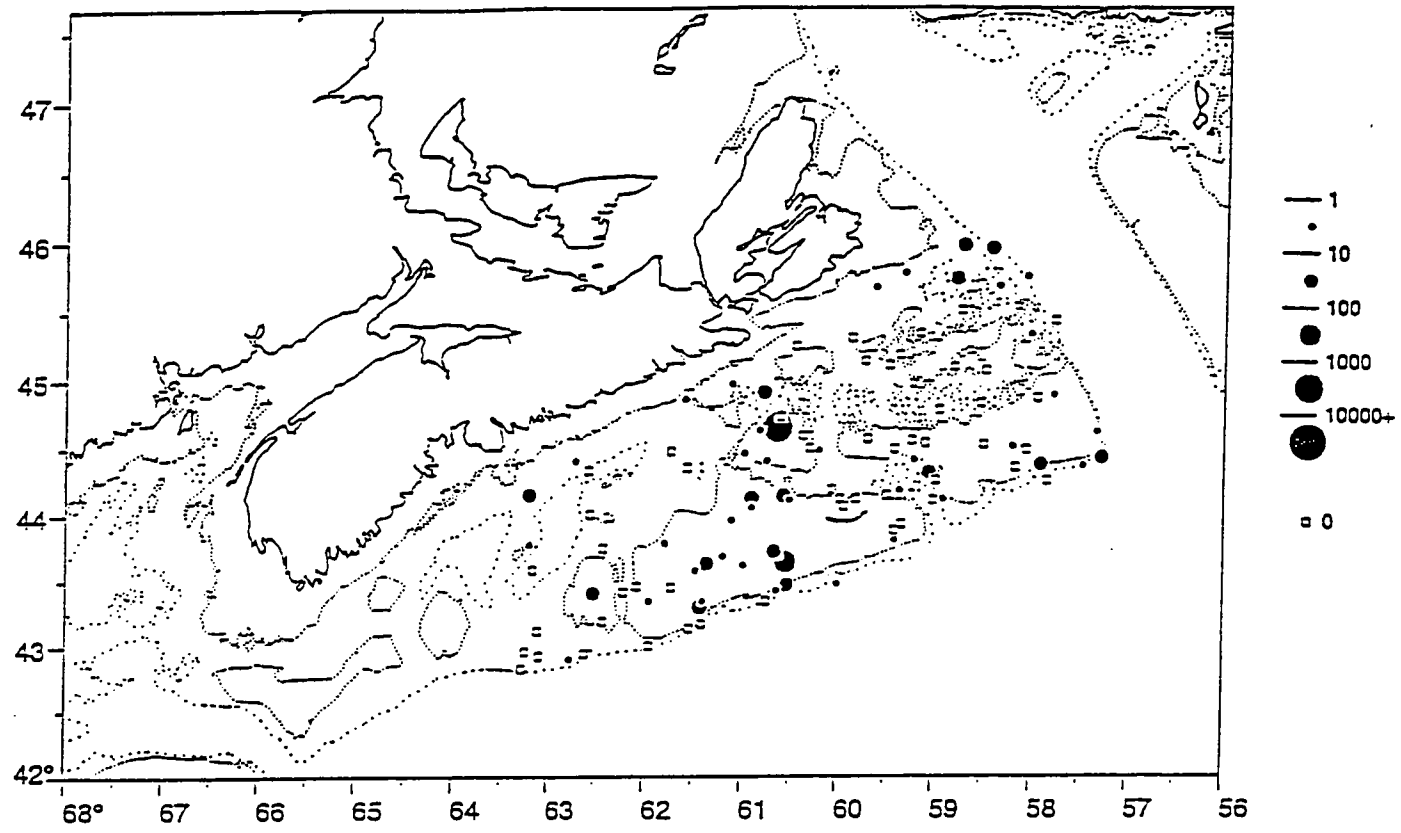


Figure 3.

4VSW SUMMER COD CATCHES (KG) IN SCOTIA FUNDY SUMMER 93 GROUNDFISH SURVEY.



4VSW SUMMER COD CATCHES (KG) IN SCOTIA FUNDY SUMMER 94 GROUNDFISH SURVEY.

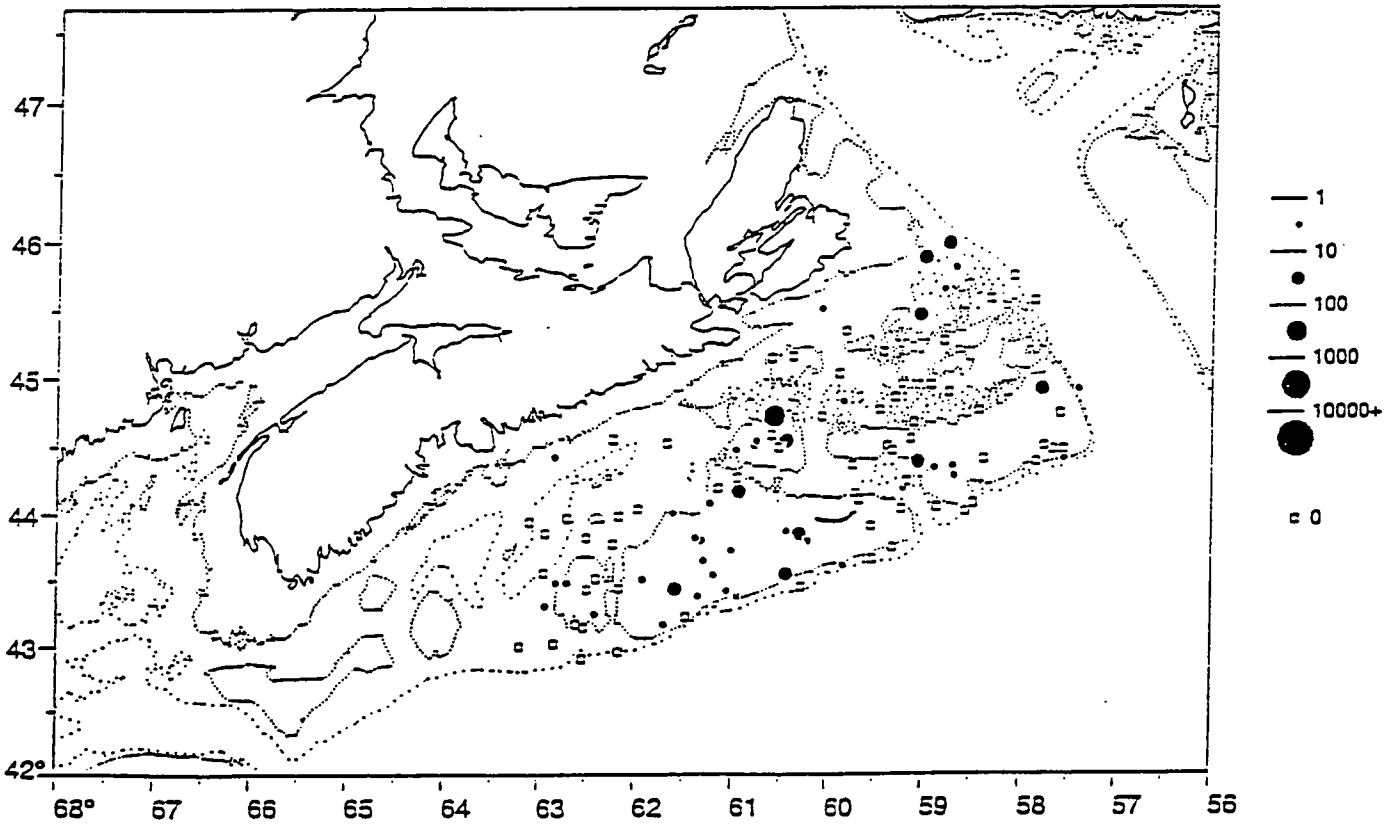


Figure 3. (Continued)

4X Cod (D. Clark and E. Trippel, SABS)

1. Abundance

The results from the 1994 summer survey appear as the final points on Figs. 4 and 5 and are compared to the projected populations based on the May 1994 assessment. The 1994 results are generally in good agreement, within the range of uncertainty, with the results of the assessment. A notable difference is seen in higher survey index for age 3, the 1991 yearclass. For this yearclass the geometric mean recruitment value was used as a population estimate, in the May assessment, following standard protocol. The 1994 survey suggests that the 1991 yearclass may be more abundant than average; however, this is the first estimate available of the size of this yearclass, and further data are necessary to corroborate it. In general, the abundance of age 5 and older cod remain well below the long-term average (Fig. 5).

2. Recruitment and Size Composition

Catches of small fish in the 1994 survey were good compared to those in the previous three surveys (Fig. 6). Particularly noticeable are the relatively high catch of cod around 10 cm in length. These are fish of the 1994 yearclass. It is too early to state whether or not this represents good recruitment.

3. Distribution

The distribution of sets and cod captures were similar to previous years, but tends to indicate reduced abundance of cod on Browns, Baccaro, LaHave and Roseway Banks, relative to the Bay of Fundy.

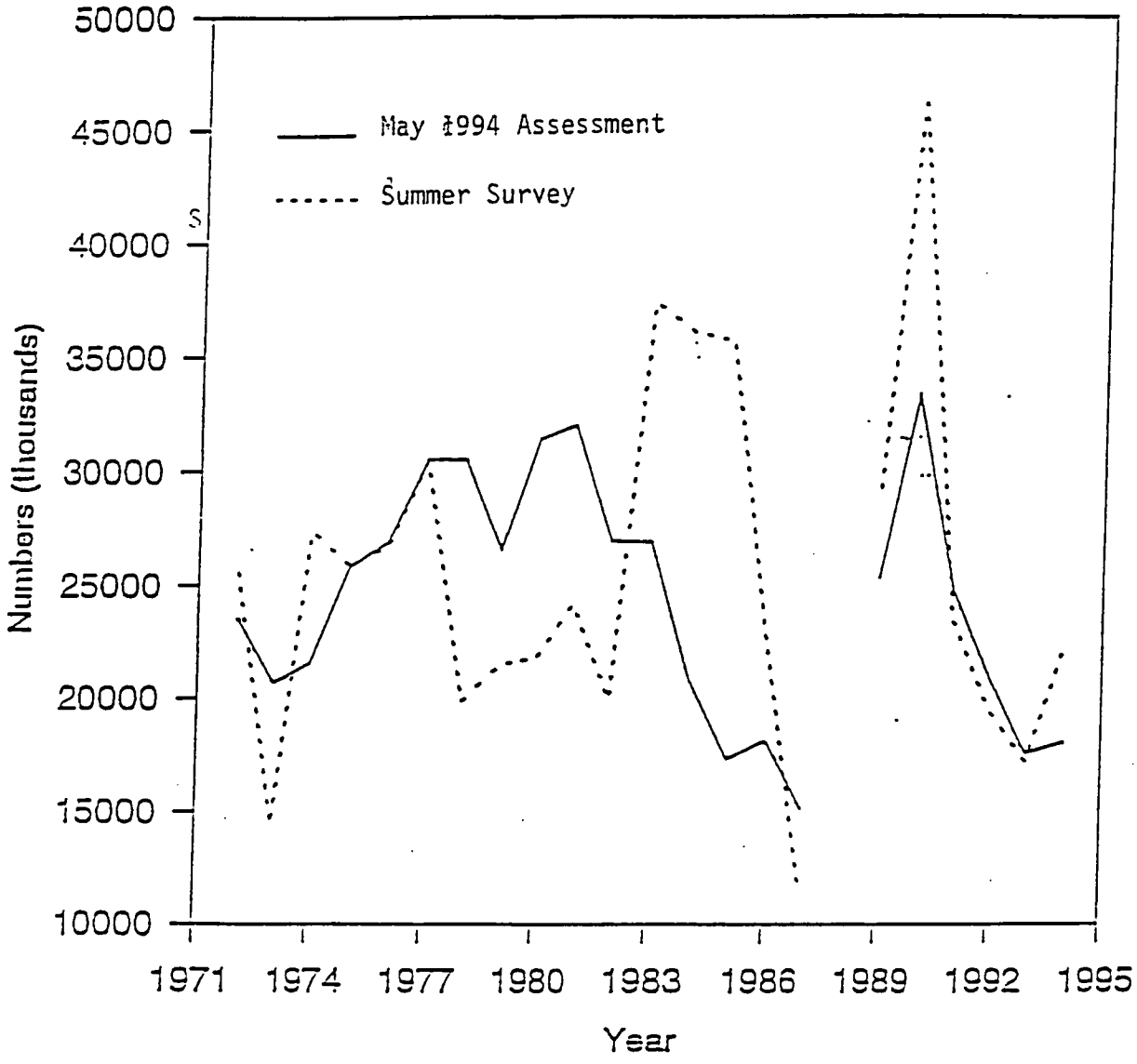


Figure 4. Summer survey estimates of 4X cod abundance, compared to mid-year population numbers produced during May 1994 assessment.

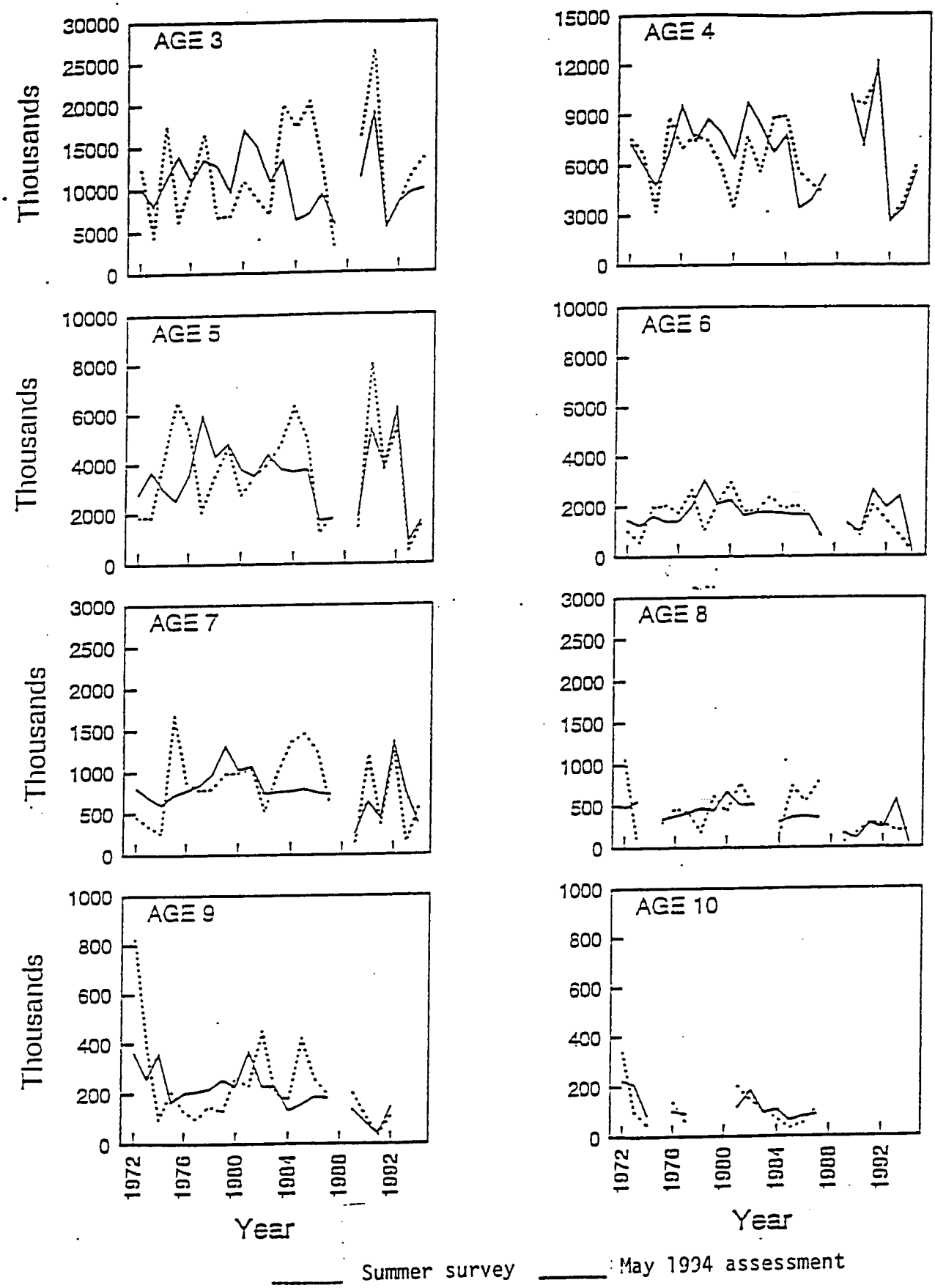


Figure 5. Summer survey estimates of 4X cod by age, compared to mid-year population numbers produced during May 1994 assessment.

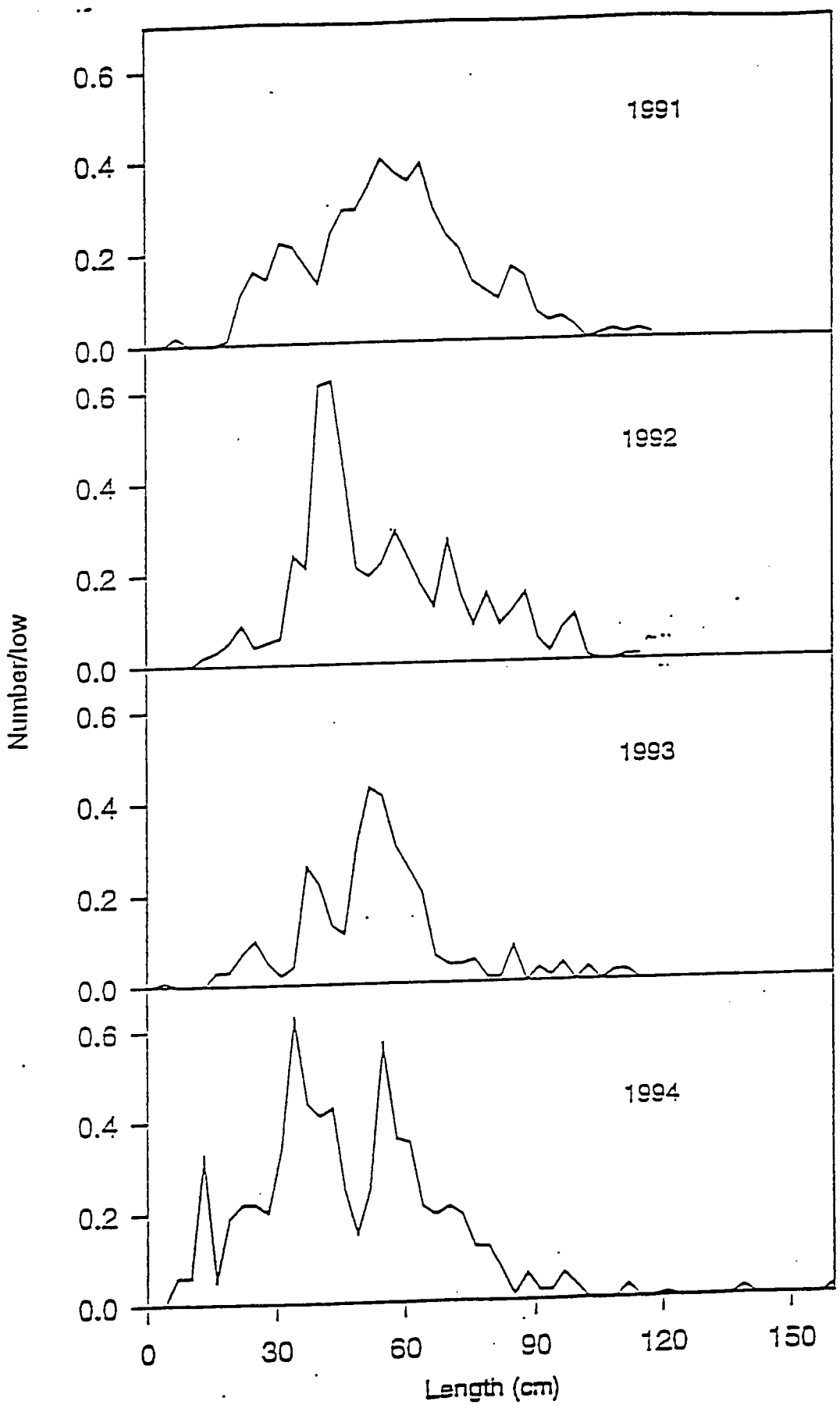
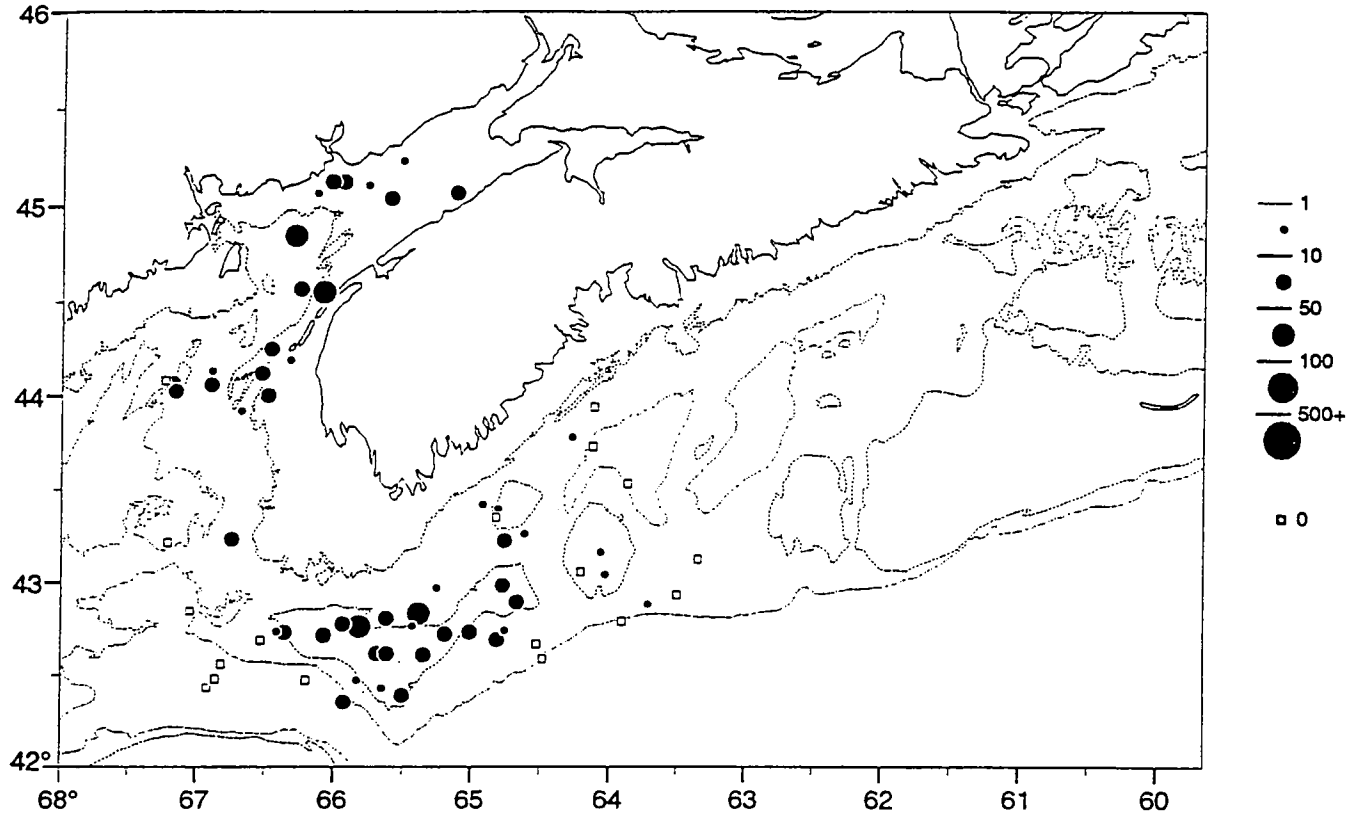


Figure 6. Mean numbers per tow at length of 4X cod from summer groundfish surveys.

4X COD CATCHES (KG) FROM SCOTIA FUNDY SUMMER 91 GROUNDFISH SURVEY



4X COD CATCHES (KG) FROM SCOTIA FUNDY SUMMER 92 GROUNDFISH SURVEY

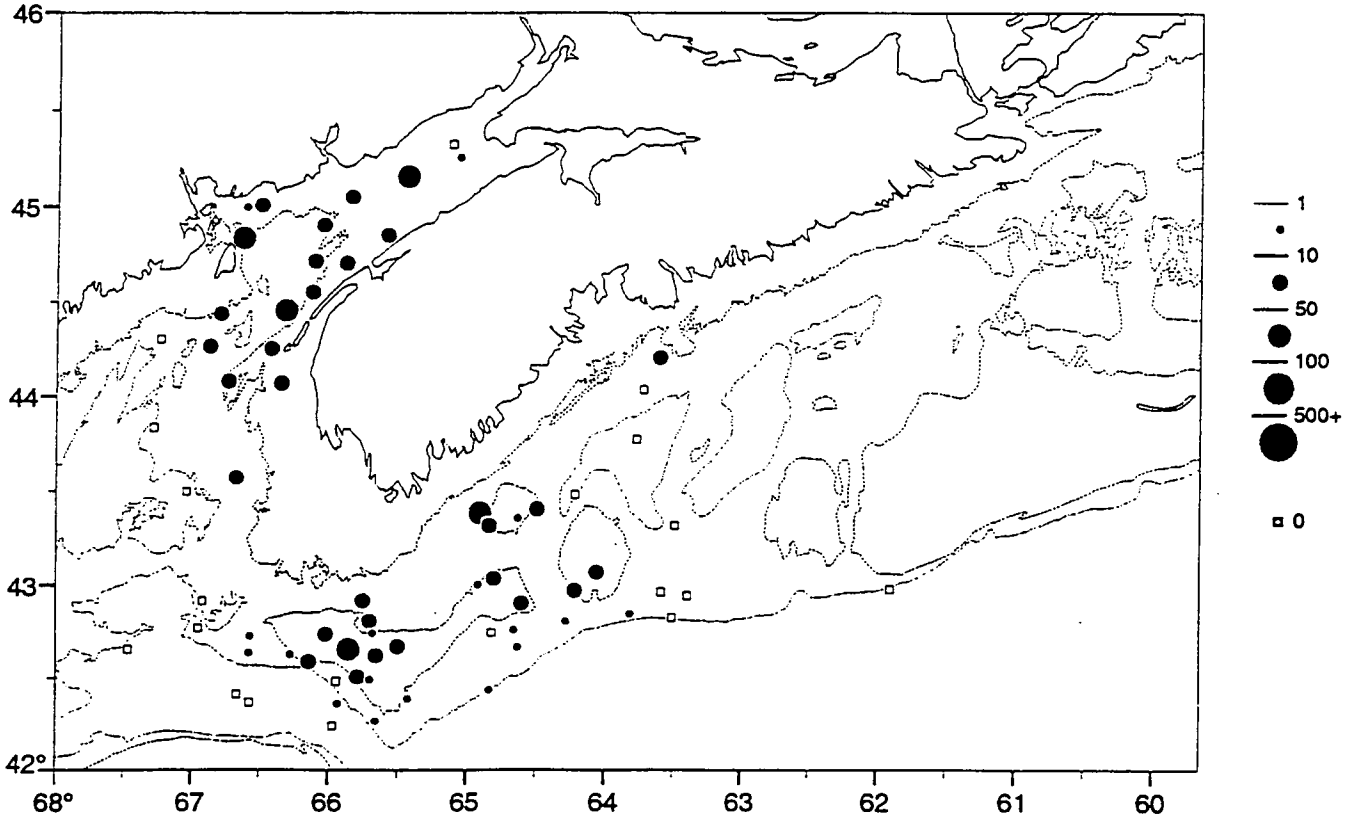
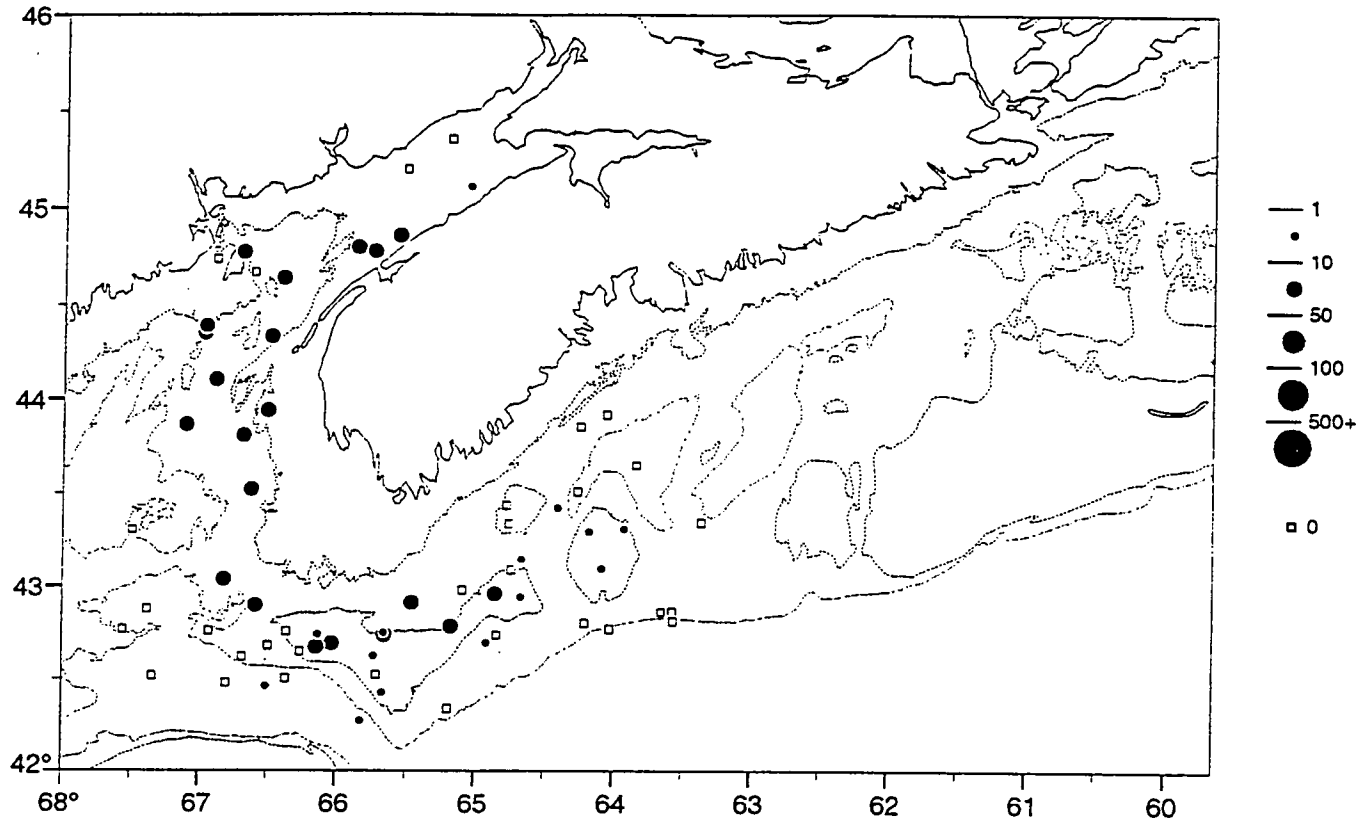


Figure 7.

4X COD CATCHES (KG) FROM SCOTIA FUNDY SUMMER 93 GROUNDFISH SURVEY



4X COD CATCHES (KG) FROM SCOTIA FUNDY SUMMER 94 GROUNDFISH SURVEY

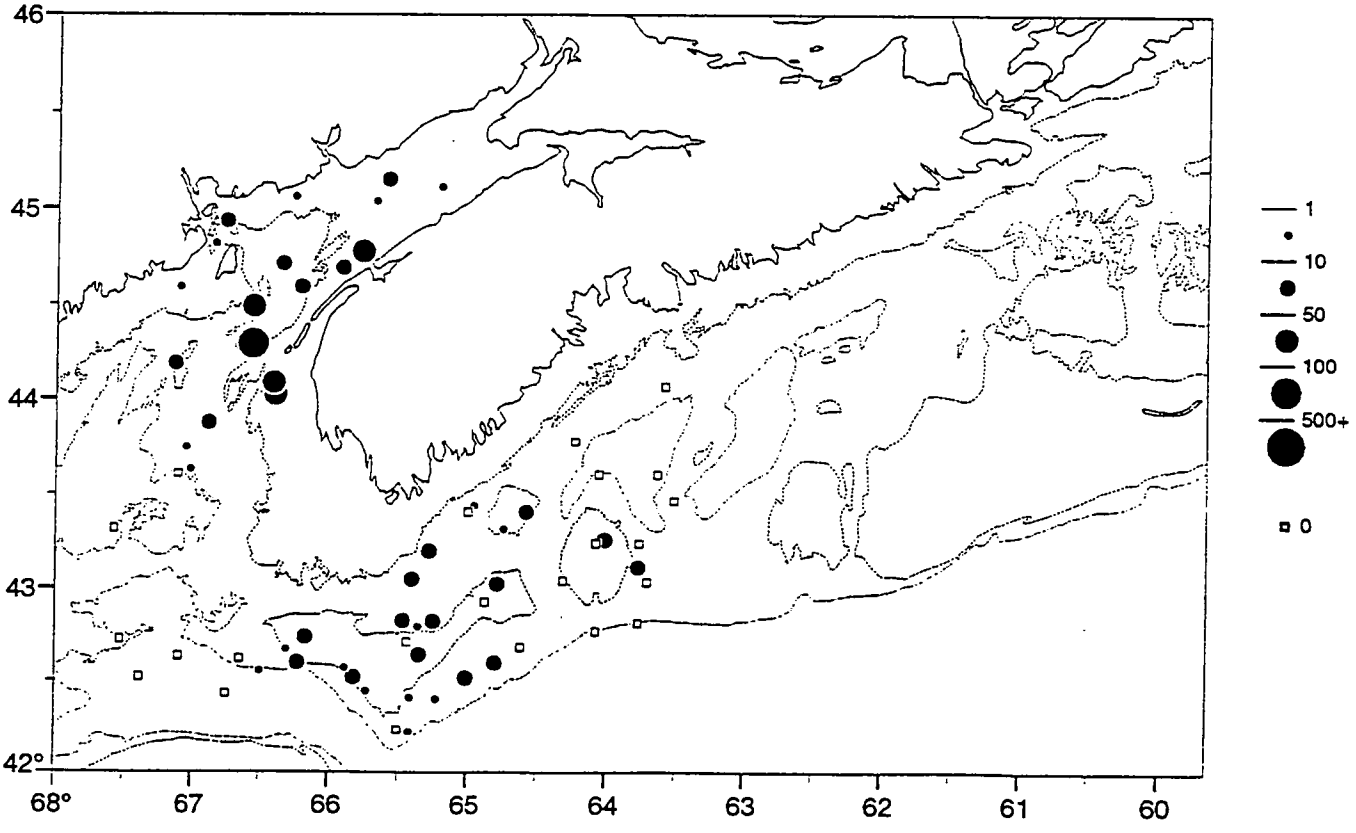


Figure 7. (Continued)

4TVW Haddock (K. Zwanenburg)

1. Abundance

Summer survey mean number per tow for the stock area (all sizes combined) has been relatively stable for the past three years (Fig. 8). This follows a decline in abundance from the early 1980s to a level roughly equivalent to the late 1970s and the implementation of Canada's 200 mile exclusive fishing zone. Abundance remains below the long-term average.

2. Recruitment and Size Composition

The 1994 length-frequency distribution for this stock (expressed as mean number per tow at length) relative to the long-term mean length-frequency distribution (1970-93) shows two noteworthy features (Fig. 9). The first is the presence of the large 1988 yearclass with a modal length of 40 cm. This yearclass which was abundant relative to adjacent cohorts has had an apparently slow growth rate for the past three years. The other features of note are the peaks in catch rate at 24 and 30 cm which indicate above average numbers of recruits in both the 1993 and 1992 yearclasses respectively. This tends to confirm what was observed in the 1993 summer survey.

3. Distribution

The surveys indicate that this resource is centered in the Emerald, Western, Sable Island Bank area (Fig. 10). Survey catches on the eastern end of the Scotian Shelf (e.g. Banquereau Bank) have been low since the decline of the abundant early 1980s yearclasses. There is some indication that the 1993 yearclass is present in above average numbers on Banquereau Bank.

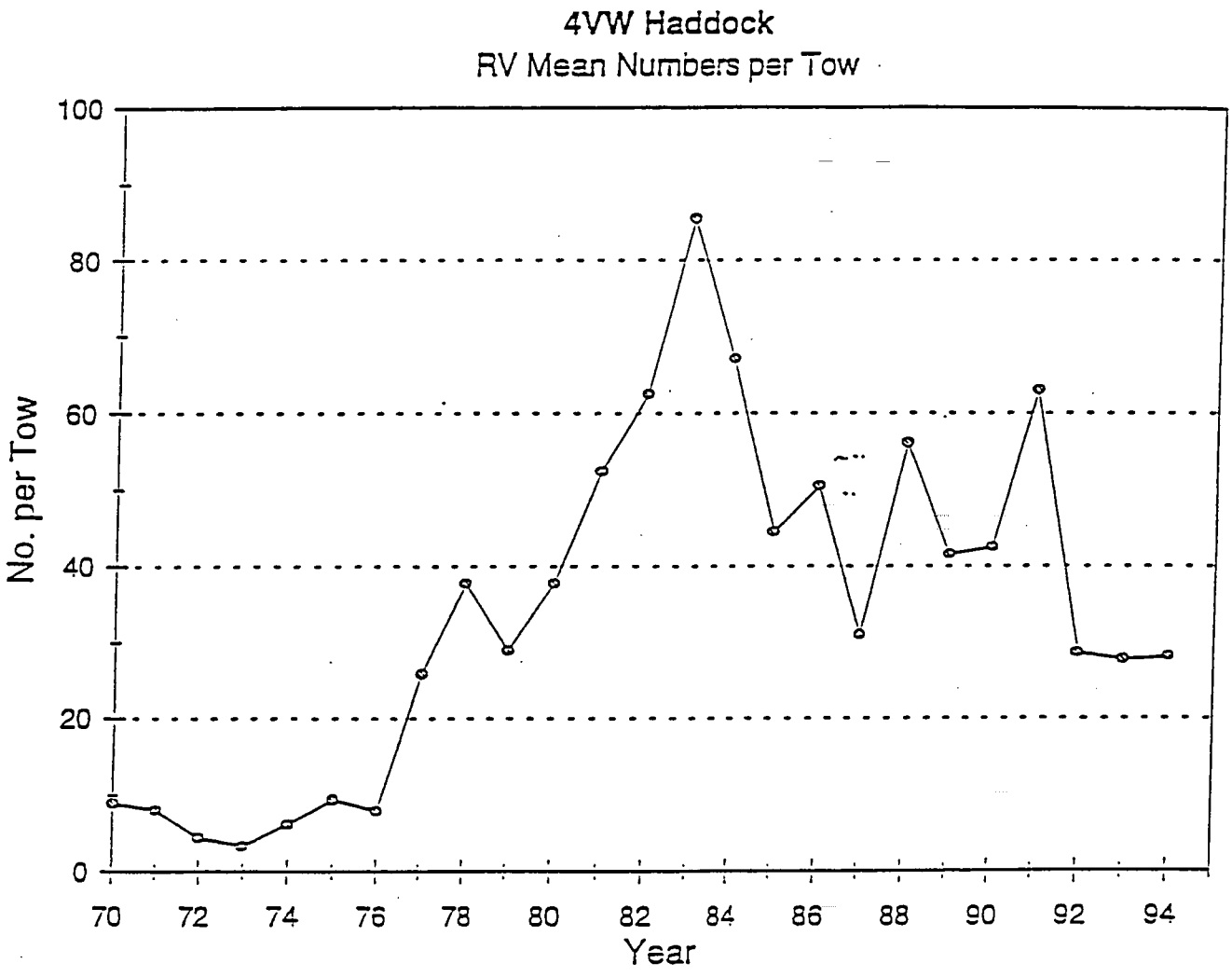

4VW Haddock
RV Mean Numbers per Tow
No. per Tow
100
80
60
40
20
0
70
72
74
76
78
80
82
84
86
88
90
92
94
Year

Figure 8.

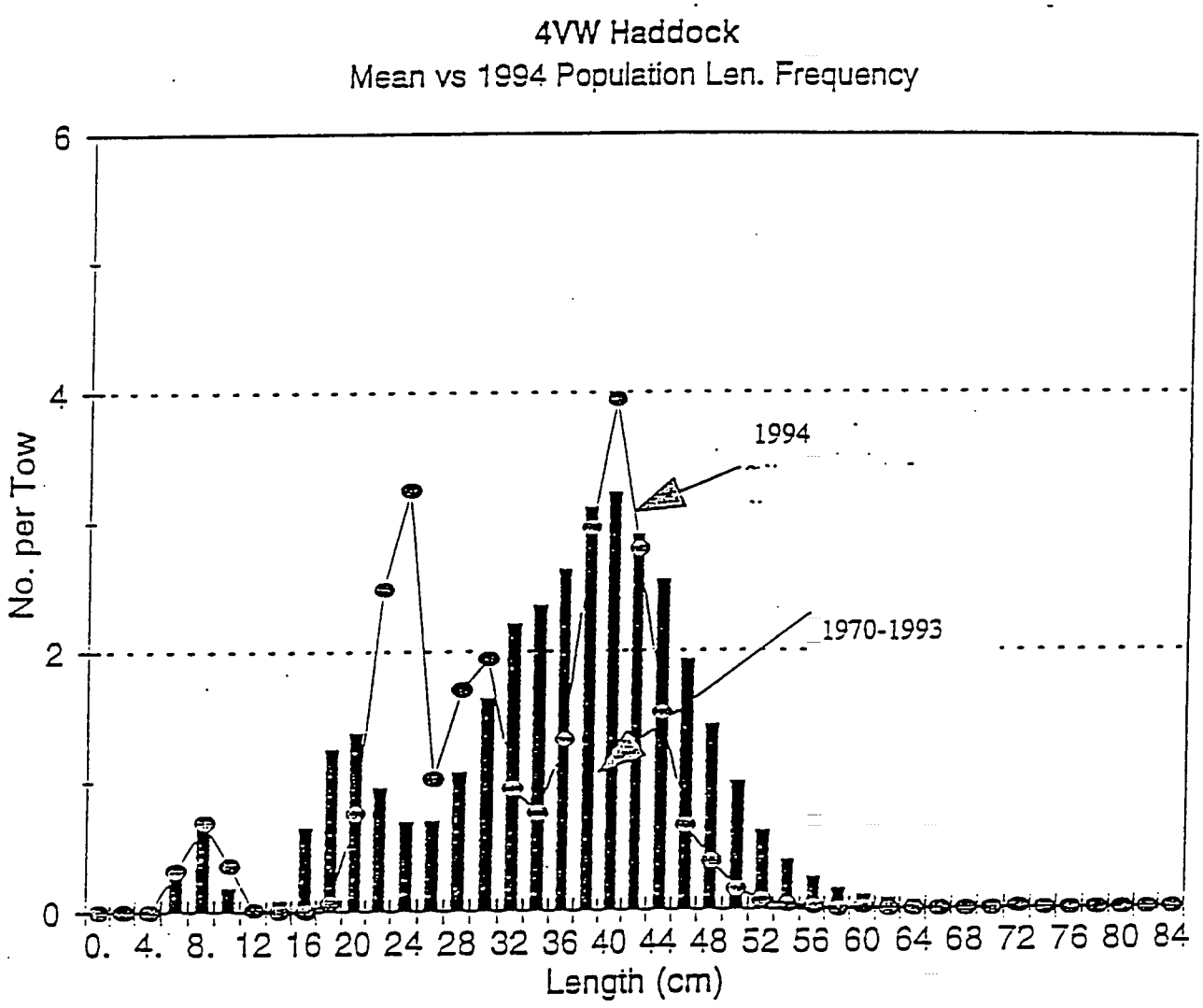
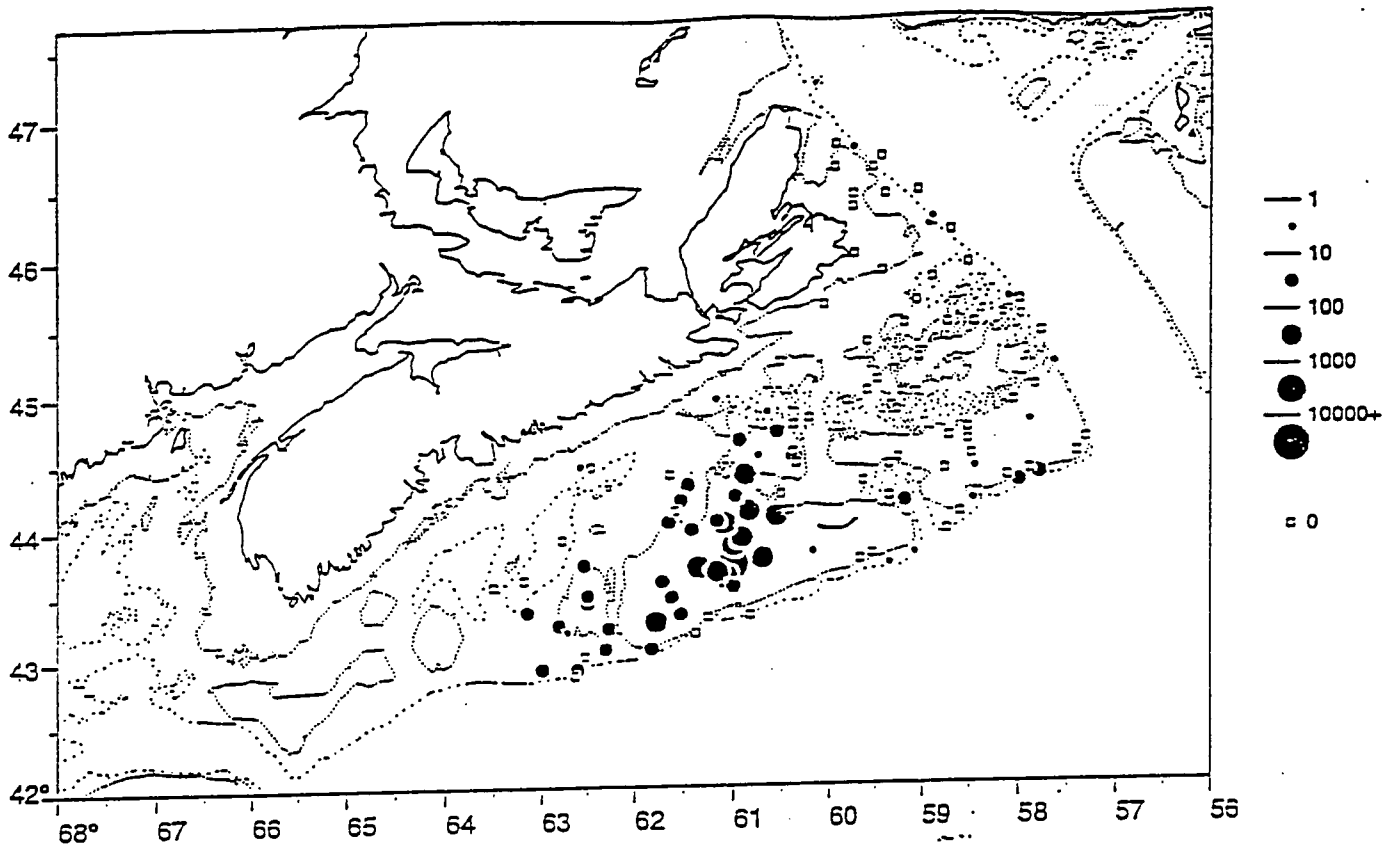

4VW Haddock
Mean vs 1994 Population Len. Frequency
No. per Tow
Length (cm)
1994
1970-1993
0
2
4
6
0. 4. 8. 12 16 20 24 28 32 36 40 44 48 52 56 60 64 68 72 76 80 84

Figure 9.

4TVW HADDOCK CATCHES (KG) IN SCOTIA FUNDY SUMMER 91 GROUNDFISH SURVEY.



4TVW HADDOCK CATCHES (KG) IN SCOTIA FUNDY SUMMER 92 GROUNDFISH SURVEY.

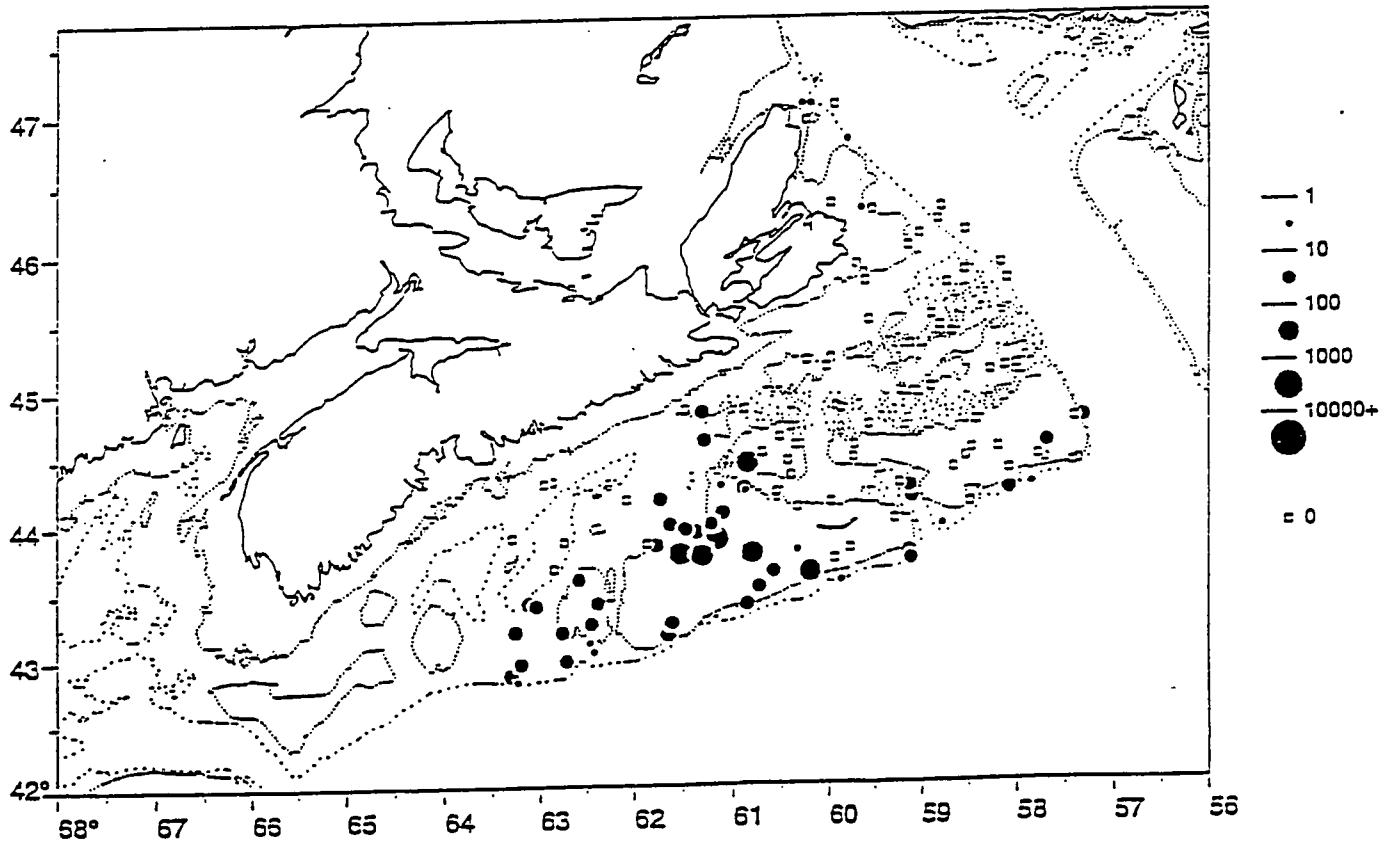
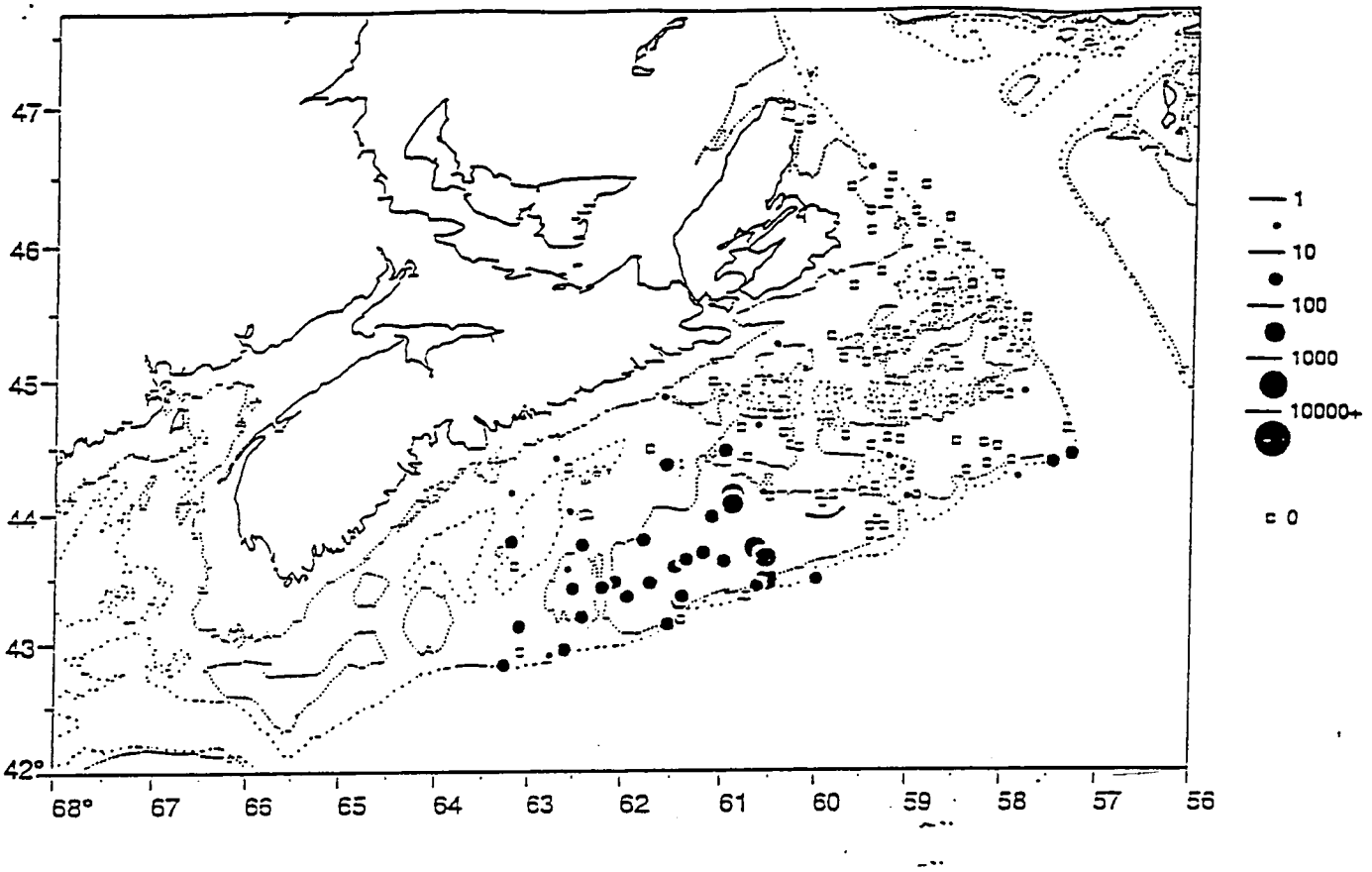


Figure 10.

4TVW HADDOCK CATCHES (KG) IN SCOTIA FUNDY SUMMER 93 GROUNDFISH SURVEY.



4TVW HADDOCK CATCHES (KG) IN SCOTIA FUNDY SUMMER 94 GROUNDFISH SURVEY.

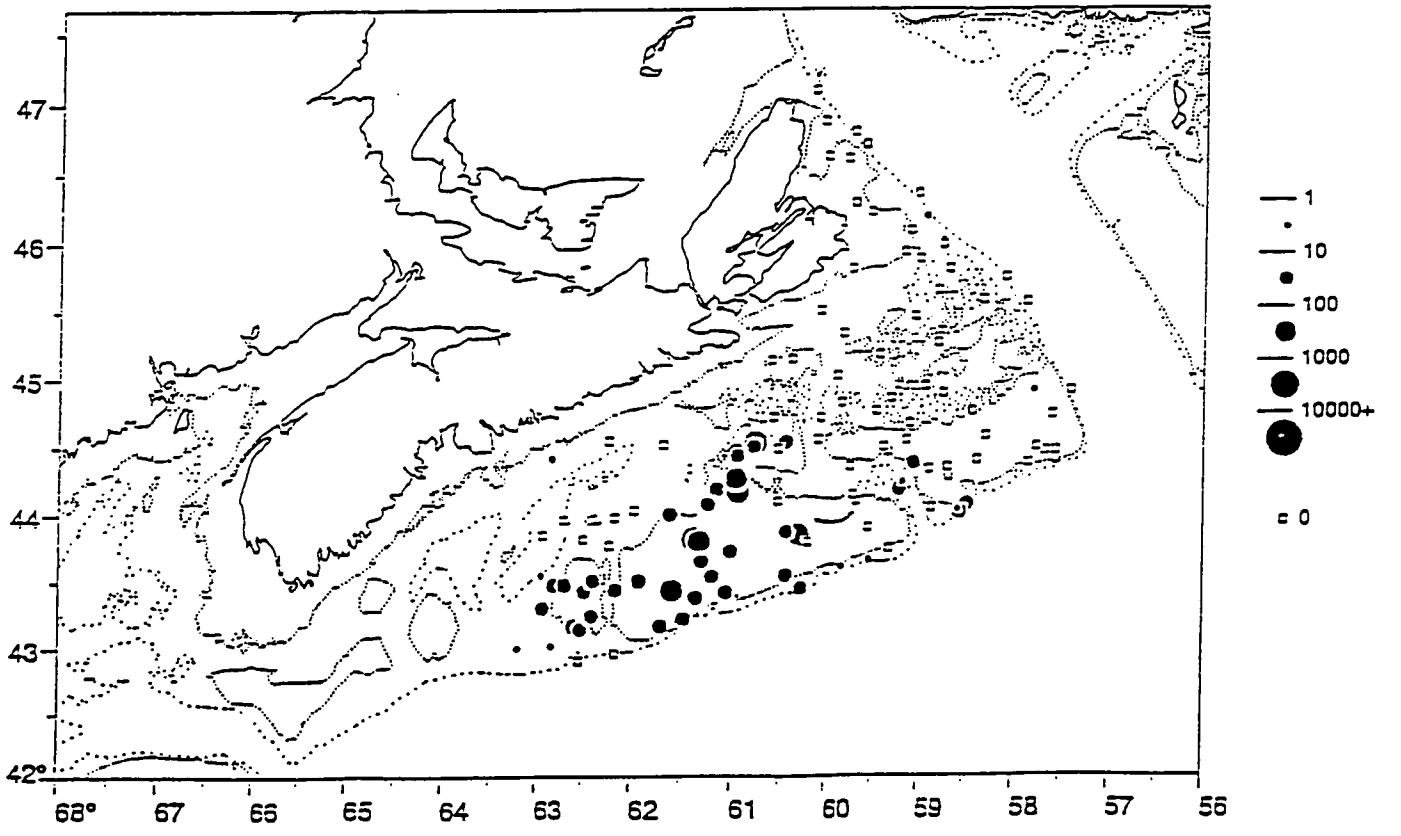


Figure 10. (Continued)

4X Haddock (P. Hurley, BIO)

1. Abundance

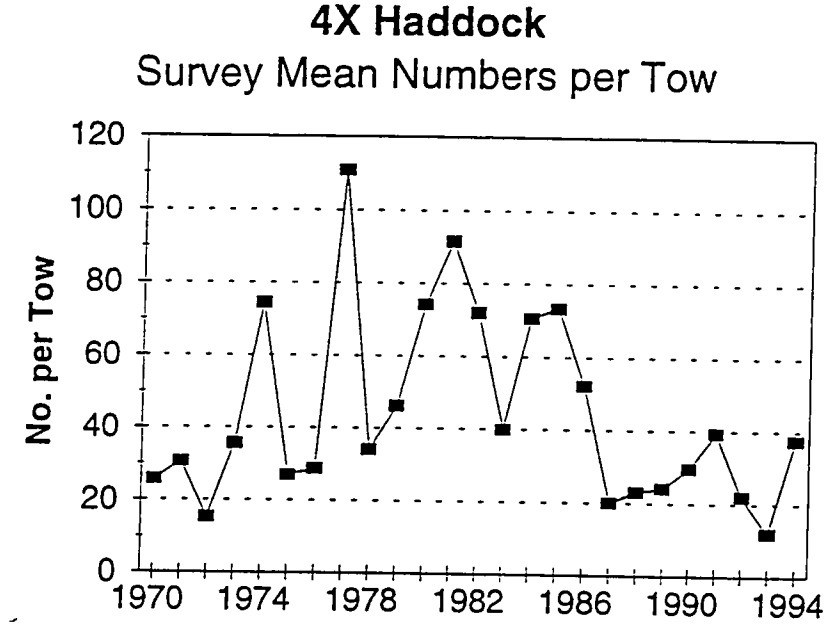
Mean number per tow of 4X haddock in the summer survey increased from a historical low of 12 fish per tow in 1993 to 37 fish per tow in 1994 (Fig. 11); however, mean weight per tow increased from 9 kg per tow to 16 kg per tow in 1994 (Fig. 11), relative to a historical average of 37 kg per tow. The substantial increase in 1994 in mean number per tow, relative to mean weight per tow, was due to the catch of large numbers of small haddock (Fig. 12d). The catch of haddock at modal lengths of 8 and 24 cm (representing haddock aged 0 and 1 years old) was much larger than average. Catches of this magnitude may indicate strong incoming yearclasses. This need to be confirmed in future surveys as haddock in these yearclasses grow and become more available to the survey gear. The 1994 survey indicates that the abundance of haddock of market sizes (>43cm) has increased slightly, but is only half the long-term average (Fig. 12d).

2. Recruitment and Size Composition

Length frequency distributions from the last four summer surveys (Fig. 12) indicate that the 1989 yearclass is weak, perhaps the weakest ever recorded by the summer survey. The 1990-92 yearclasses appear smaller than average while those of 1993-94 appear much stronger than average. Future surveys will be required to confirm these estimates.

3. Distribution

The distribution of haddock in NAFO Division 4X in the 1994 summer survey was not markedly different from previous years (Fig. 13); the increases in 1994 occurred on LaHave and Baccaro Banks and in the Bay of Fundy.


4X Haddock
Survey Mean Numbers per Tow
No. per Tow
120
100
80
60
40
20
0
1970
1974
1978
1982
1986
1990
1994

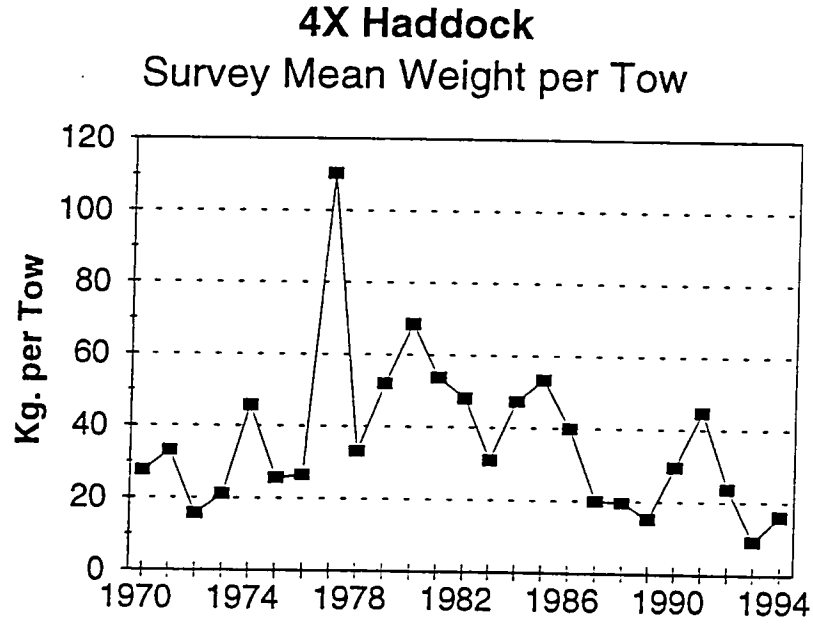

4X Haddock
Survey Mean Weight per Tow
Kg. per Tow
120
100
80
60
40
20
0
1970
1974
1978
1982
1986
1990
1994

Figure 11.

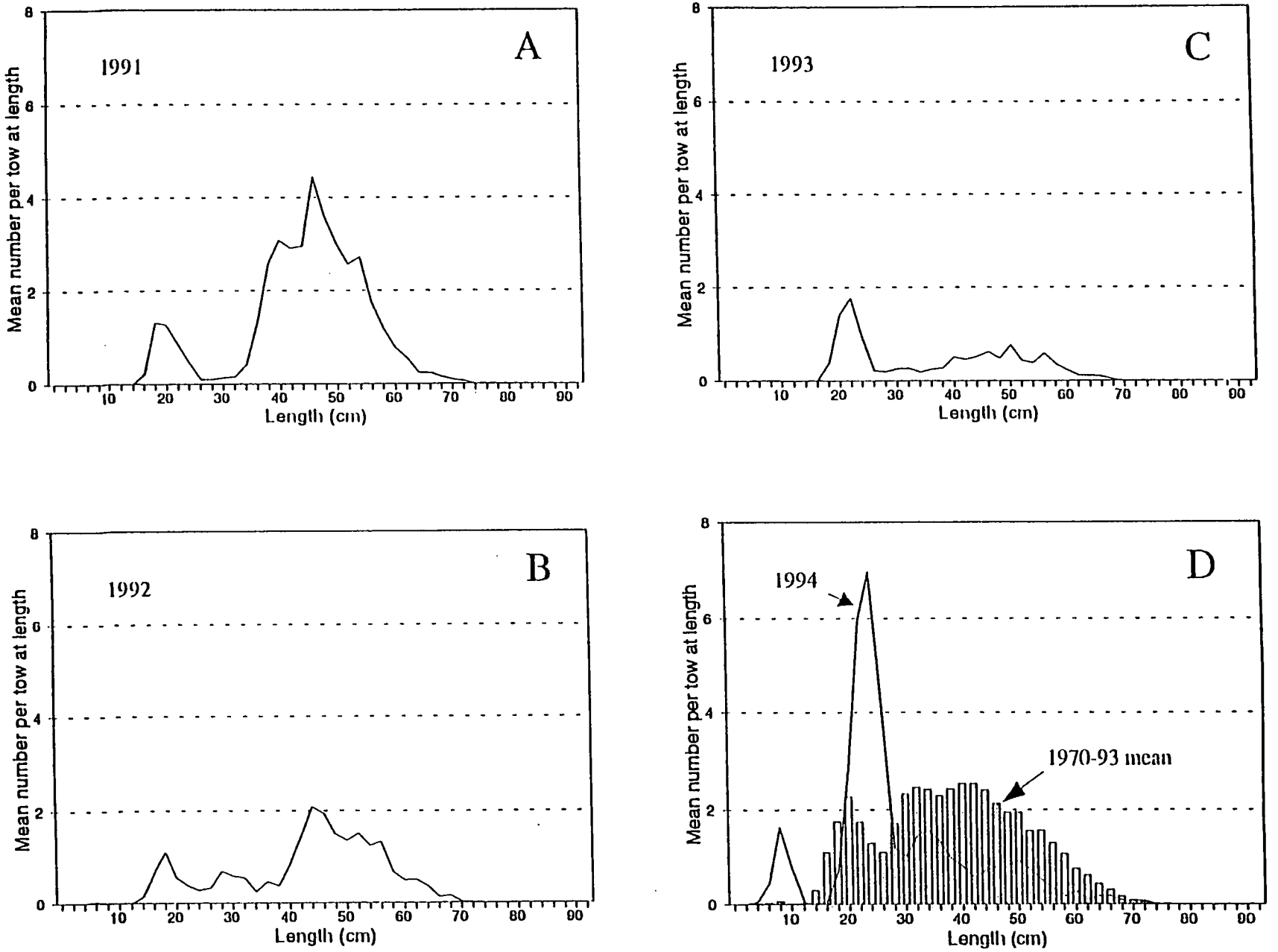
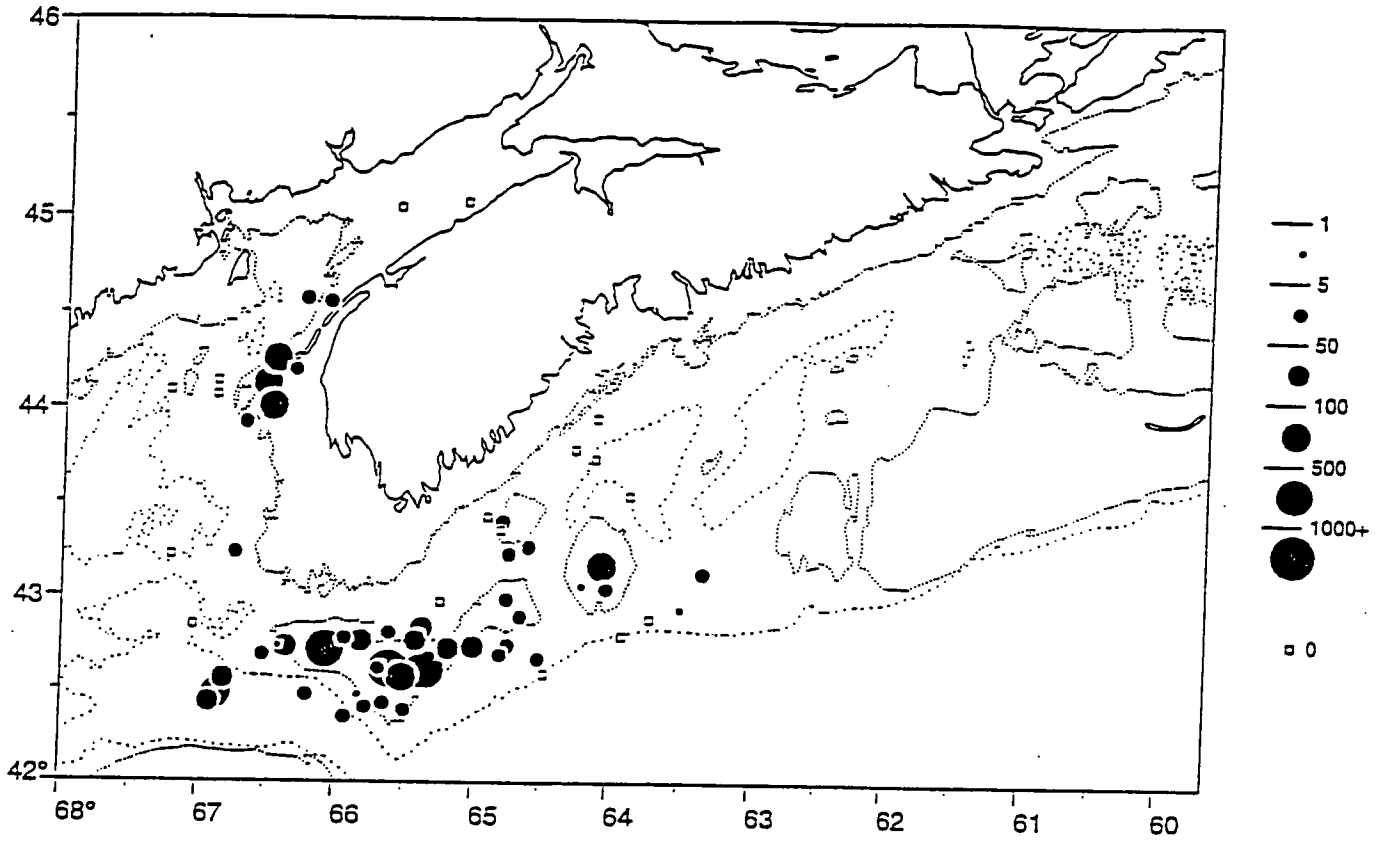


Figure 12. 4X haddock length frequencies for the summer groundfish survey 1991-94 and 1970-93 mean.

4X HADDOCK CATCHES (KG) IN SCOTIA FUNDY SUMMER 91 GROUNDFISH SURVEY.



4X HADDOCK CATCHES (KG) IN SCOTIA FUNDY SUMMER 92 GROUNDFISH SURVEY.

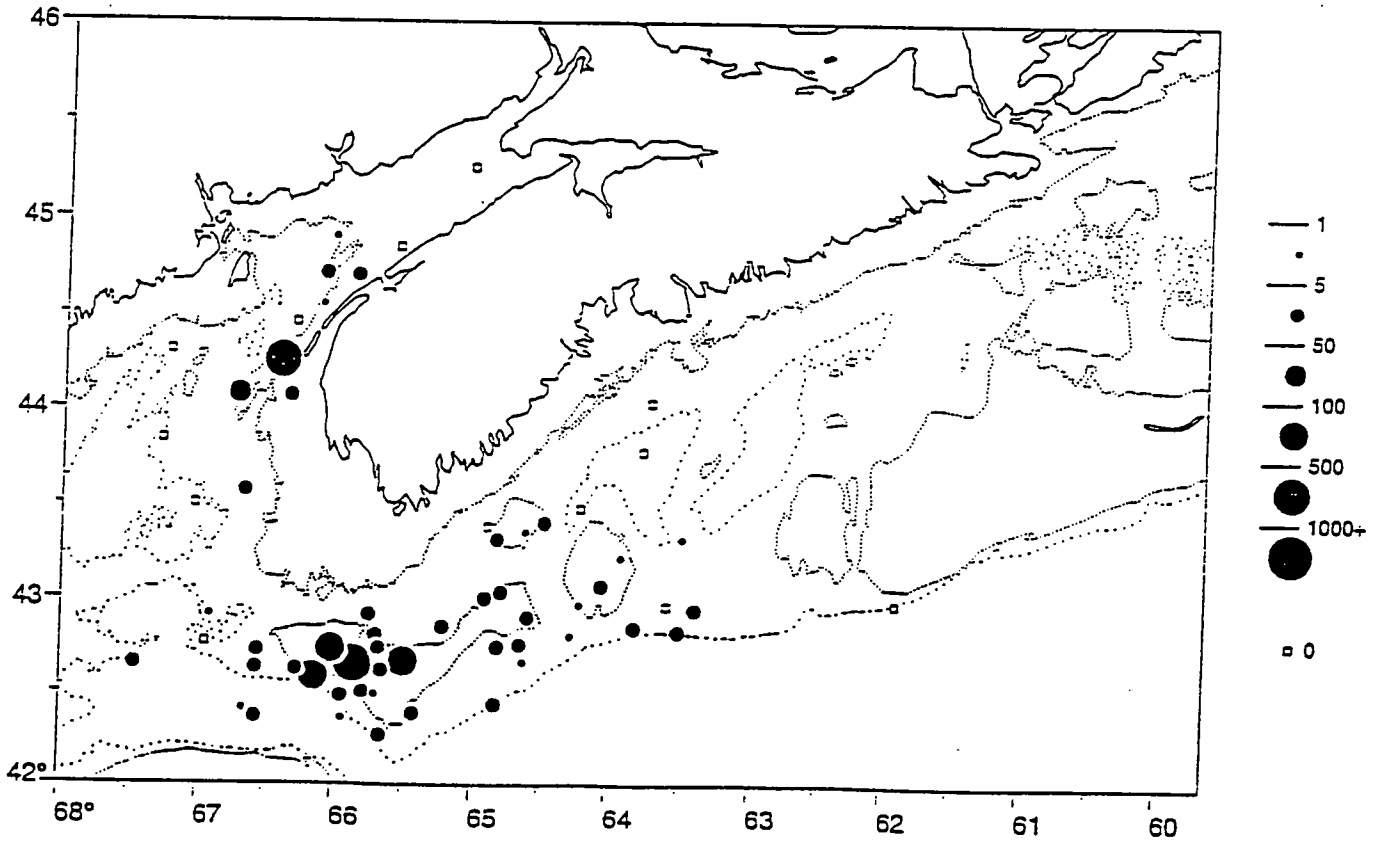
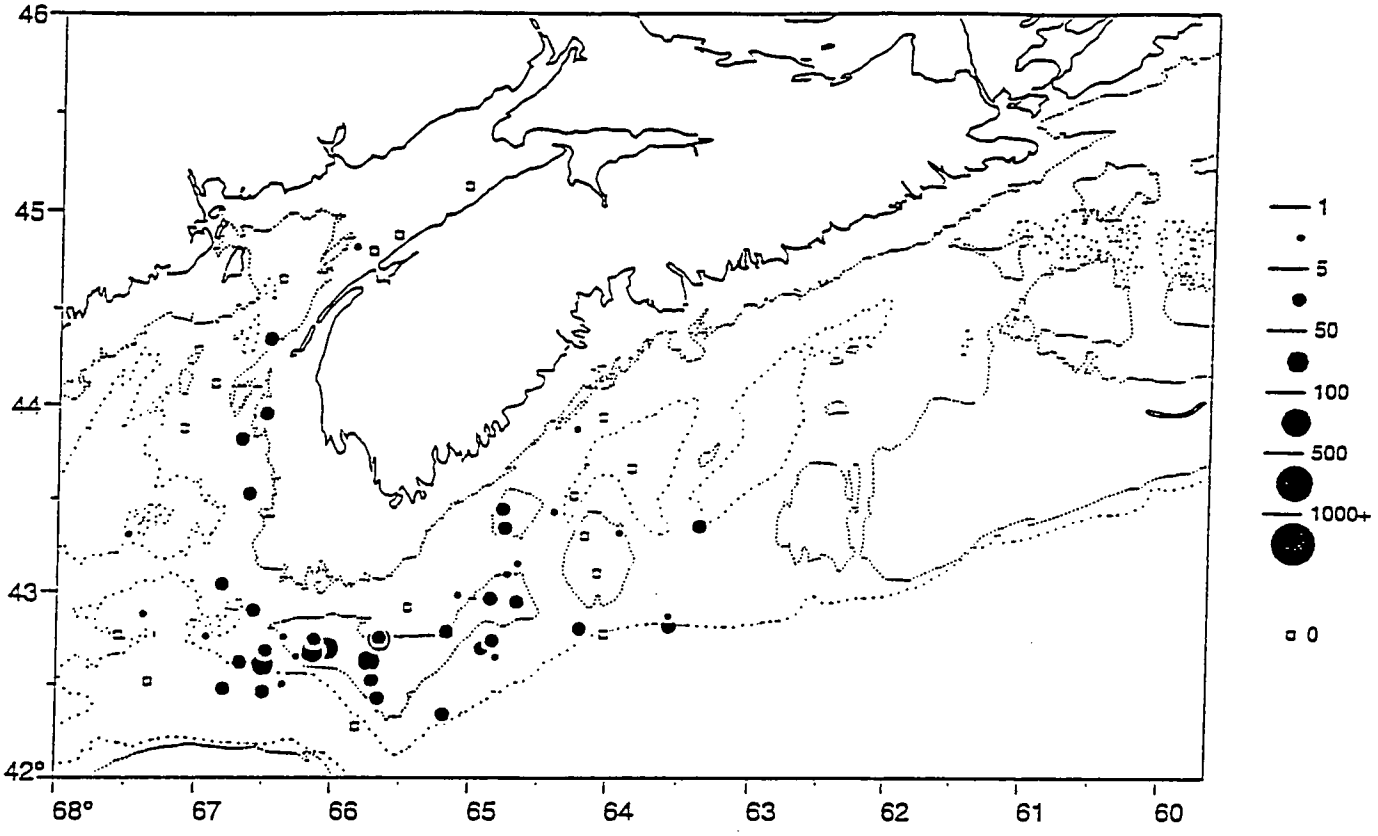


Figure 13.

4X HADDOCK CATCHES (KG) IN SCOTIA FUNDY SUMMER 93 GROUNDFISH SURVEY.



4X HADDOCK CATCHES (KG) IN SCOTIA FUNDY SUMMER 94 GROUNDFISH SURVEY.

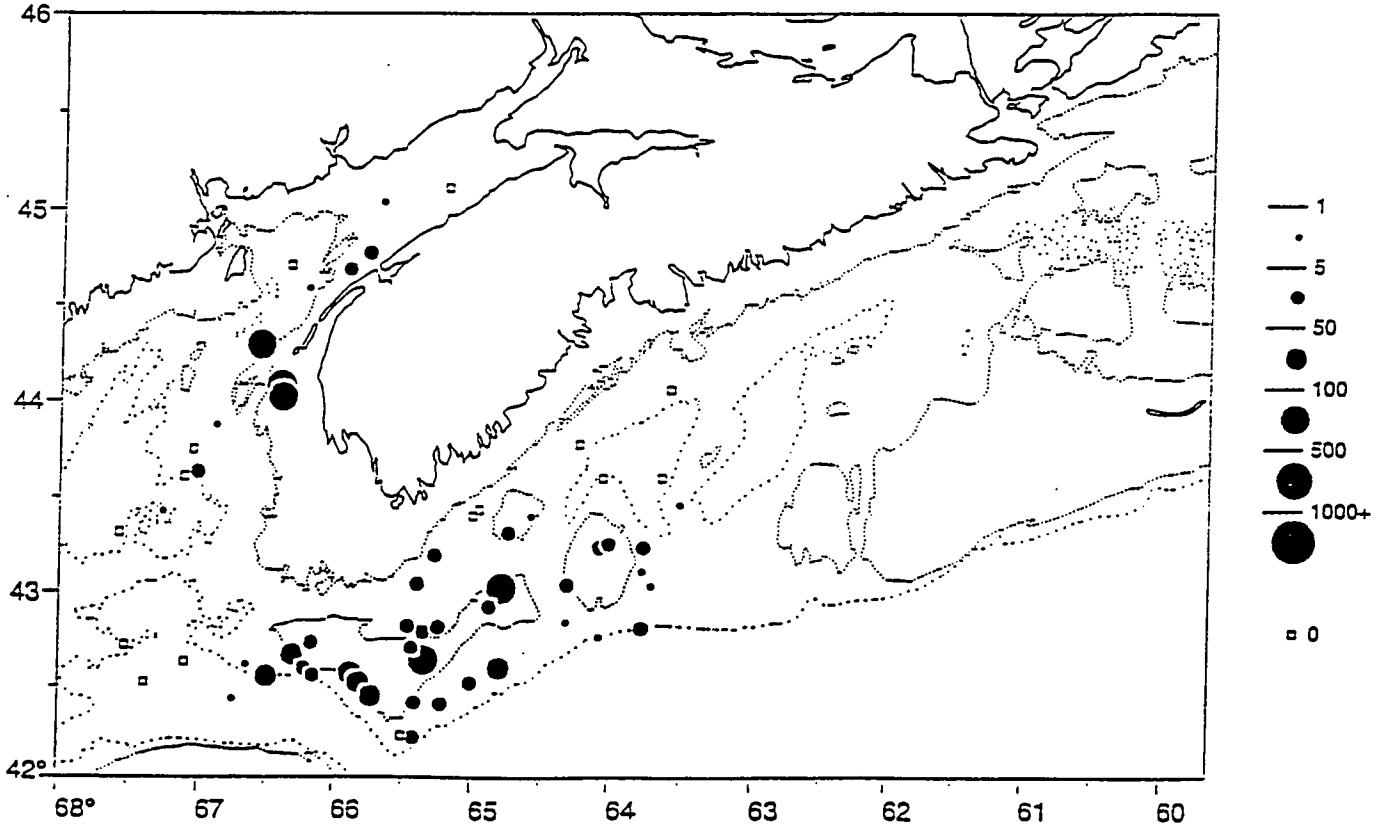


Figure 13. (Continued)

4VWX5Ze Pollock (J. Neilson, SABS)

1. Abundance

The survey results for pollock have typically been highly variable from year to year (Fig. 14). The data are shown in age-aggregation form, as the age determinations from the 1994 survey are not complete as yet. The 1994 abundance index is considerably lower than the 1993 value.

2. Recruitment and Size Composition

The length-frequency distributions from summer research vessel surveys are shown in Fig. 15. The strong interannual variability in survey results persist from 1993 to 1994, with the apparently strong younger yearclasses evident in 1993 no longer apparent in 1994. The 1994 survey gives no indication of strong yearclasses recruiting to the fishery.

3. Distribution

The distribution of sets with catches of pollock over the past four years are shown in Fig. 16. The distribution of pollock in the 1994 survey appears comparable to previous years. Pollock were more common in the NAFO 4WX area compared with 4V.

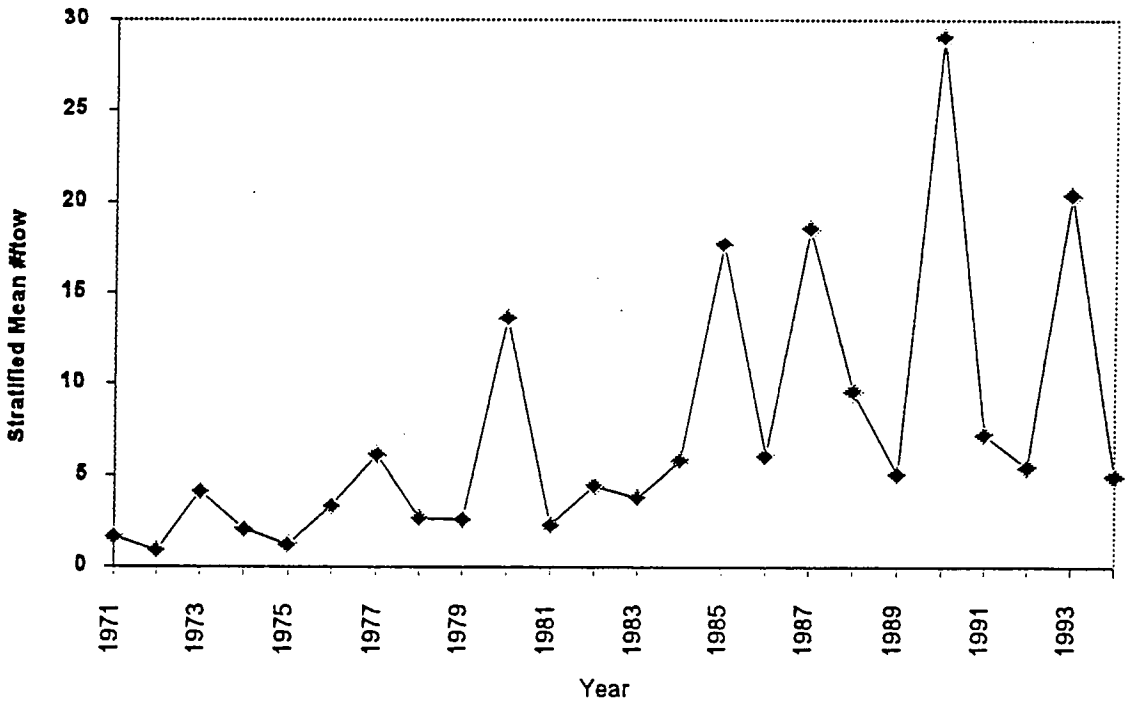

Stratified Mean #/tow
30
25
20
15
10
5
0
1971
1973
1975
1977
1979
1981
1983
1985
1987
1989
1991
1993
Year

Figure 14.

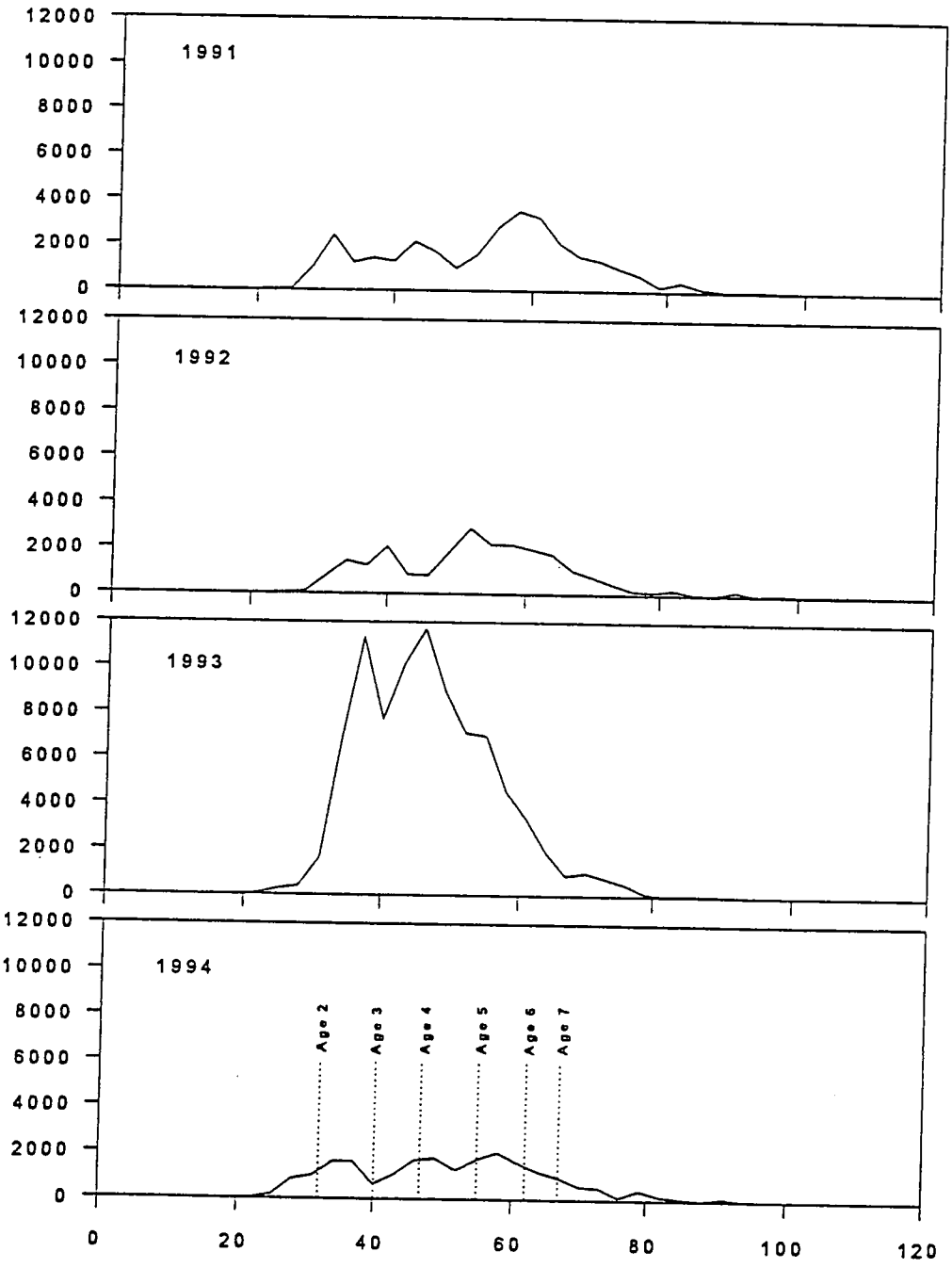
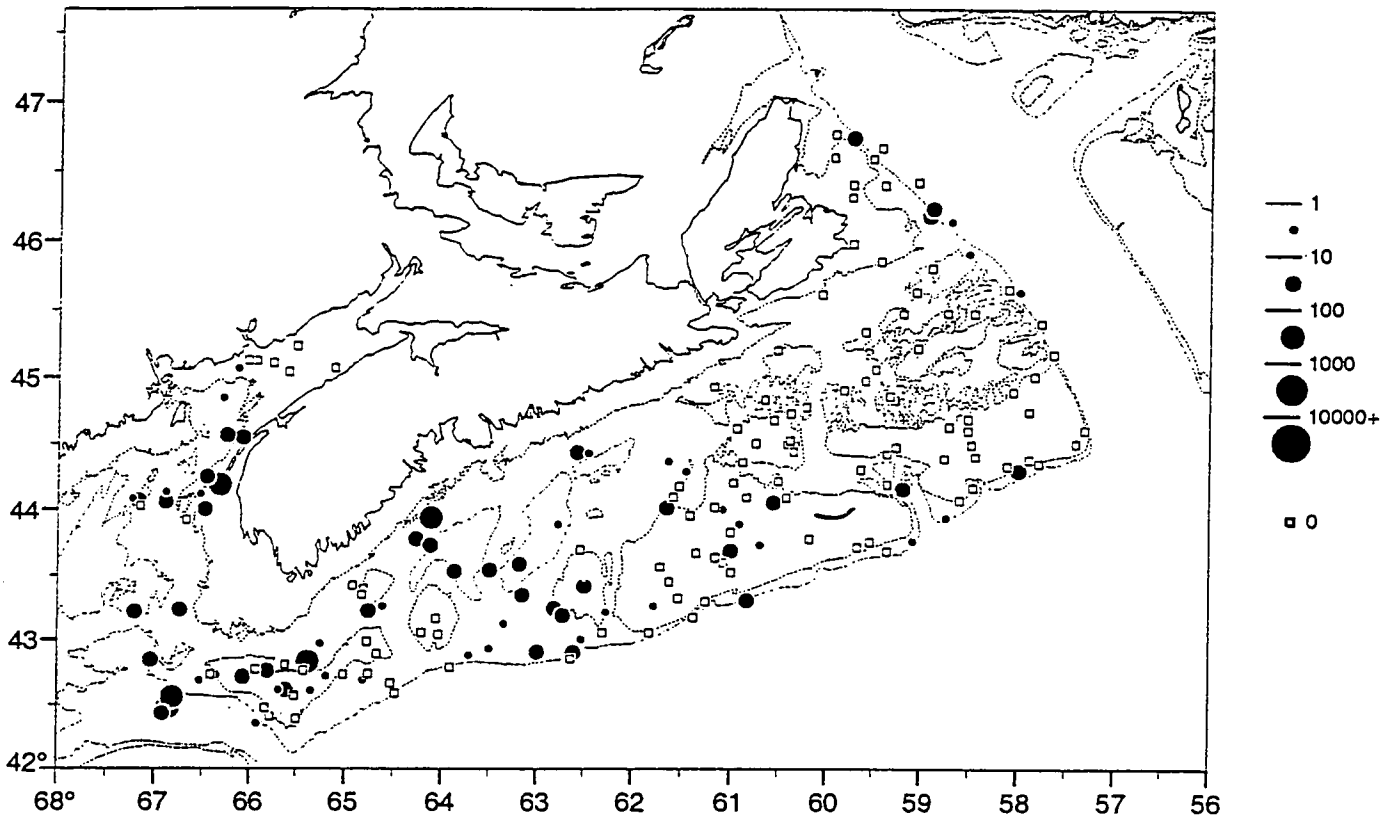

1991
1992
1993
1994
12000
10000
8000
6000
4000
2000
0
Age 2
Age 3
Age 4
Age 5
Age 6
Age 7
0
20
40
60
80
100
120

Figure 15.

4VWX POLLOCK CATCHES (KG) FROM SCOTIA FUNDY SUMMER 91 GROUNDFISH SURVEY



4VWX POLLOCK CATCHES (KG) FROM SCOTIA FUNDY SUMMER 92 GROUNDFISH SURVEY

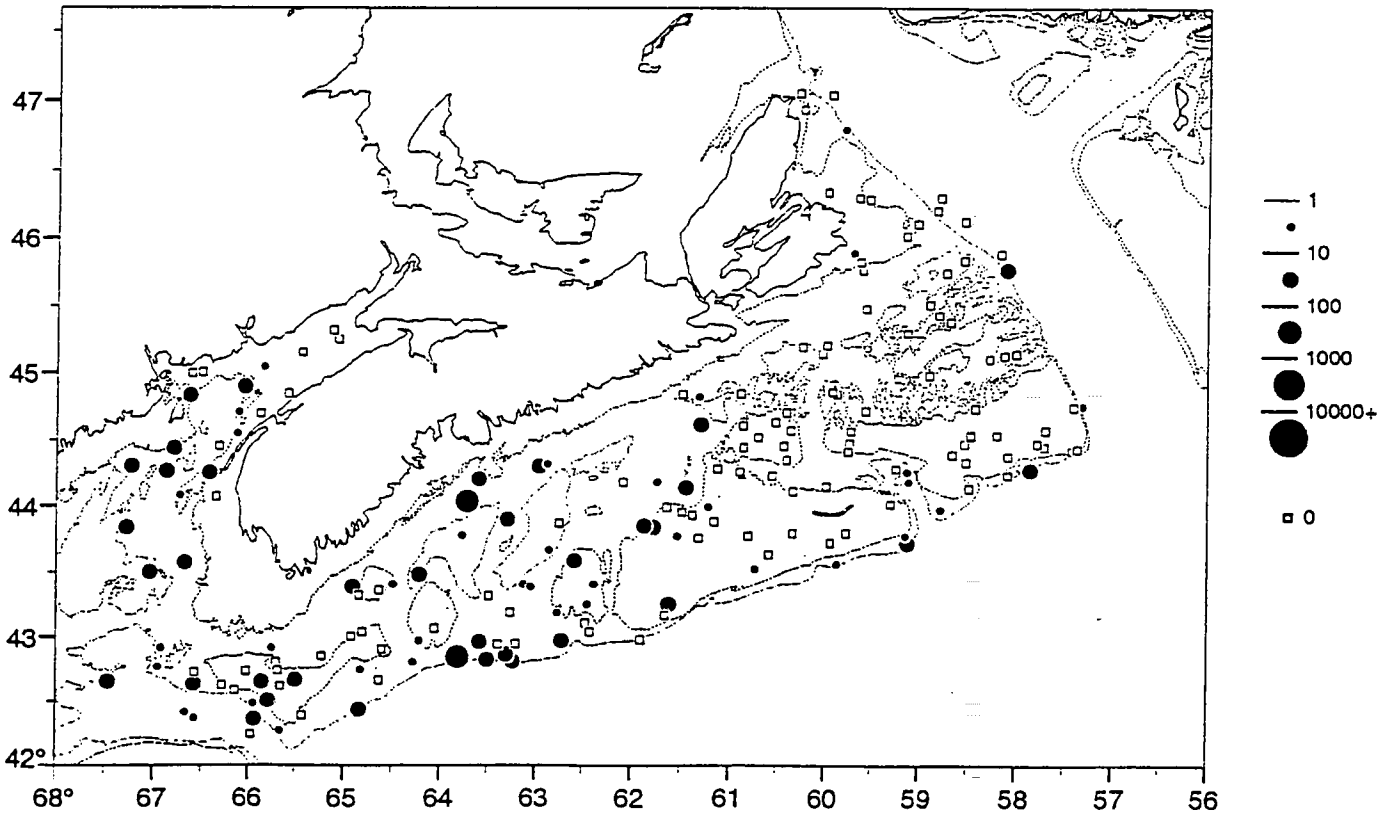
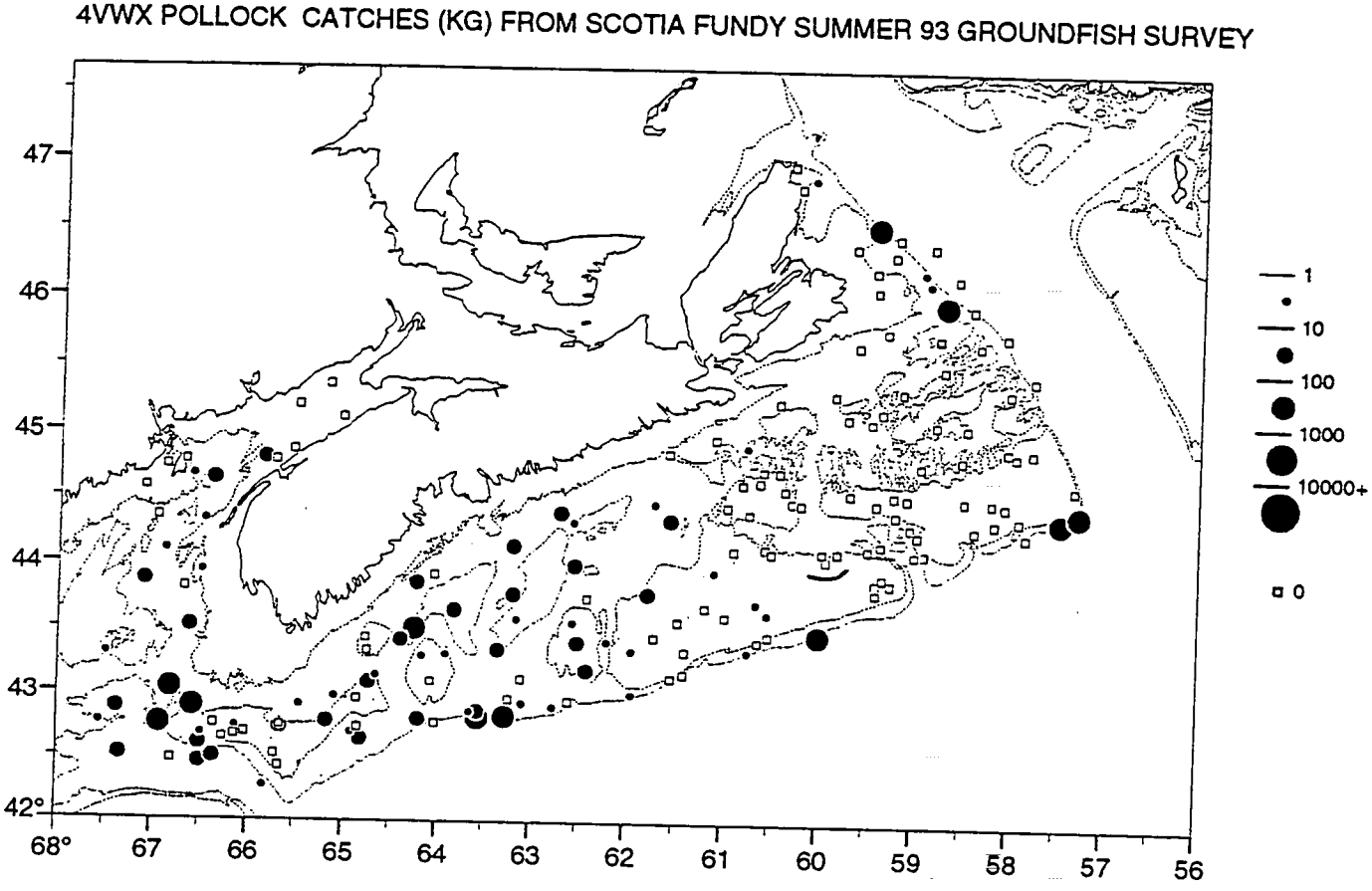


Figure 16.



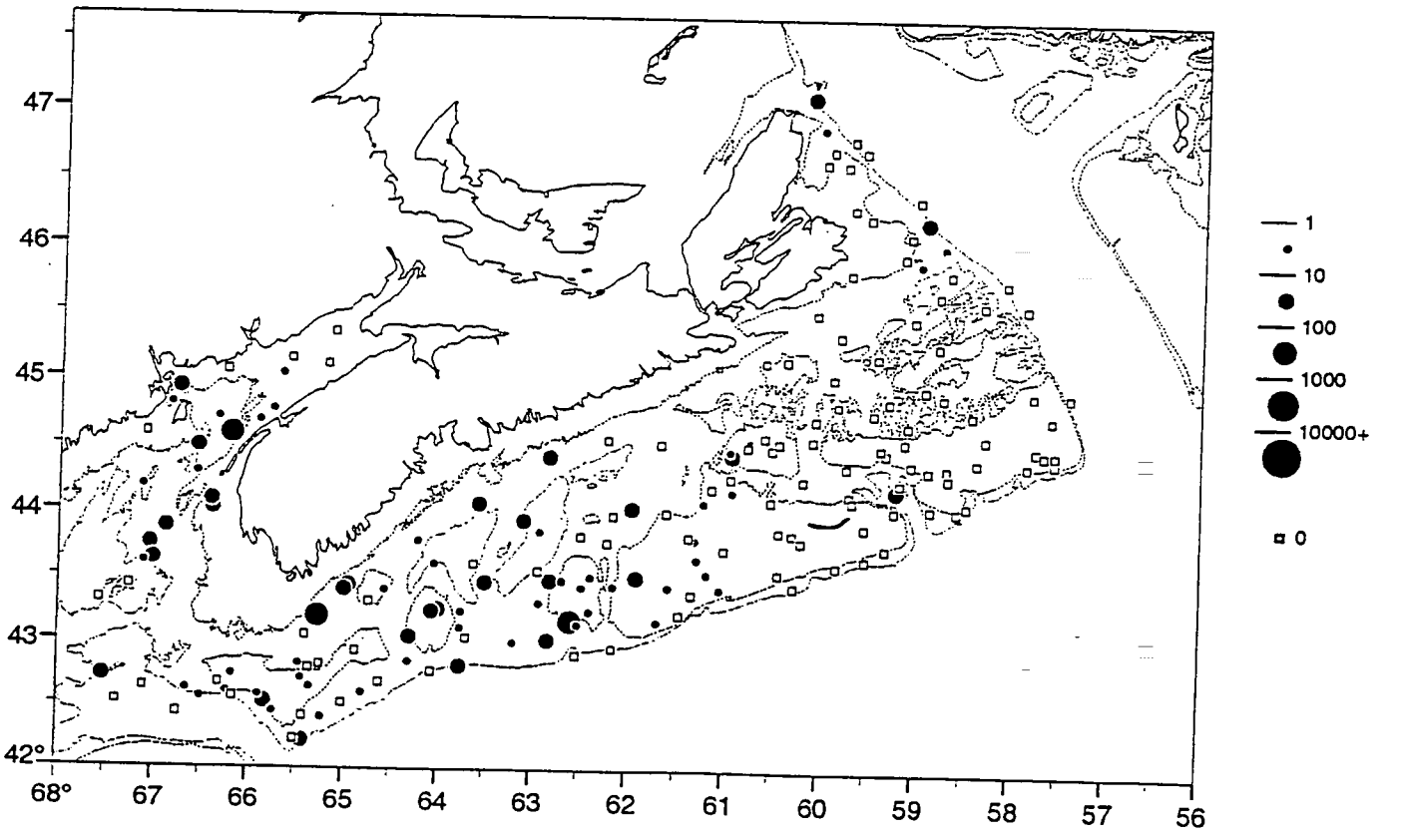


Figure 16. (Continued)

Unit 3 Redfish (R. Branton, BIO)

1. Abundance

Mean numbers per tow for Unit 3 Redfish increased from 76 fish per tow in 1993 to 80 fish per tow in 1994, and is above the 10 year average of 67 fish tow (Fig. 17).

2. Recruitment and Size Composition

Population size compositions in 1990-93 were generally unimodal at about 25 cm. (Fig. 18), with an additional mode of smaller fish occuring at 11 cm in 1991. In 1994, the primary mode was also at 25 cm and a second mode occured at 13 cm. These modes of smaller fish in 1991 and 1994 indicate some moderate level of recruitment to the population which can be attributed to a 1987 or 1988 yearclass.

3. Distribution

The population continues to be widely distibuted in all deepwater areas of the management unit (defined as strata 456 and 458 to 495), except that redfish were caught around Middle Bank in all years but 1994 (Fig. 19).

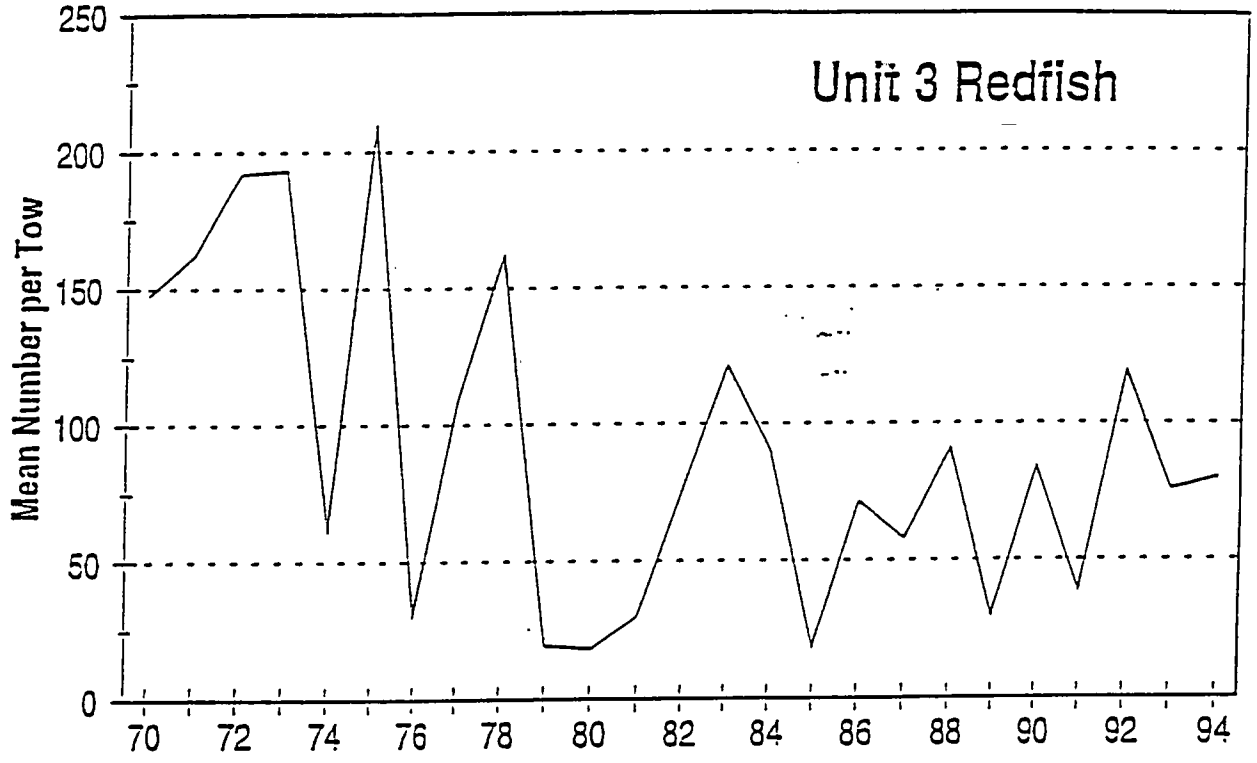


Figure 17. Mean number per tow for Unit 3 redfish from Scotian Shelf groundfish survey 1970 to 1994.

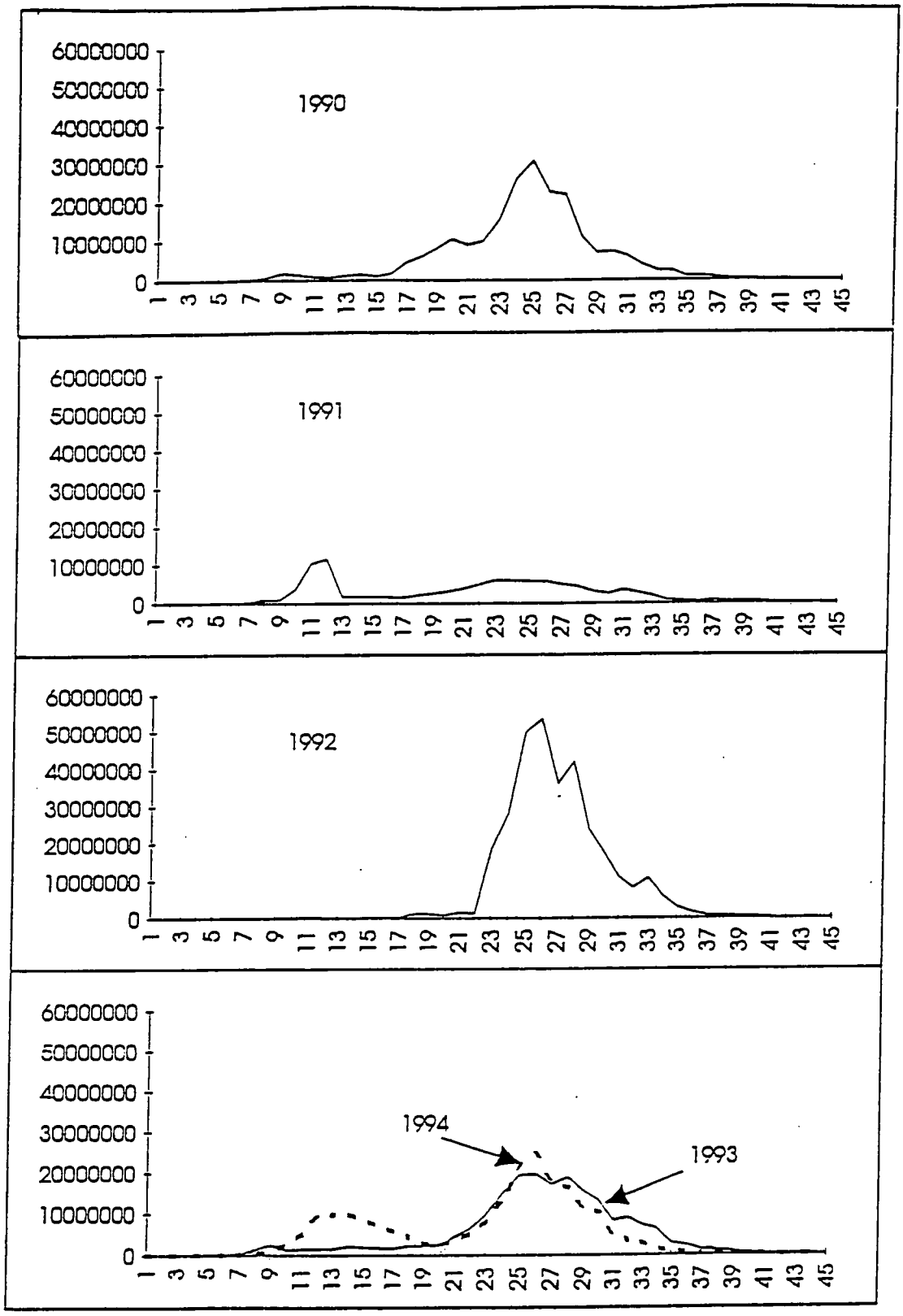
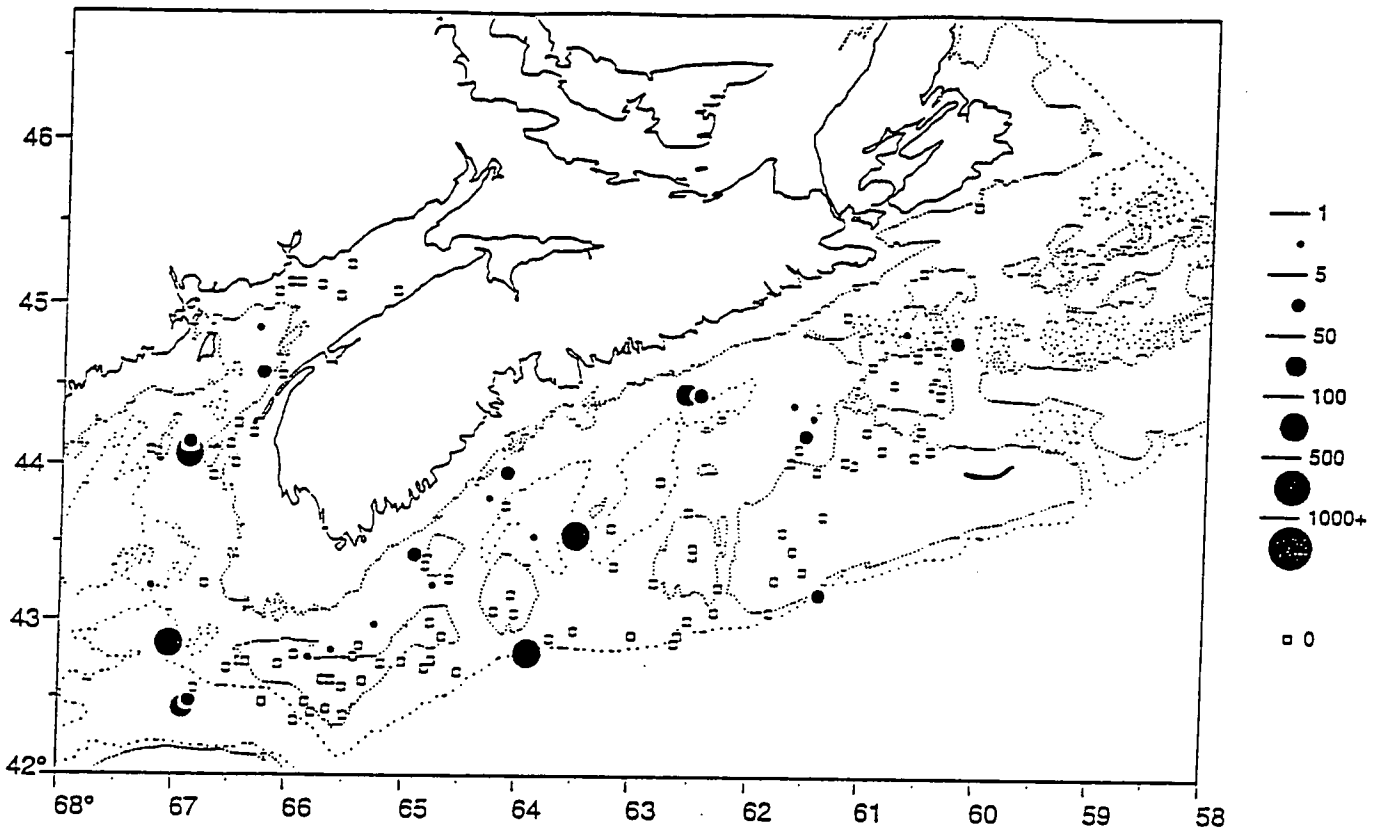


Figure 18. Length frequency distribution of Unit 3 redfish from July groundfish surveys for 1990 to 1994.

UNIT 3 REDFISH CATCHES (KG) IN SCOTIA FUNDY SUMMER 91 GROUNDFISH SURVEY.



UNIT 3 REDFISH CATCHES (KG) IN SCOTIA FUNDY SUMMER 92 GROUNDFISH SURVEY.

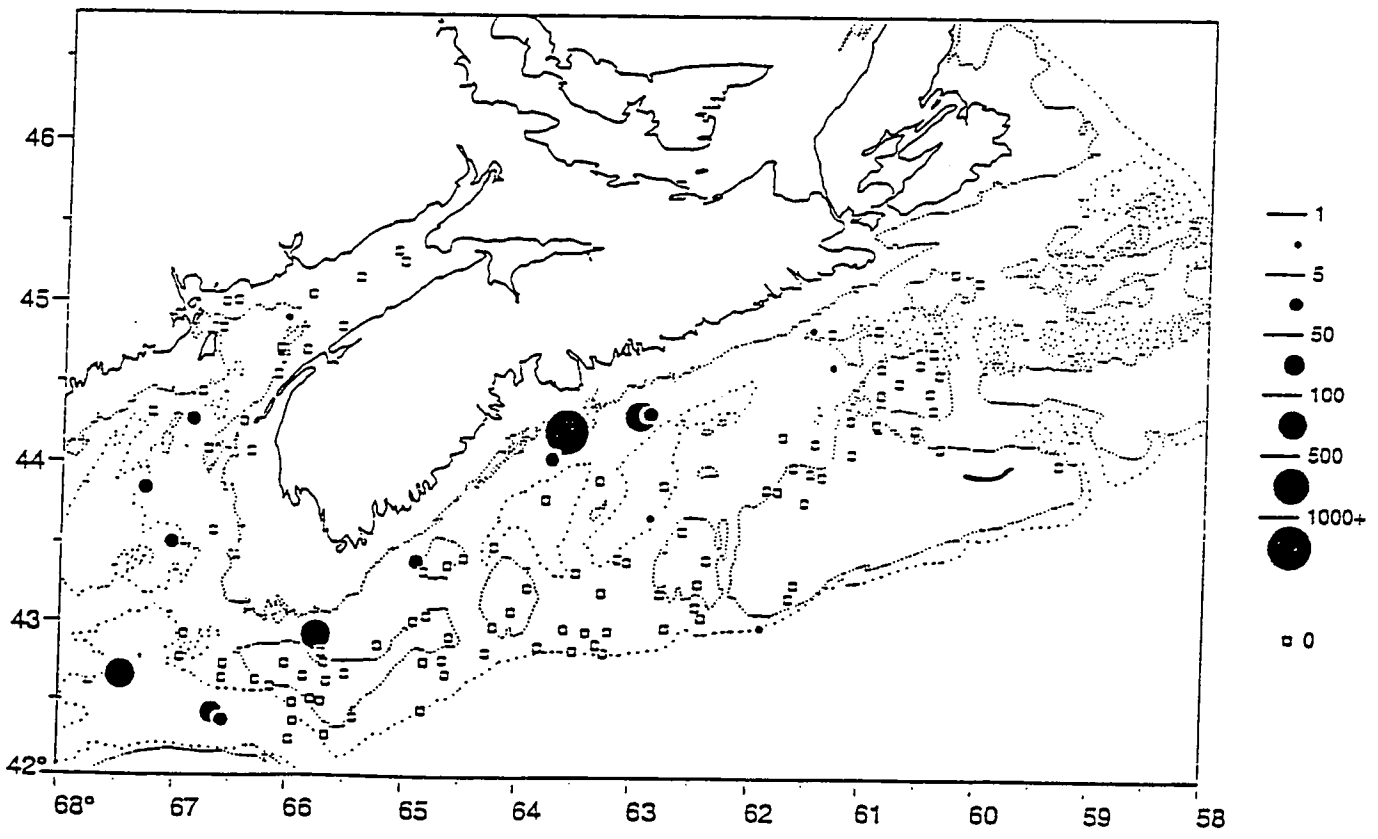
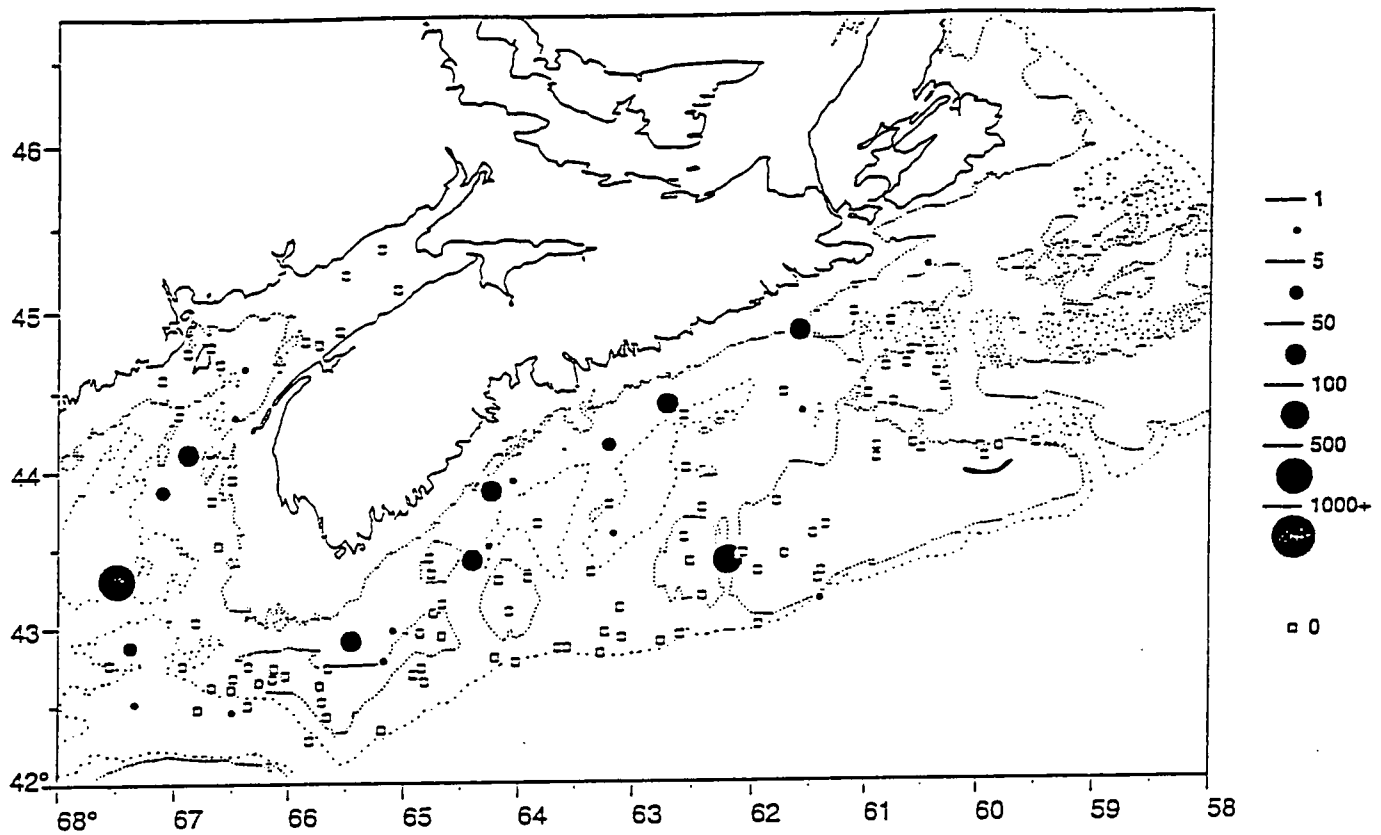


Figure 19.

UNIT 3 REDFISH CATCHES (KG) IN SCOTIA FUNDY SUMMER 93 GROUNDFISH SURVEY.



UNIT 3 REDFISH CATCHES (KG) IN SCOTIA FUNDY SUMMER 94 GROUNDFISH SURVEY.

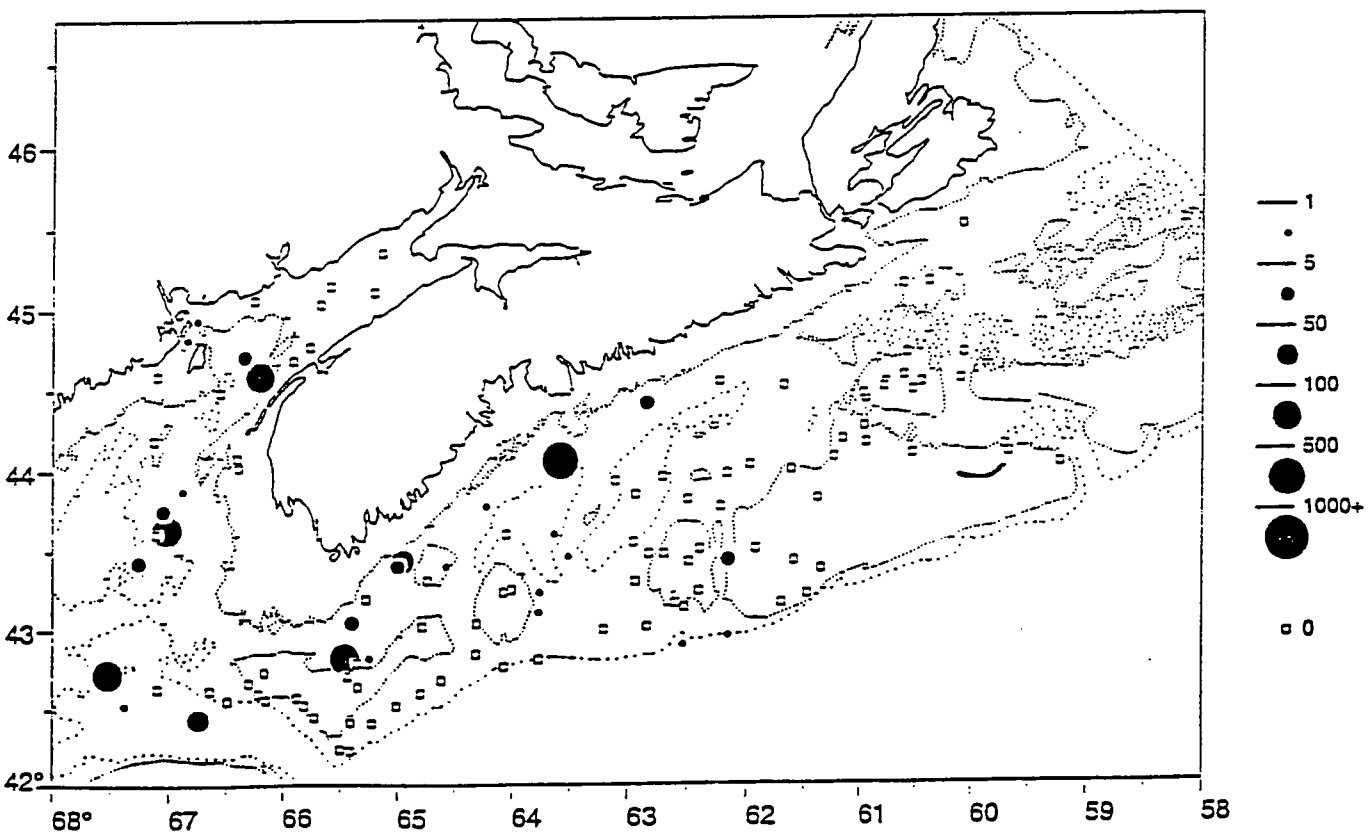


Figure 19. (Continued)

4VW Flatfish (C. Annand, BIO)

1. Abundance

American Plaice: Mean numbers per tow have remained relatively stable from 1993 to 1994, with 27.78 and 28.21 fish per tow respectively (Fig. 20). Numbers are among the lowest on record, and well below the longterm average, especially in 4V where a large proportion of the fishery takes place.

Yellowtail Flounder: Mean numbers per tow declined from 18 fish per tow in 1993 to 17 fish per tow in 1994. The 1994 point is the lowest in the 24 year time series (Fig. 20).

Witch Flounder: Mean numbers per tow increased from 3.52 fish per tow in 1993 to 5.59 fish per tow in 1994 (Fig. 20).

Winter Flounder: Mean numbers per tow declined from 3.85 fish per tow in 1993 to 1.86 fish per tow in 1994 (Fig. 20).

2. Recruitment and Size Composition

American plaice: The survey length distributions did not indicate any significant change in size composition from previous years (Fig. 21a). Relatively few fish >35 cm were caught in either the 1993 or 1994 survey.

Yellowtail flounder: The survey length frequencies indicated very little change between 1993 and 1994 size compositions (Fig. 21b). It should be noted that in both years relatively few fish >30 cm were caught during the survey. The commercial fishery tends to concentrate on fish in the 28-36 cm range.

Witch flounder: Survey length frequencies did not indicate any significant changes between 1993 and 1994 size compositions, although fewer witch <20 cm were caught in 1994 (Fig. 21c). In both years relatively few fish >40 were caught.

Winter flounder: Survey length frequencies did not indicate any significant changes between 1993 and 1994 size compositions (Fig. 21d). Winter flounder <20 cm were observed in the 1994 survey which may indicate incoming recruitment. There is very little commercial fishery for winter flounder in 4VW.

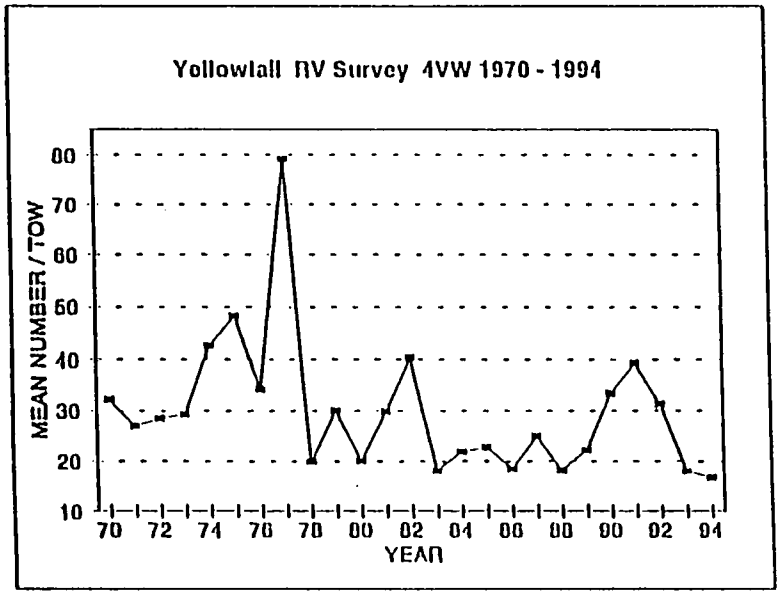
3. Distribution

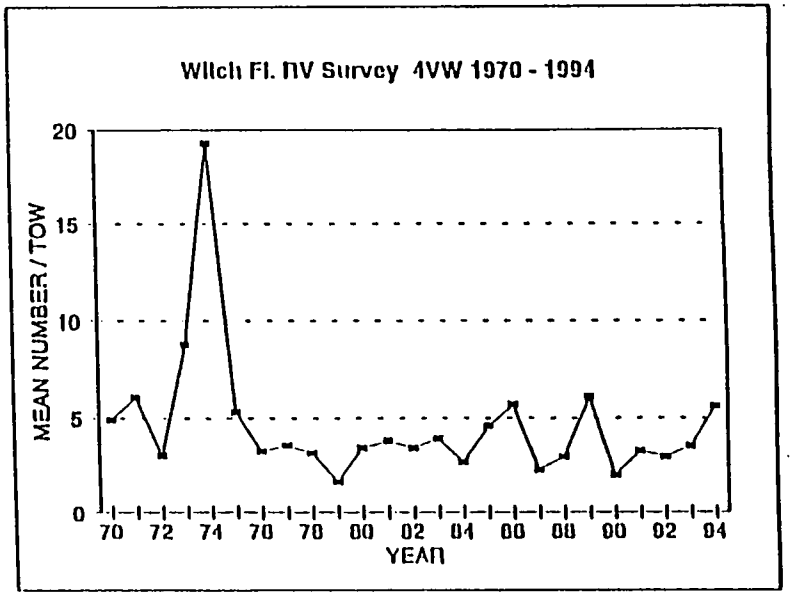
American Plaice: Survey catch rates show a similar distribution to previous years with major concentrations observed in the 4V area. Catches in the Banquereau Bank (4VSc) area were low compared to earlier years (Fig. 22a) and may represent either a shift or reduction of abundance in this area.

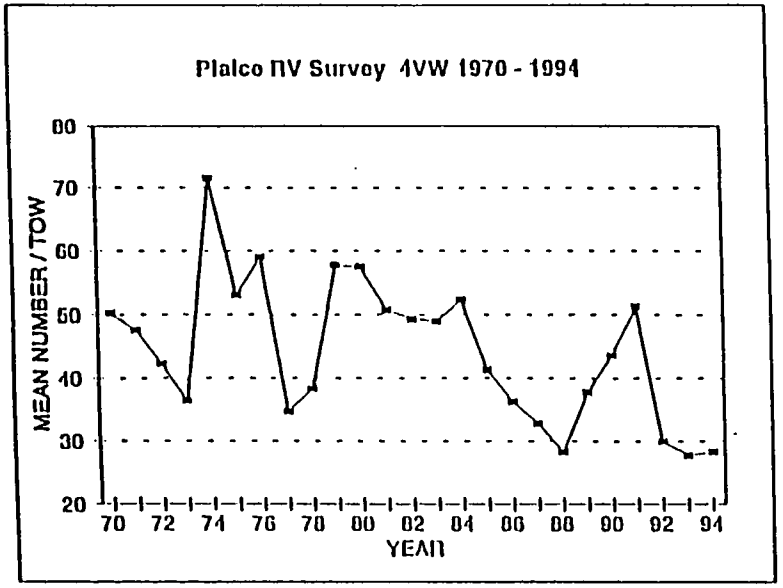
Yellowtail: The 1994 survey catch rates continue to indicate a change in distribution between 4V and 4W. Major concentrations were noted in 4W with relatively few yellowtail caught on Banquereau Bank (4VSc), although a large proportion of the yellowtail fishery takes place there (Fig. 22b).

Witch flounder: Survey distributions indicate that witch flounder are widely distributed in 4VW but at low concentrations. Localized areas of abundance occur in the Gully and in deep holes north of Banquereau and in the 4Vn area. These very localized areas may account for the variability in the survey estimates (Fig. 22c).

Winter flounder: The 1994 summer survey continues to show concentrations of winter flounder only to the west of Sable Island, and Middle and Western Banks. A large proportion of the survey abundance is contained within the 4W closed area (Fig. 22d).







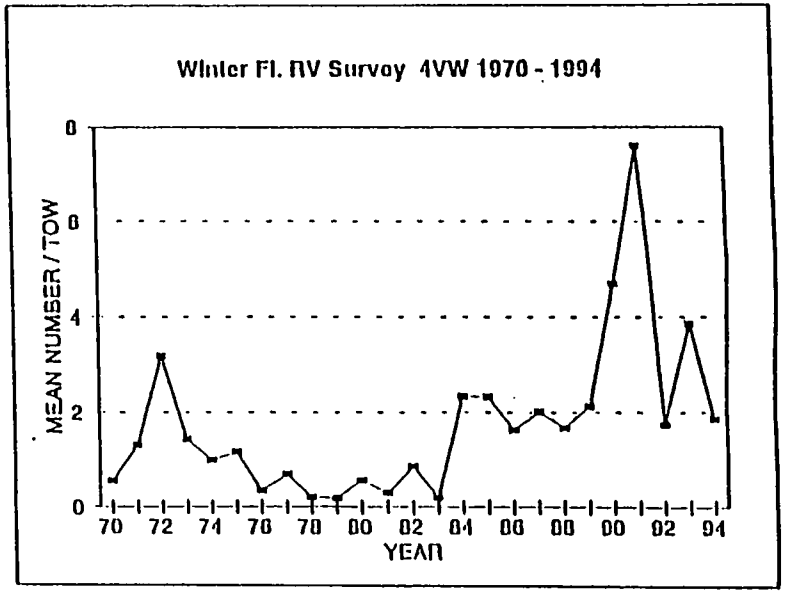
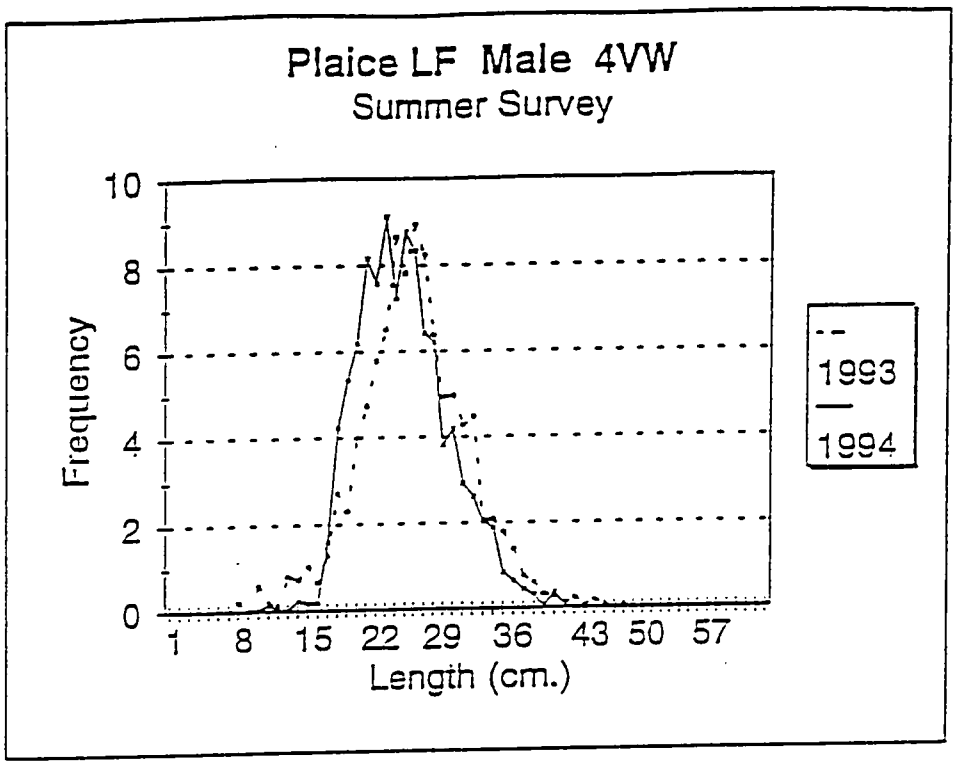


Figure 20. Survey mean number per tow.



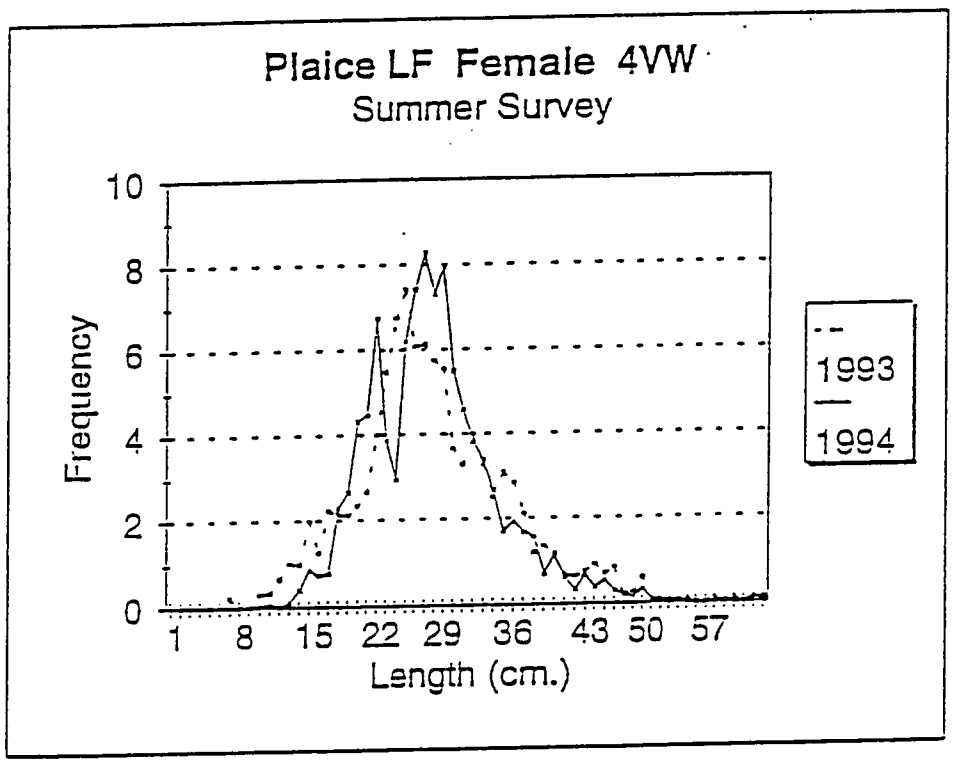
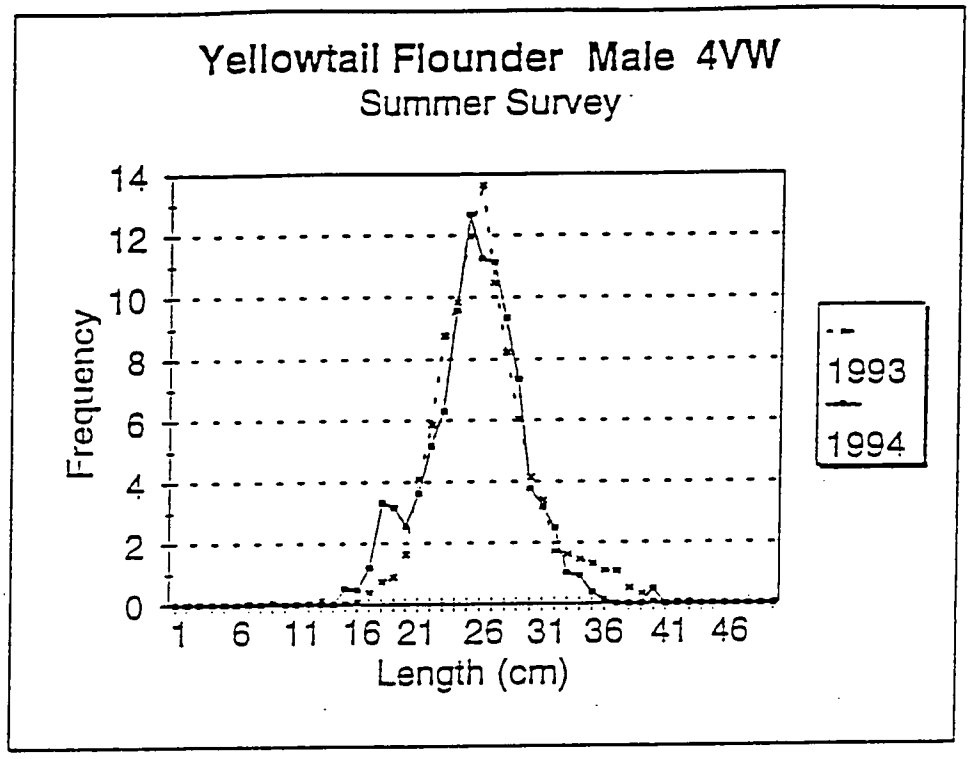


Figure 21a. Survey length frequency.



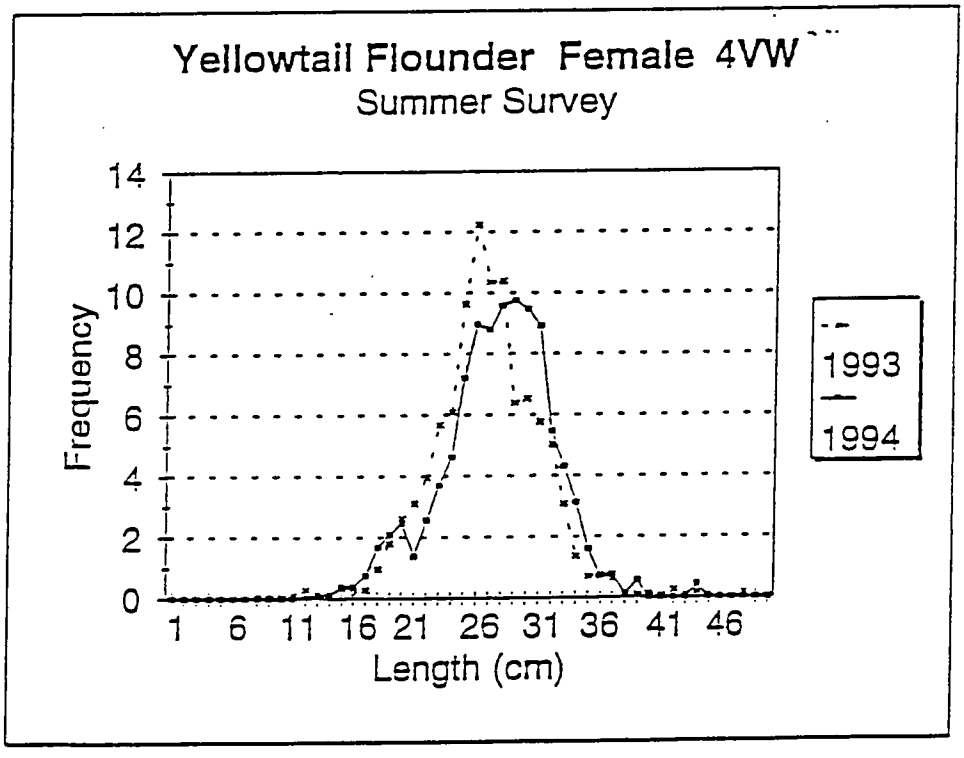
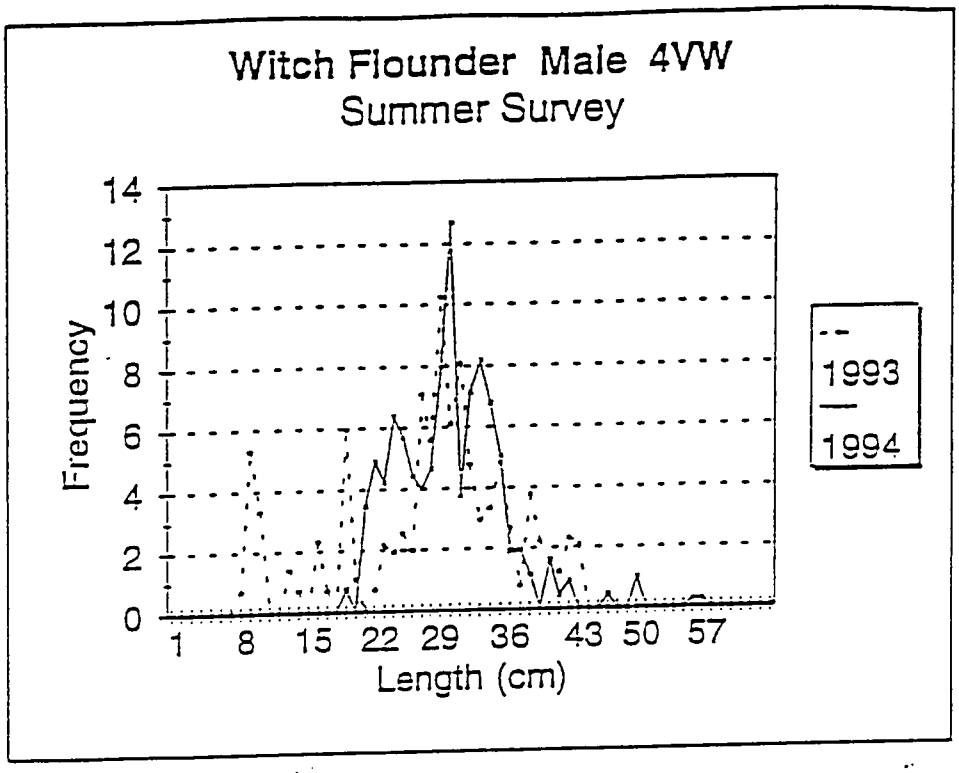


Figure 21b. Survey length frequency.



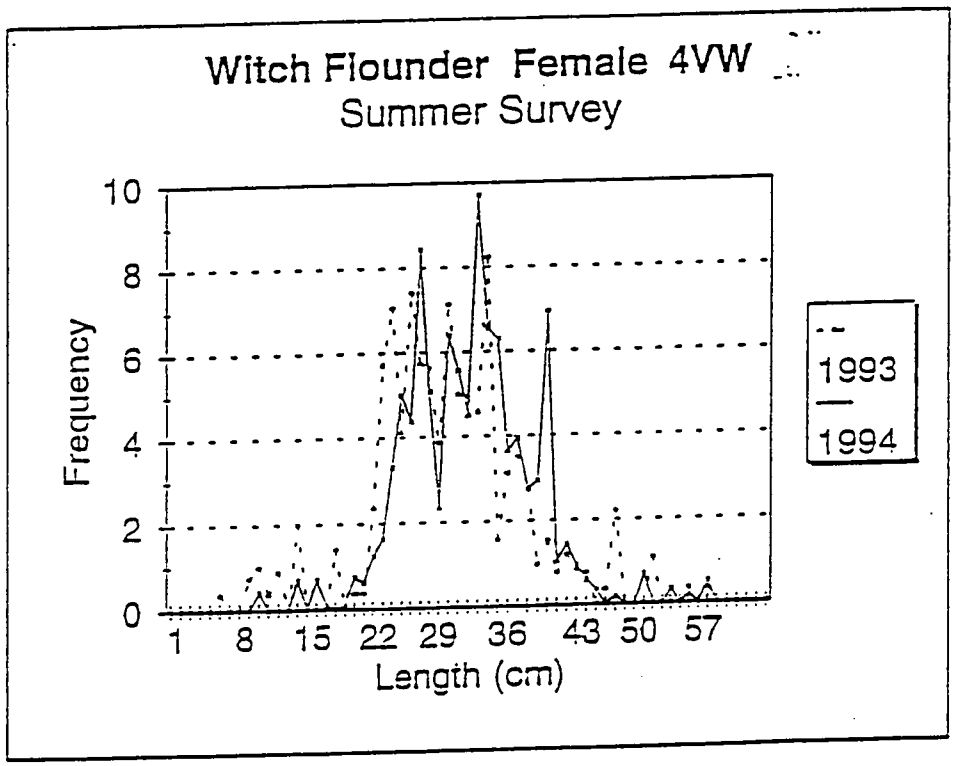
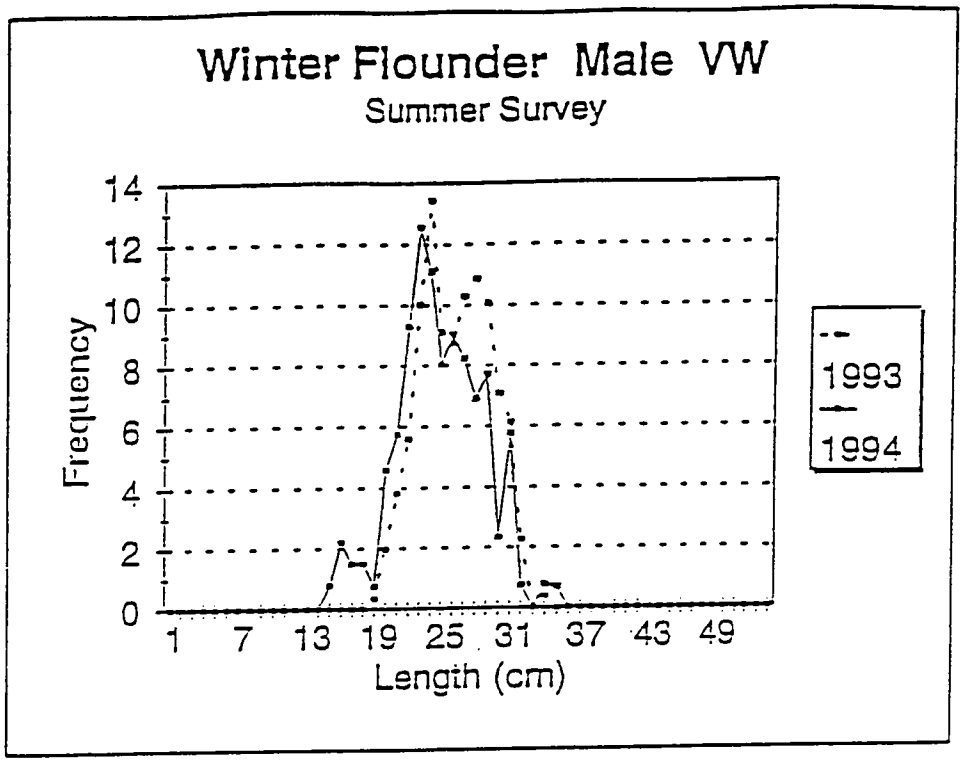


Figure 21c. Survey length frequency.



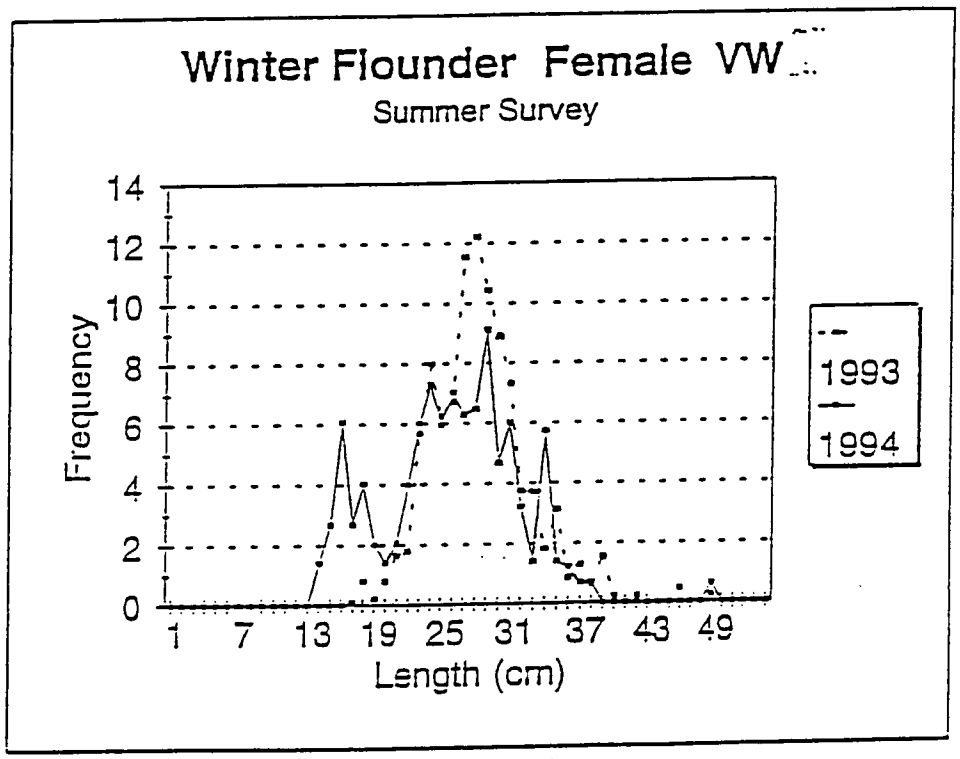
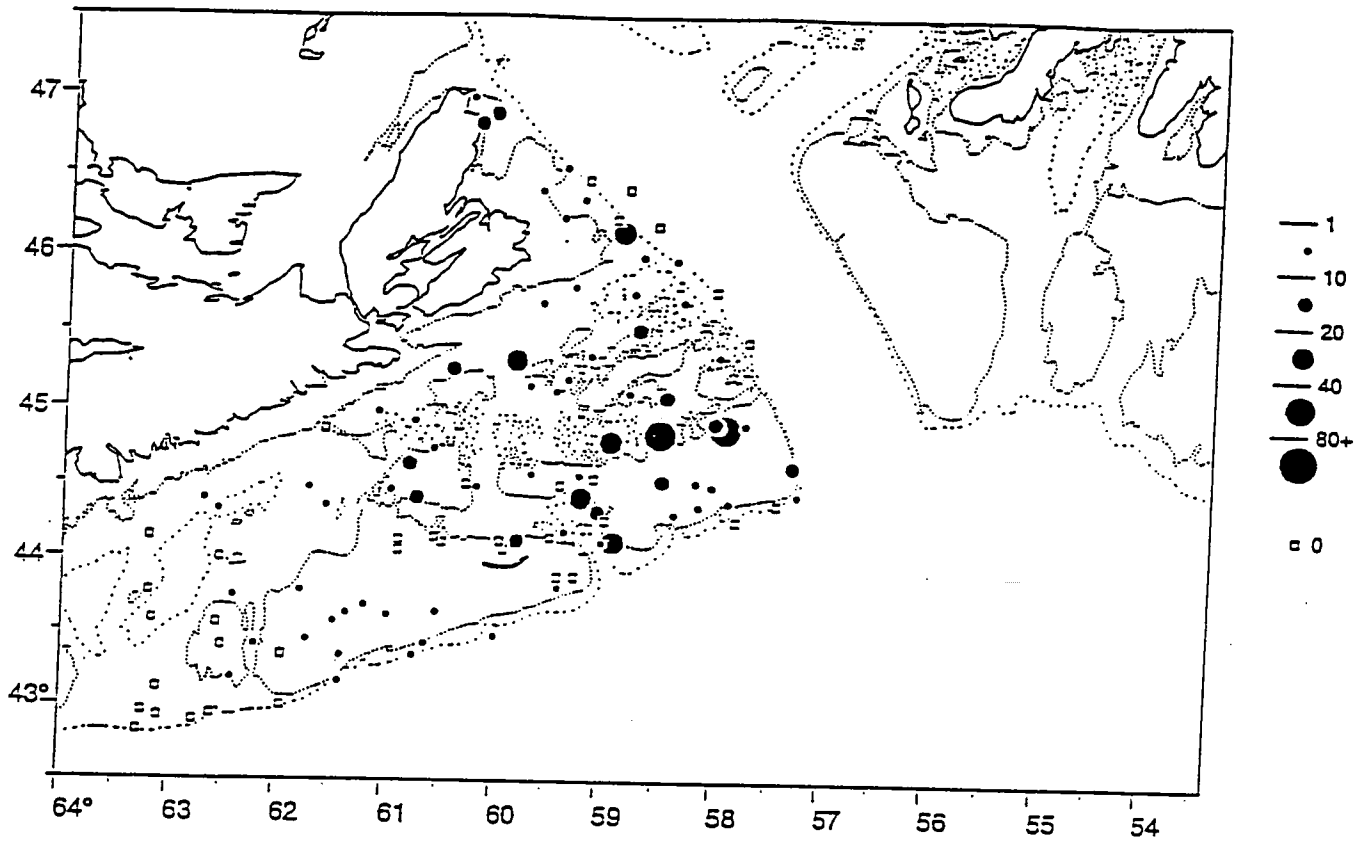


Figure 21d. Survey length frequency.

4VW PLAICE CATCHES (KG) IN SCOTIA FUNDY SUMMER 93 GROUNDFISH SURVEY.



4VW PLAICE CATCHES (KG) IN SCOTIA FUNDY SUMMER 94 GROUNDFISH SURVEY.

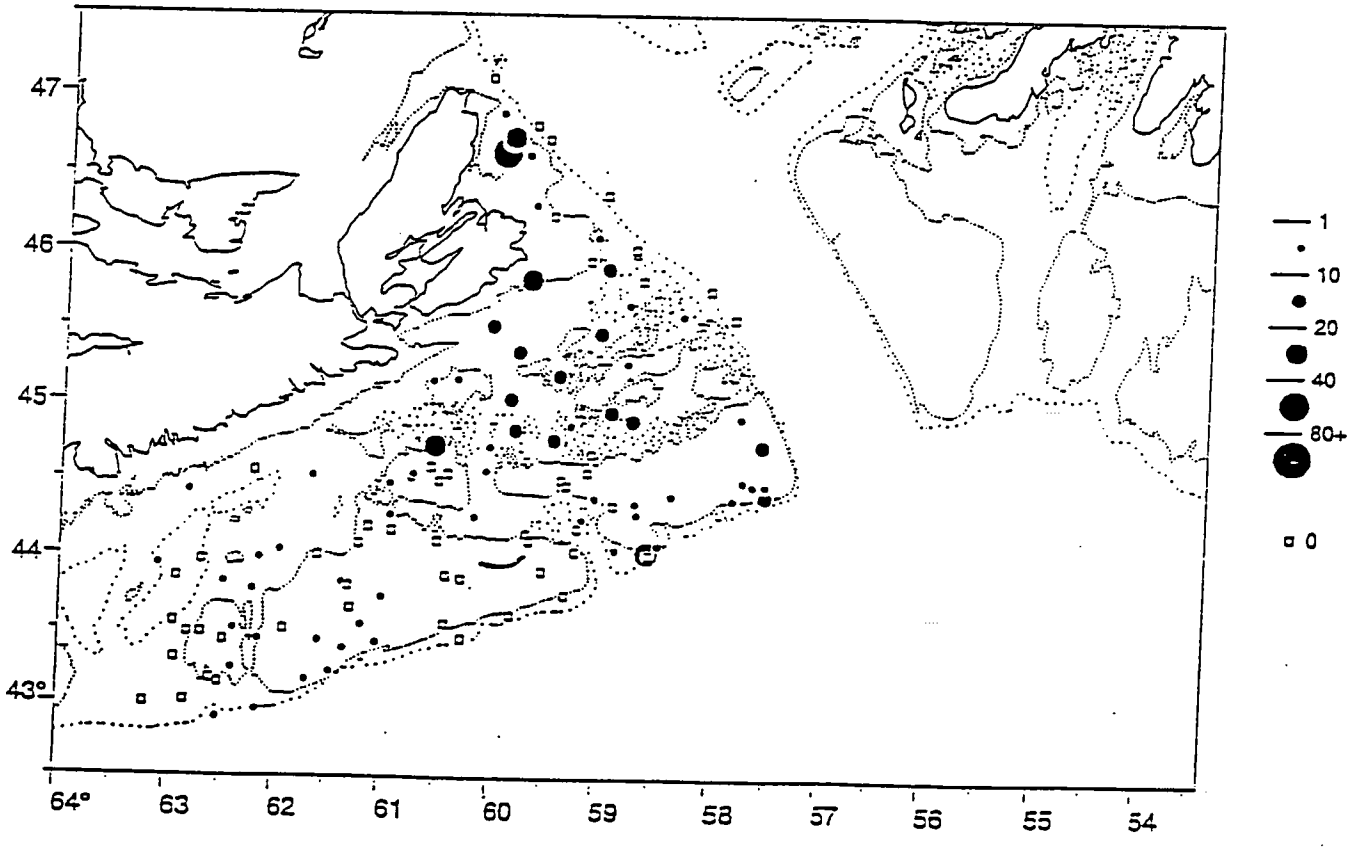
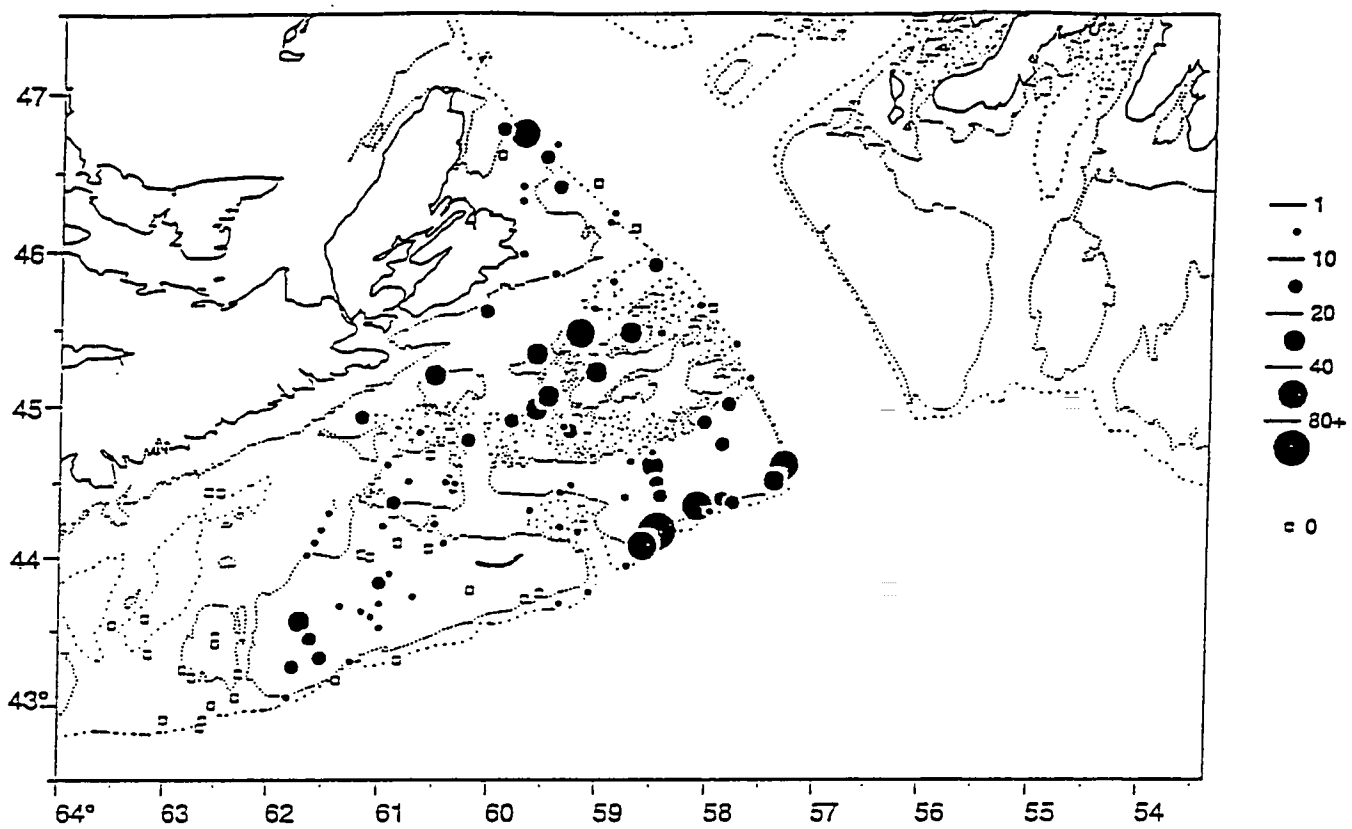


Figure 22a.

4VW PLAICE CATCHES (KG) IN SCOTIA FUNDY SUMMER 91 GROUNDFISH SURVEY.



4VW PLAICE CATCHES (KG) IN SCOTIA FUNDY SUMMER 92 GROUNDFISH SURVEY.

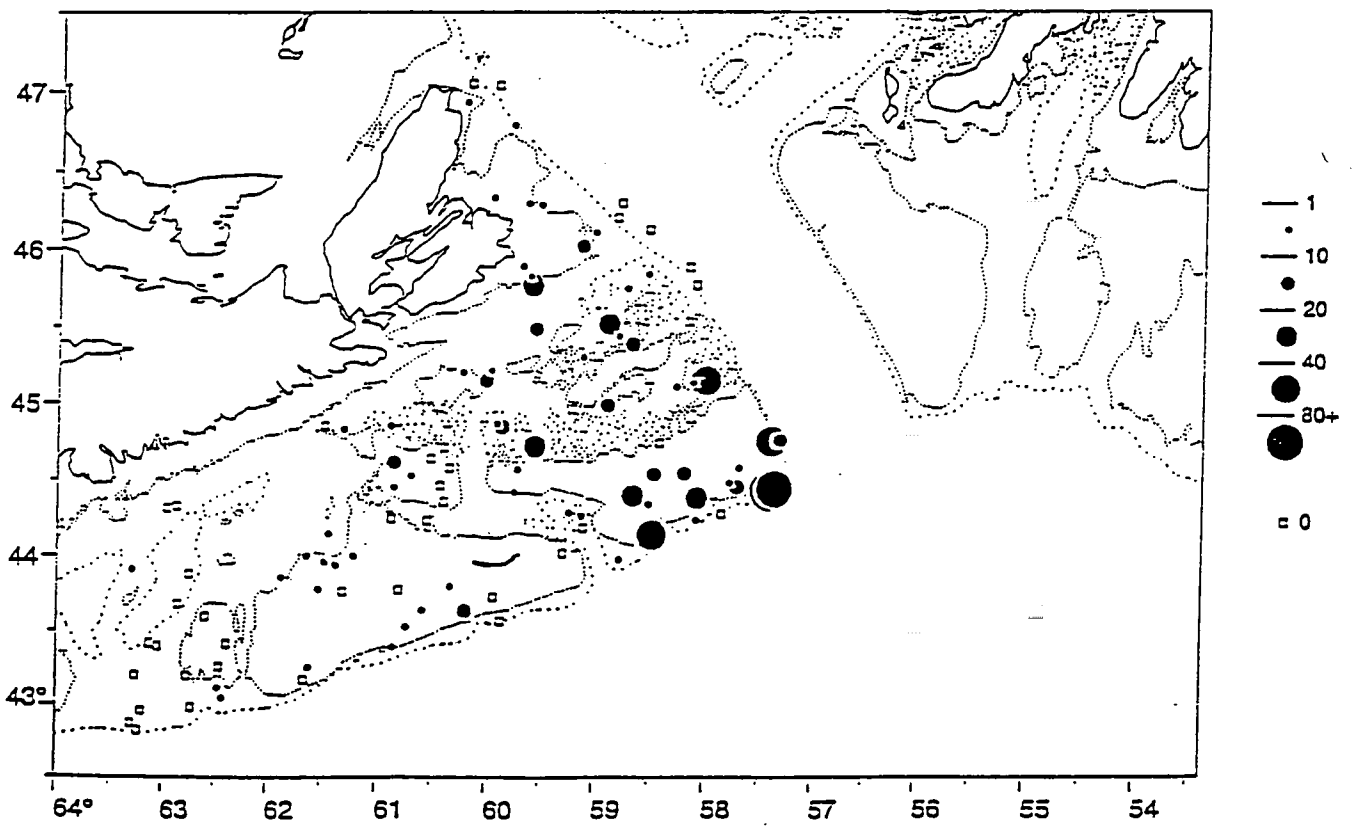
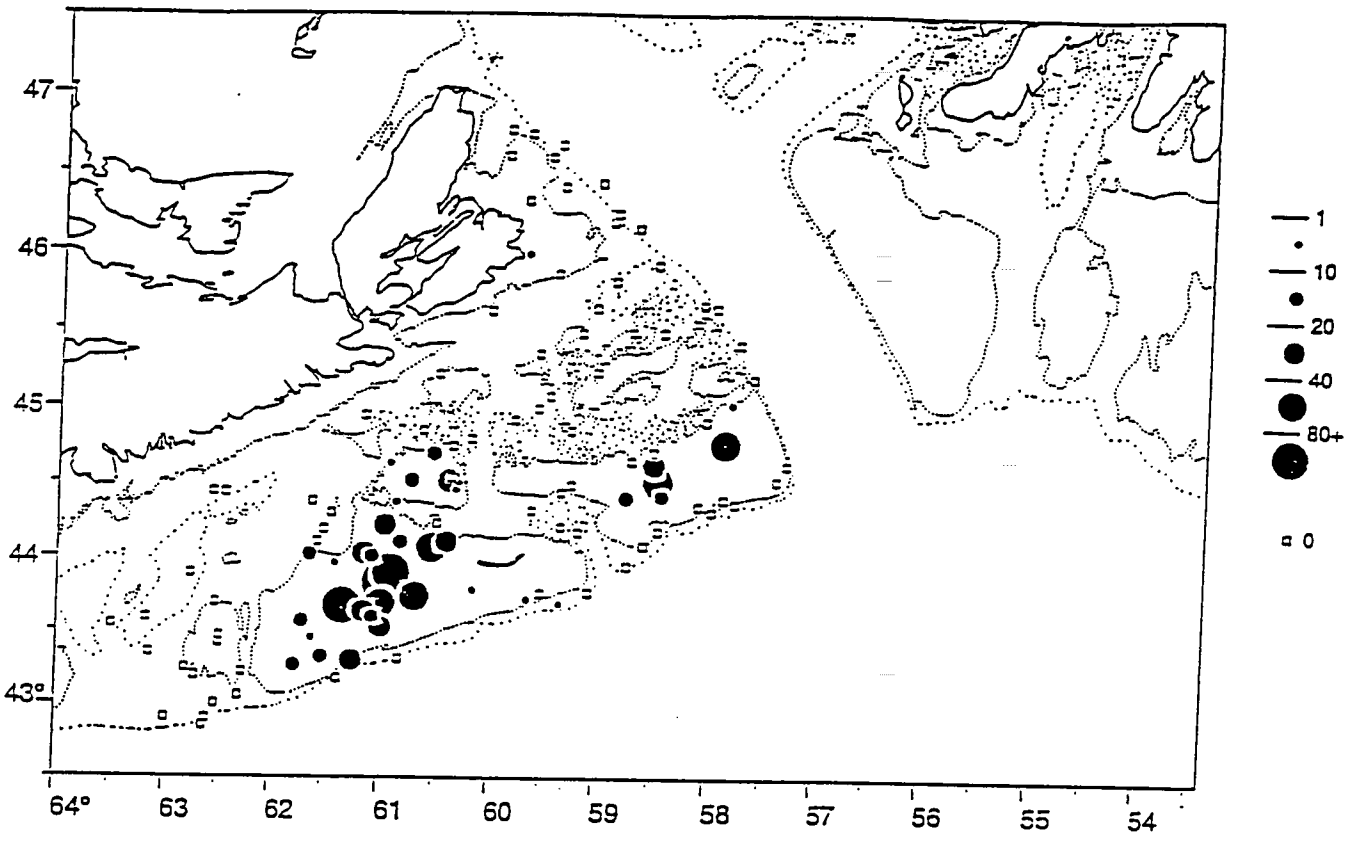


Figure 22a. (Continued)

4VW YELLOWTAIL CATCHES (KG) IN SCOTIA FUNDY SUMMER 91 GROUNDFISH SURVEY.



4VW YELLOWTAIL CATCHES (KG) IN SCOTIA FUNDY SUMMER 92 GROUNDFISH SURVEY.

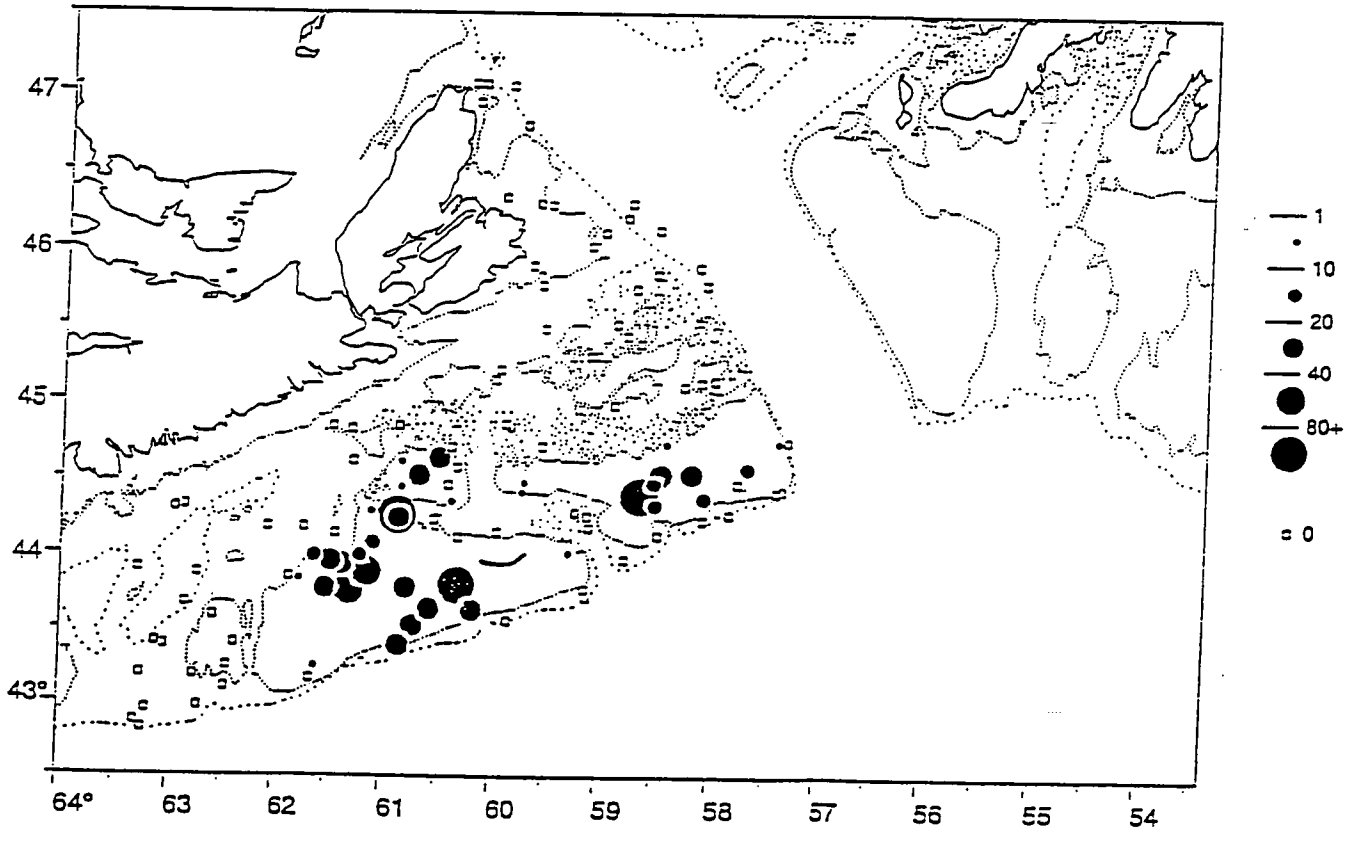
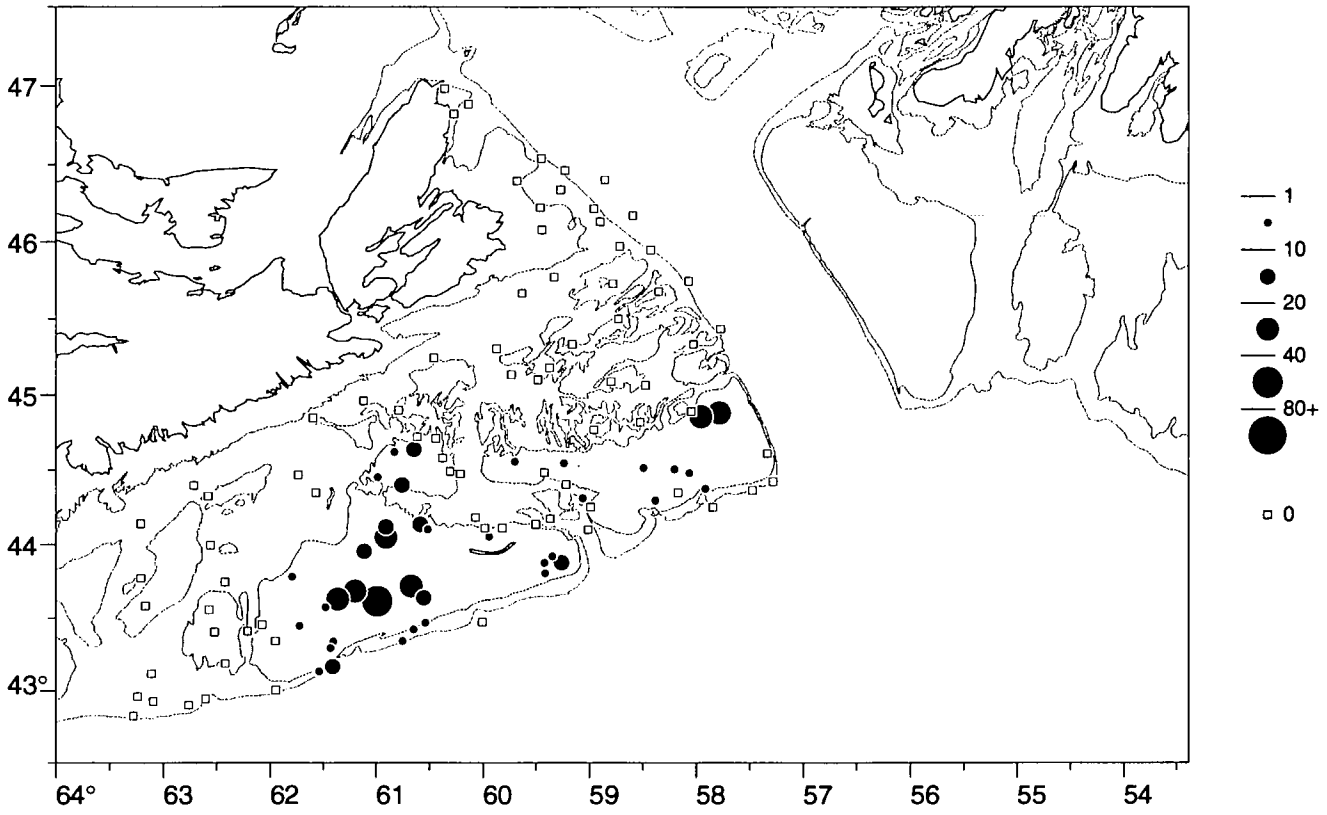


Figure 22b.

4VW YELLOWTAIL CATCHES (KG) FROM SCOTIA FUNDY SUMMER 93 GROUNDFISH SURVEY



4VW YELLOWTAIL CATCHES (KG) FROM SCOTIA FUNDY SUMMER 94 GROUNDFISH SURVEY

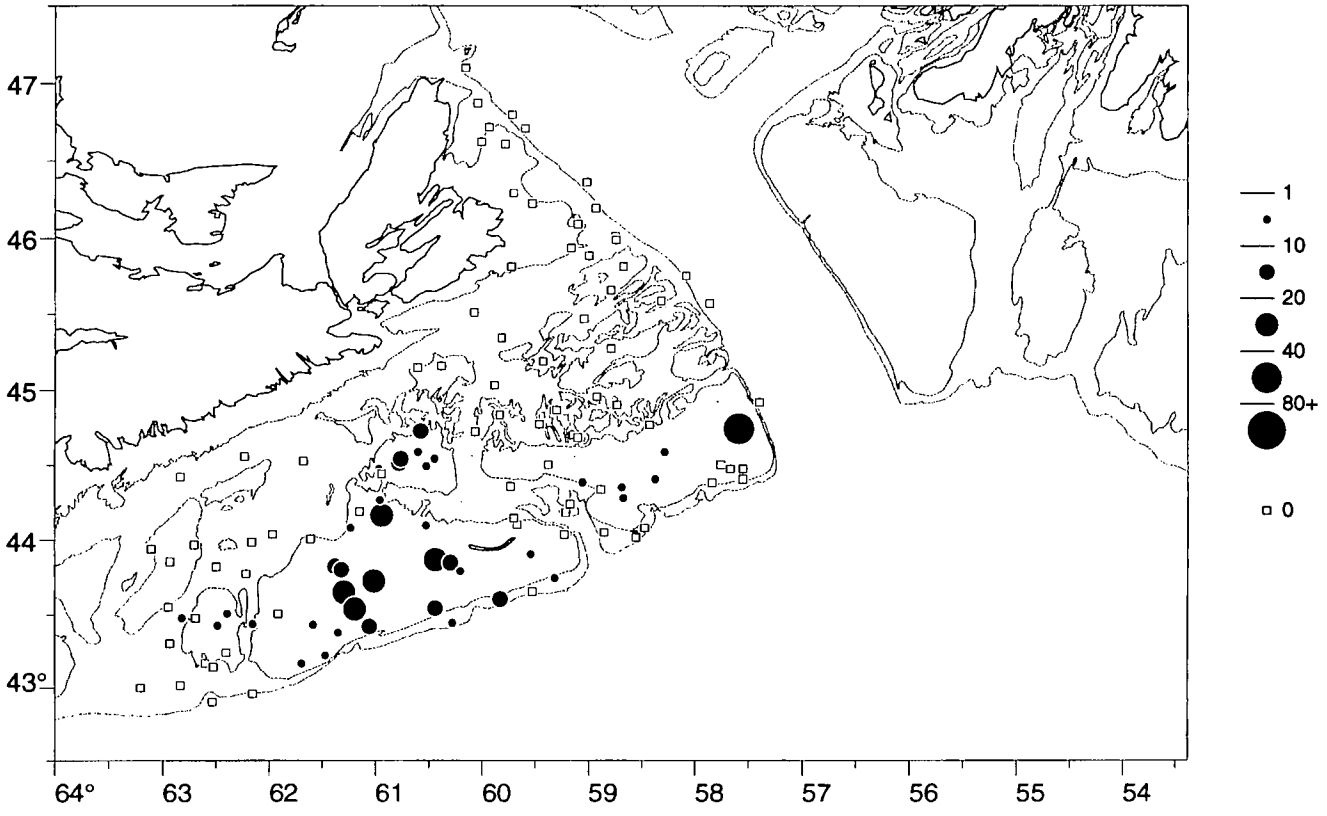
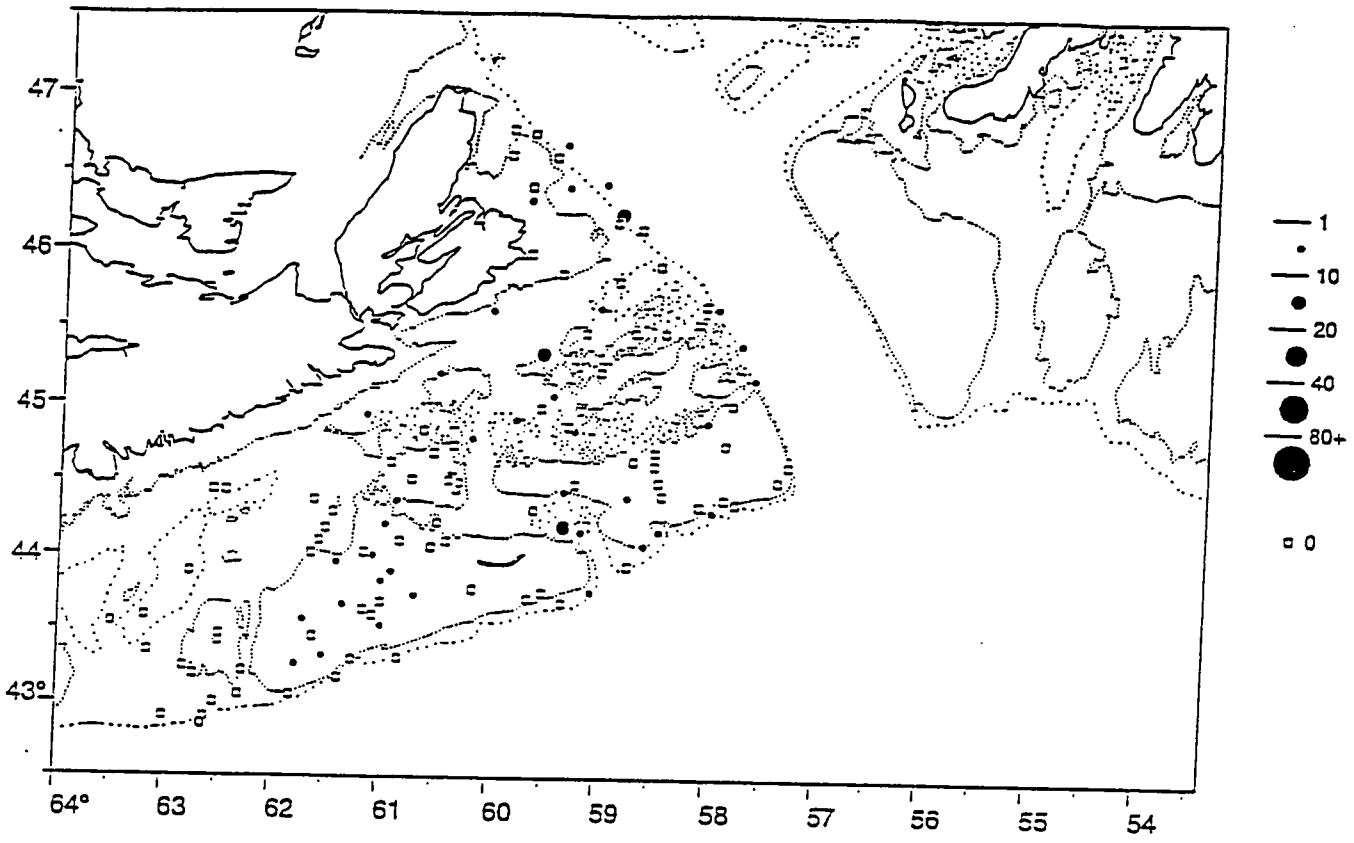


Figure 22b. (Continued)

4VW WITCH CATCHES (KG) IN SCOTIA FUNDY SUMMER 91 GROUNDFISH SURVEY.



4VW WITCH CATCHES (KG) IN SCOTIA FUNDY SUMMER 92 GROUNDFISH SURVEY.

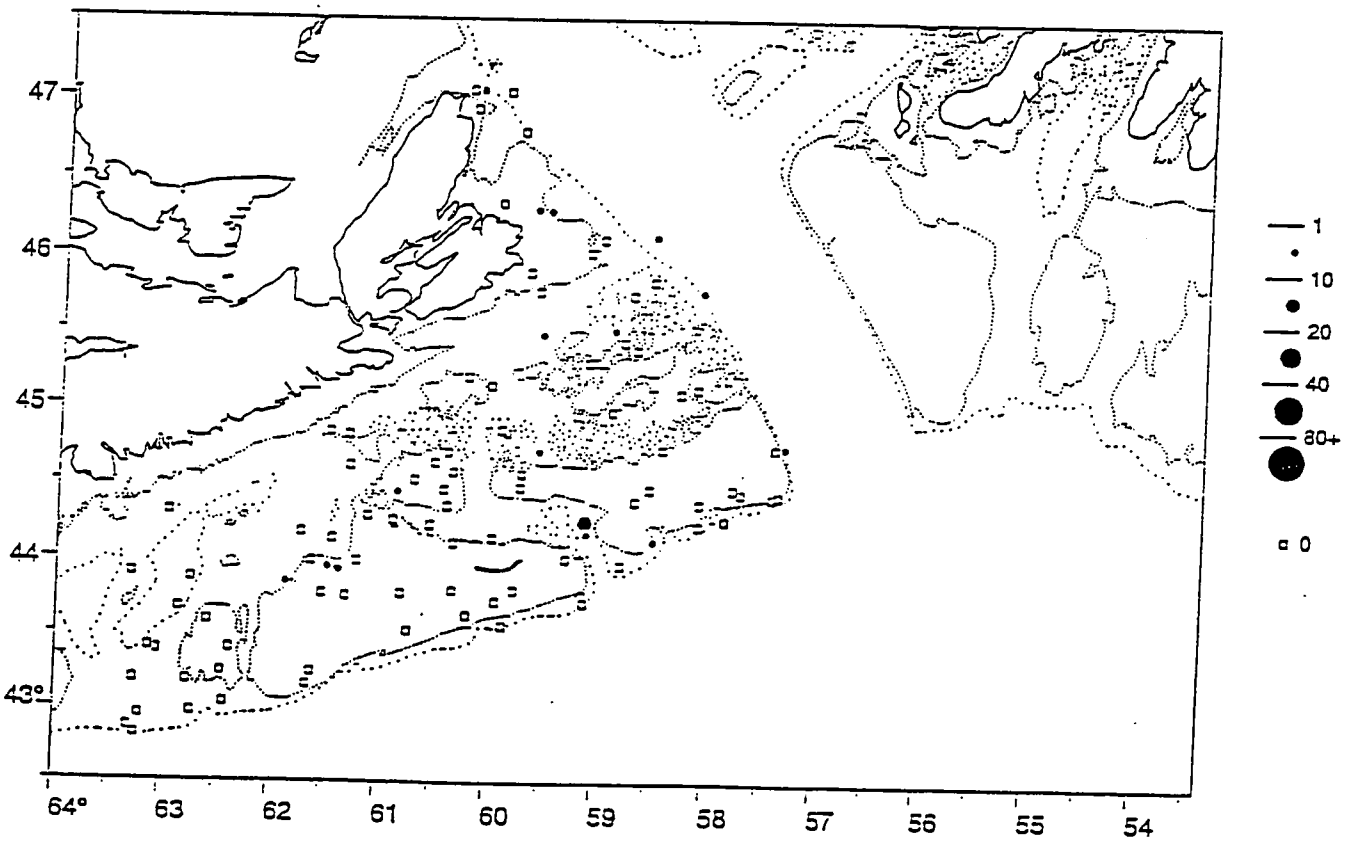
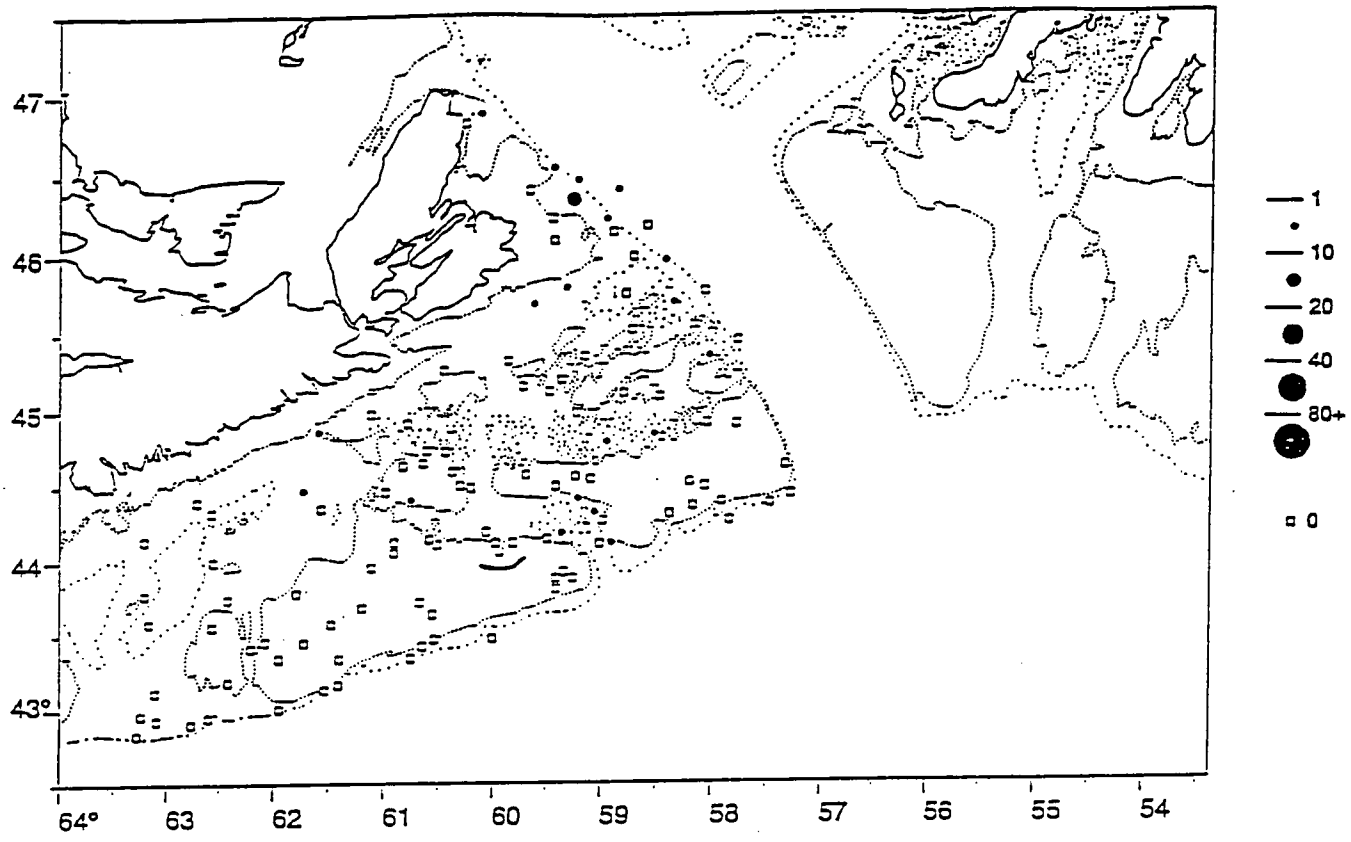


Figure 22c.

4VW WITCH CATCHES (KG) IN SCOTIA FUNDY SUMMER 93 GROUNDFISH SURVEY.



4VW WITCH CATCHES (KG) IN SCOTIA FUNDY SUMMER 94 GROUNDFISH SURVEY.

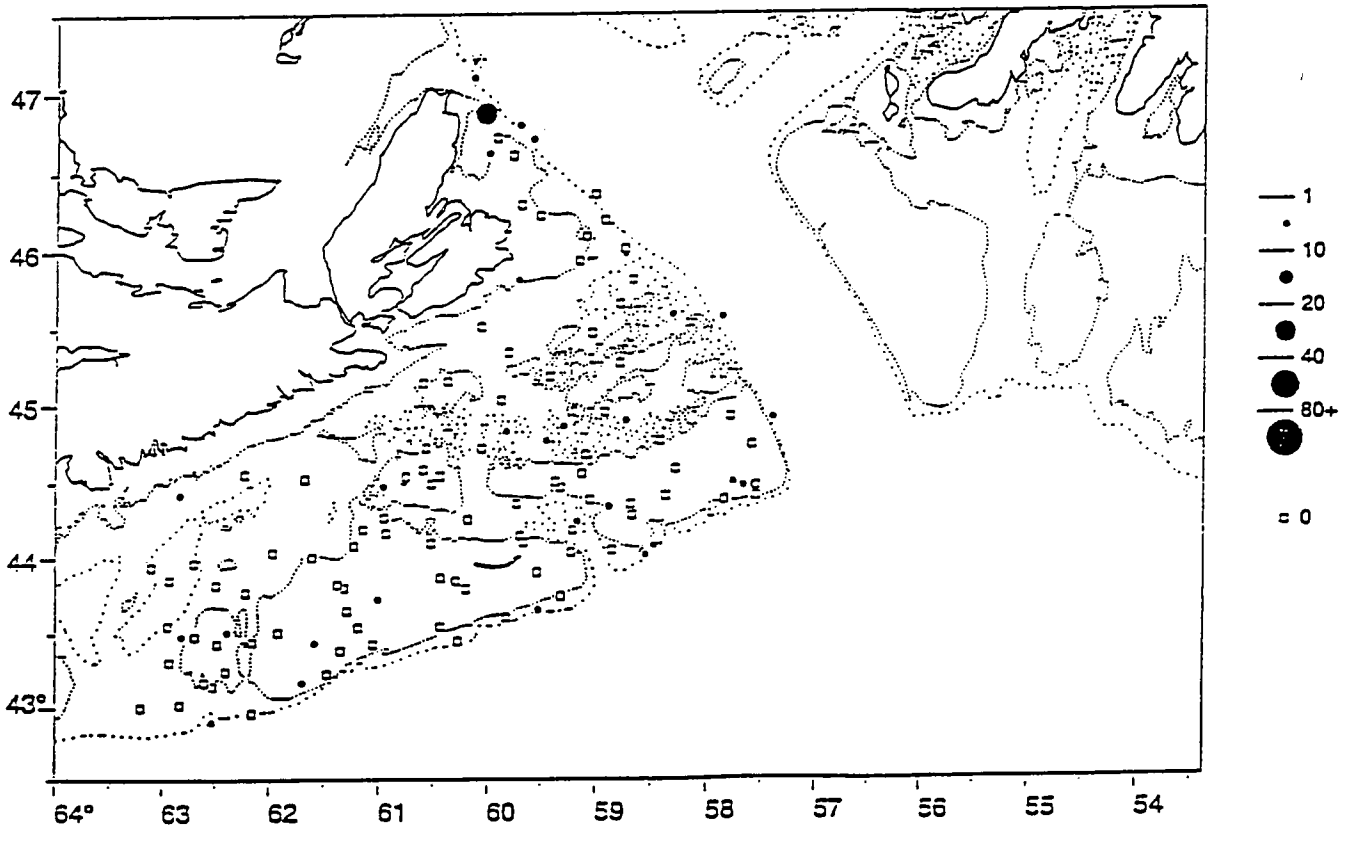
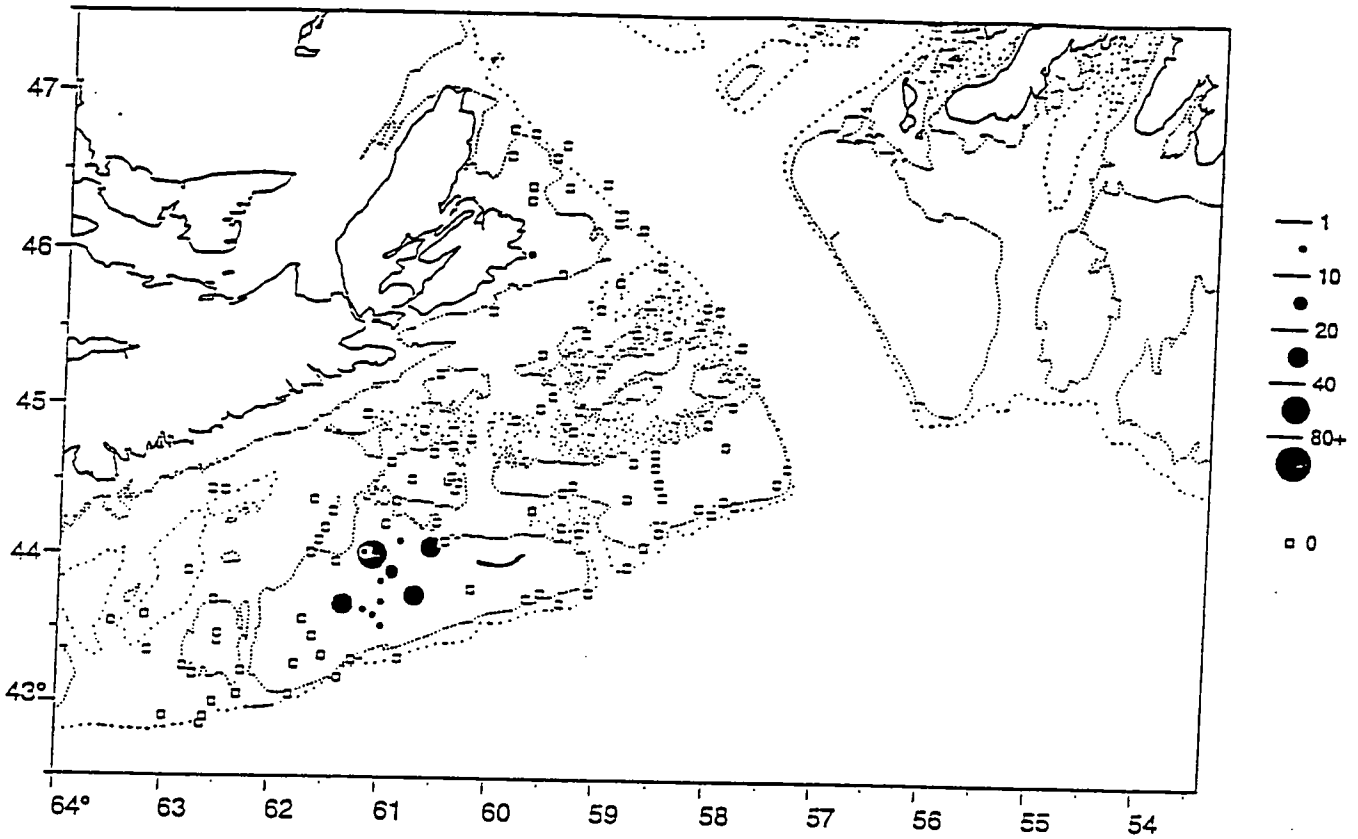


Figure 22c. (Continued)

4VW WINTER FLOUNDER CATCHES (KG) IN SCOTIA FUNDY SUMMER 91 GROUNDFISH SURVEY.



4VW WINTER FLOUNDER CATCHES (KG) IN SCOTIA FUNDY SUMMER 92 GROUNDFISH SURVEY.

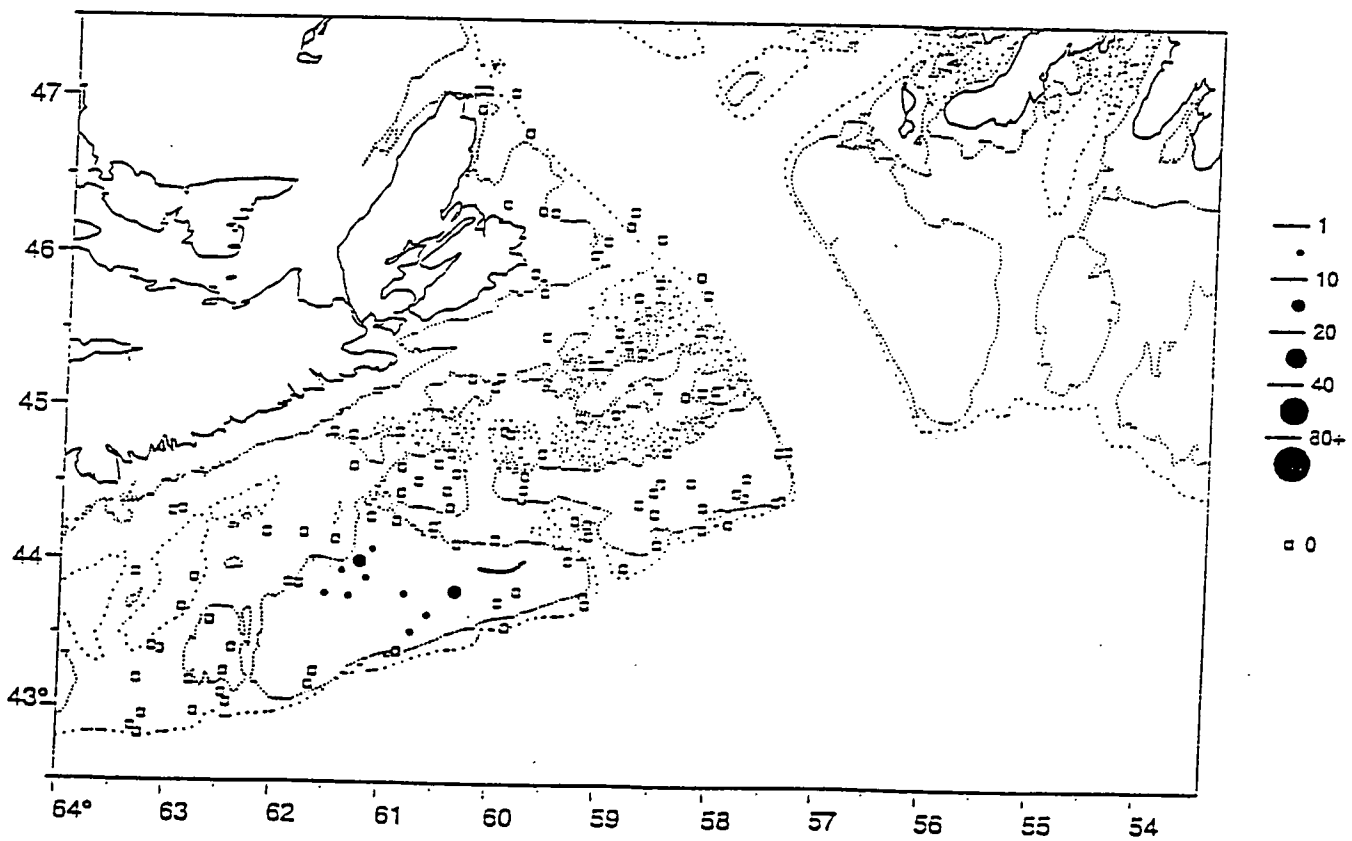
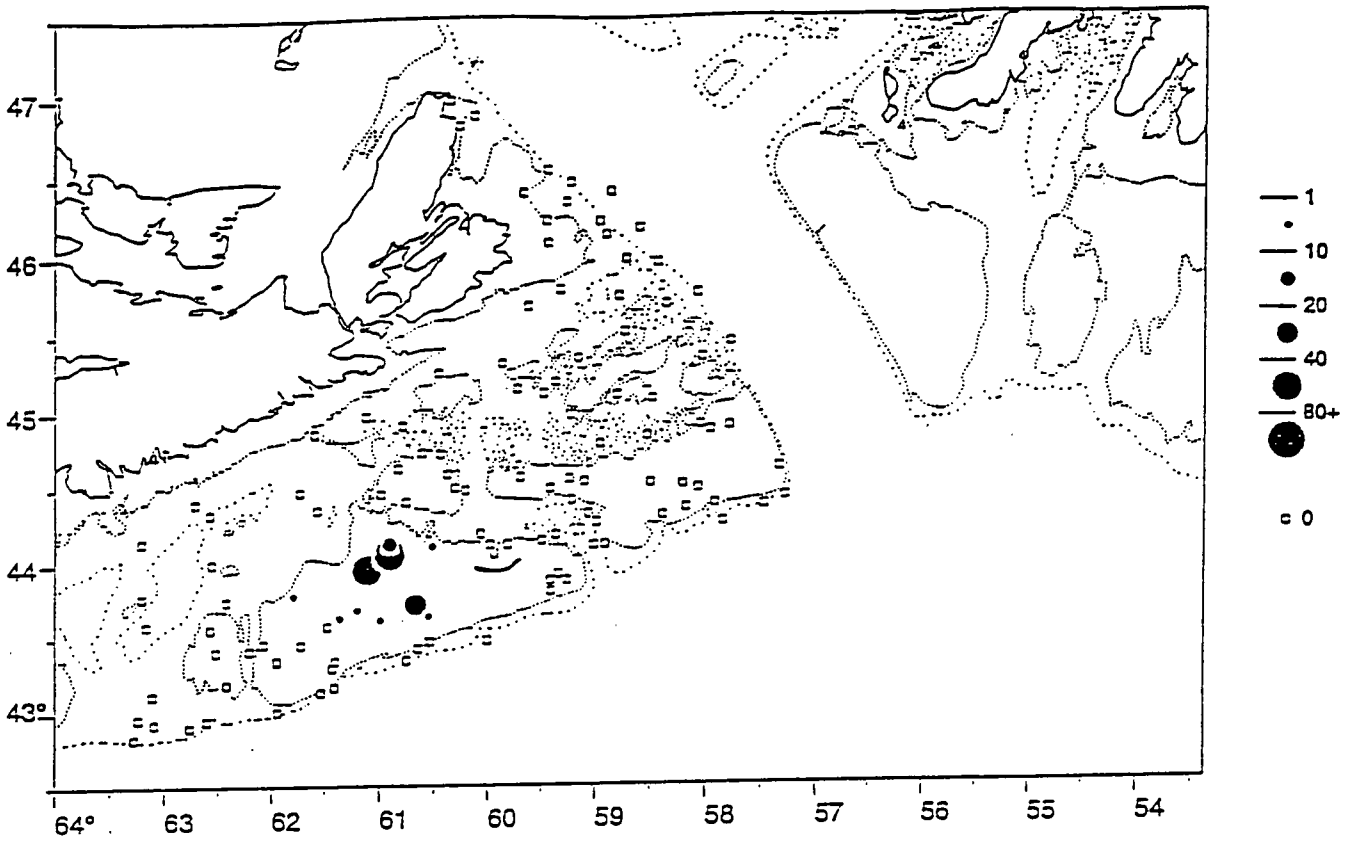


Figure 22d.

4VW WINTER FLOUNDER CATCHES (KG) IN SCOTIA FUNDY SUMMER 93 GROUNDFISH SURVEY.



4VW WINTER FLOUNDER CATCHES (KG) IN SCOTIA FUNDY SUMMER 94 GROUNDFISH SURVEY.

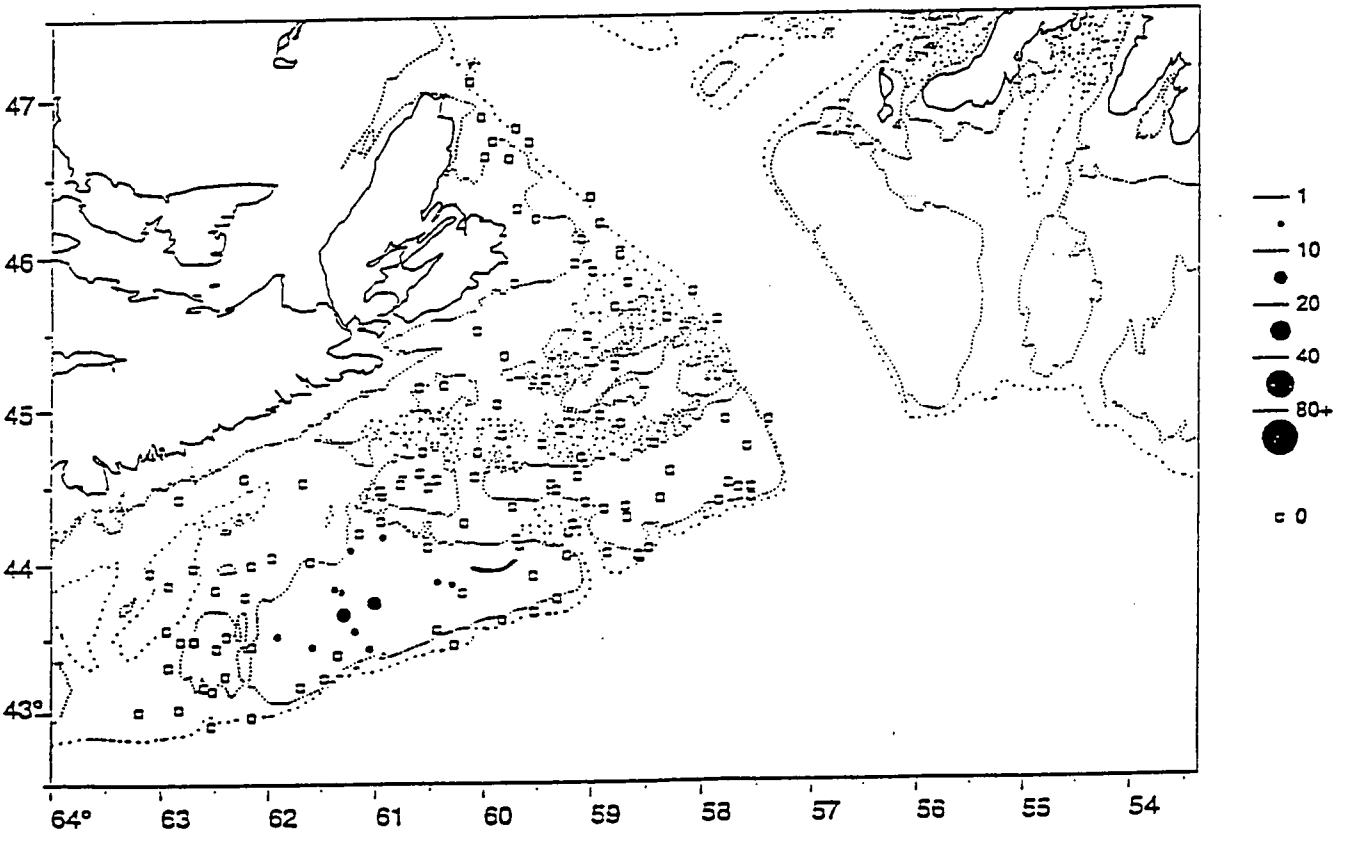
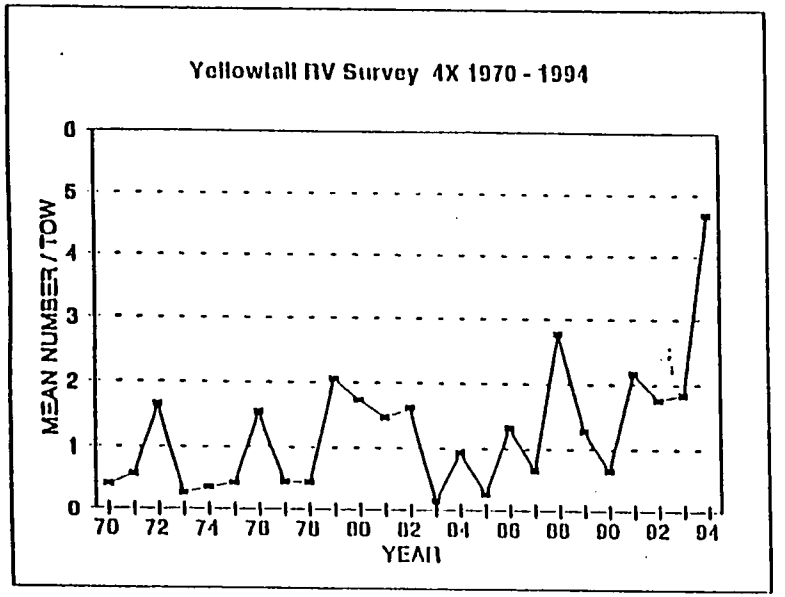
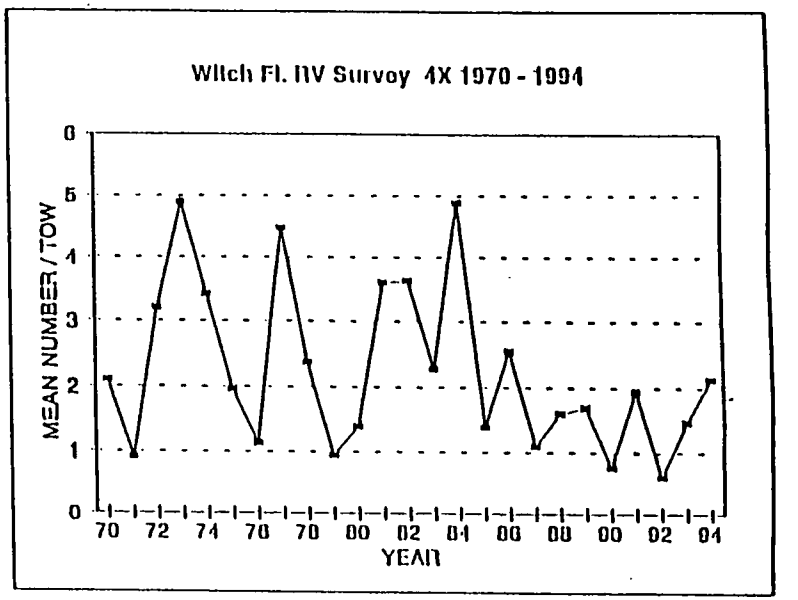
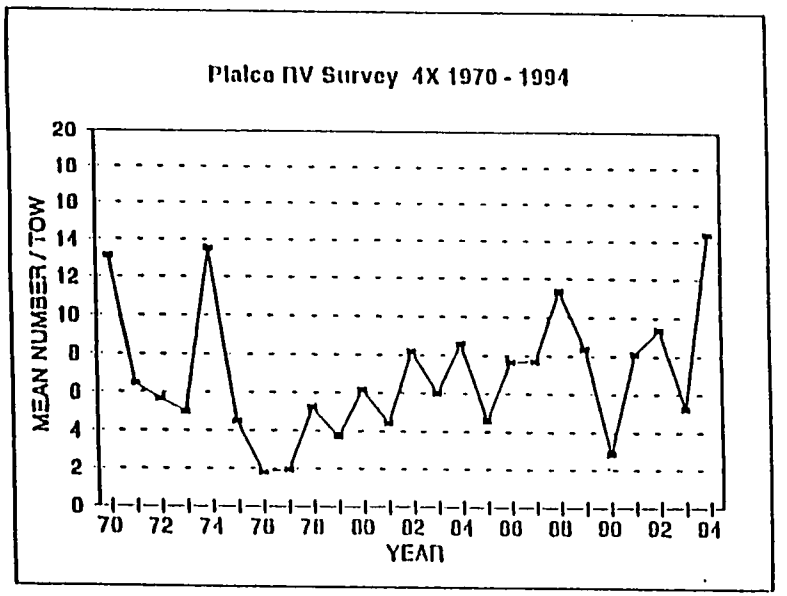


Figure 22d. (Continued)







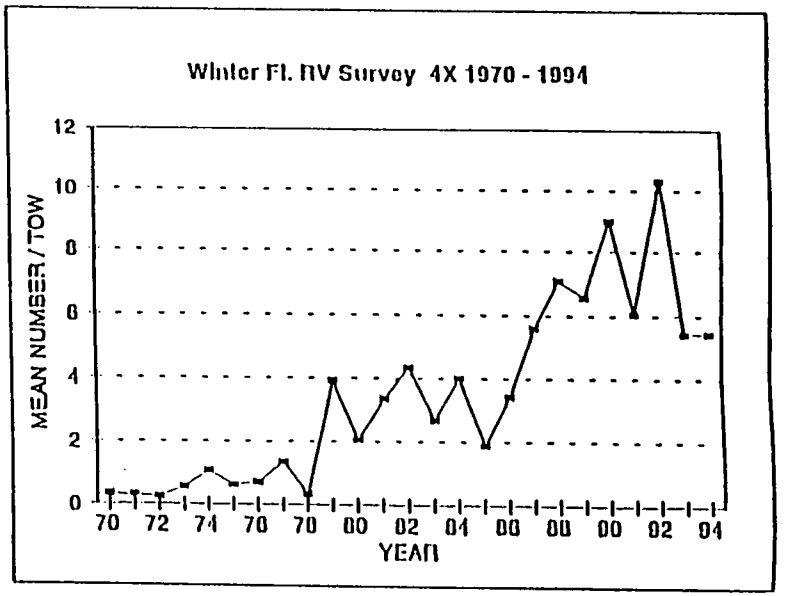


Figure 23. Survey mean number per tow.

4X Flatfish (C. Annand, BIO)

1. Abundance

Winter flounder: Mean numbers per tow remained stable in 1994 at 5.44 fish per tow, approximately half the 1992 value (Fig. 23). It should be noted that the survey does not cover the inshore portion of 4X which is thought to contain a large portion of winter flounder abundance.

Witch flounder: Mean numbers per tow increased from 1.47 fish per tow in 1993 to 2.13 fish per tow in 1994 (Fig. 23).

American plaice: Mean numbers per tow increased from 5.26 fish per tow in 1993 to 14.35 fish per tow in 1994, the highest value in the time series (Fig. 23).

Yellowtail flounder: Mean numbers per tow increased from 1.47 fish per tow in 1993 to an historical high of 4.66 fish per tow in 1994 (Fig. 23). These catches are dependent on a few very large sets on the edge of Brown's Bank.

2. Recruitment and Size Composition

Winter flounder: 1994 survey length frequencies did not indicate any significant changes compared to the 1993 size distribution although somewhat fewer large female winter flounder were caught in the 1994 survey (Fig. 24a).

Witch flounder: Survey length frequencies indicate fewer large fish in the population in 1994 compared to 1993. The survey is generally not a good indicator of recruitment for witch flounder as juvenile witch are not fully recruited to the survey gear, however more small witch flounder (<30 cm) were caught in the 1994 survey compared to 1993 (Fig. 24b).

American plaice: The 1994 survey length distributions did not indicate any significant changes compared to previous years. However, more American plaice in the 10-20 cm size range were caught in the 1994 survey, which may be an indication of incoming recruitment (Fig. 24c).

Yellowtail flounder: Yellowtail flounder caught in the 1994 survey were generally smaller than those caught in 1993 and may indicate a good yearclass recruiting to the fishery (Fig. 24d).

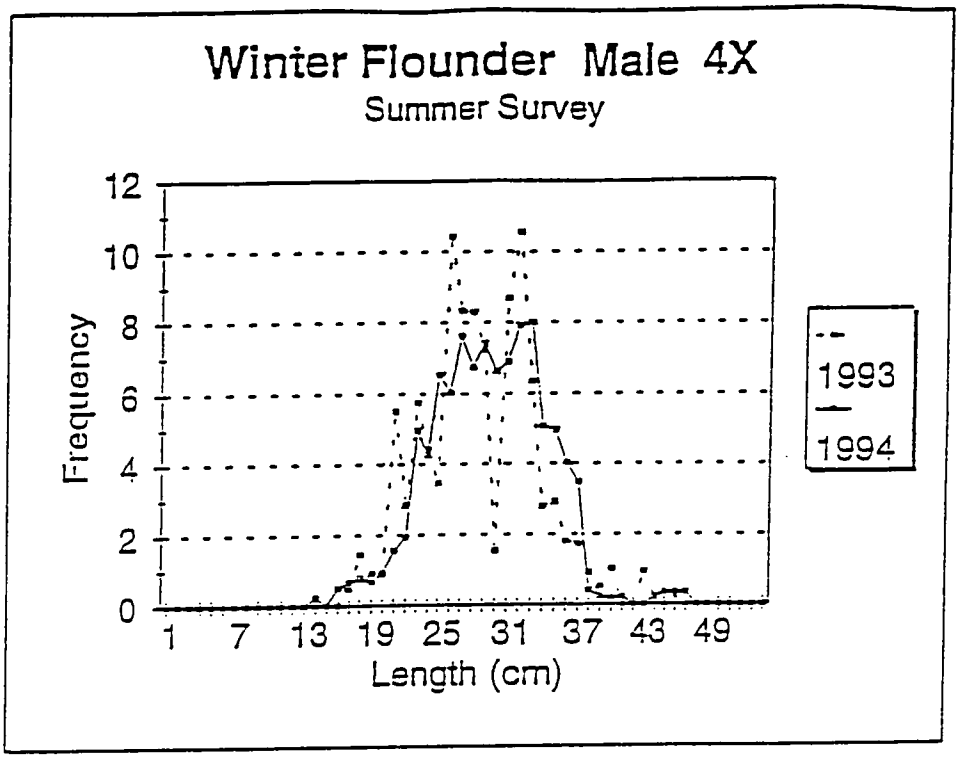
3. Distribution

Winter flounder : As in 1993, the 1994 summer survey distribution of winter flounder appears to be restricted to the Browns Bank area and the Bay of Fundy. Catches on Browns Bank were lower than in recent years (Fig. 25a).

Witch flounder: The 1994 survey catch rates indicate that witch flounder are widely distributed in 4X but at low concentrations. Distributions in 1994 were similar to recent years; however, more witch flounder were caught east of Browns Bank than in 1993 (Fig. 25b).

American plaice: The highest catch rates were obtained in the area between Roseway and Browns Bank with distribution similar to previous years. More American plaice were caught around the mouth of the Bay of Fundy in the 1994 survey than in 1993 (Fig. 25c).

Yellowtail flounder: 1994 survey catch rates indicate that yellowtail distribution in 4X is limited to the Brown Bank area with lower catches in and around the mouth of the Bay of Fundy (Fig. 25d).



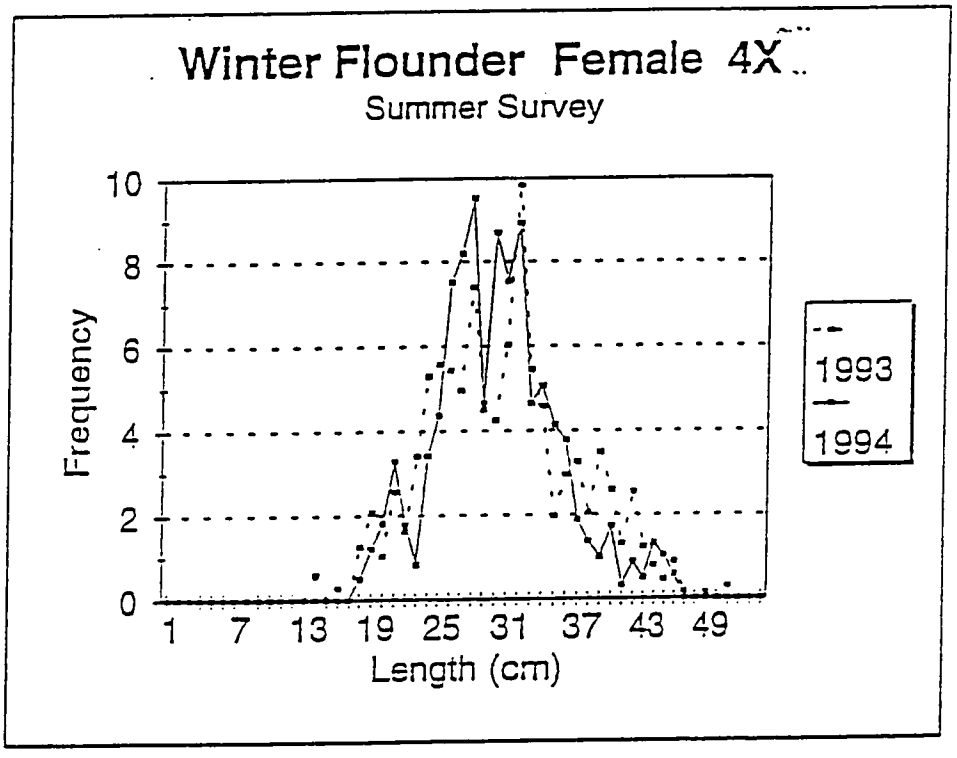
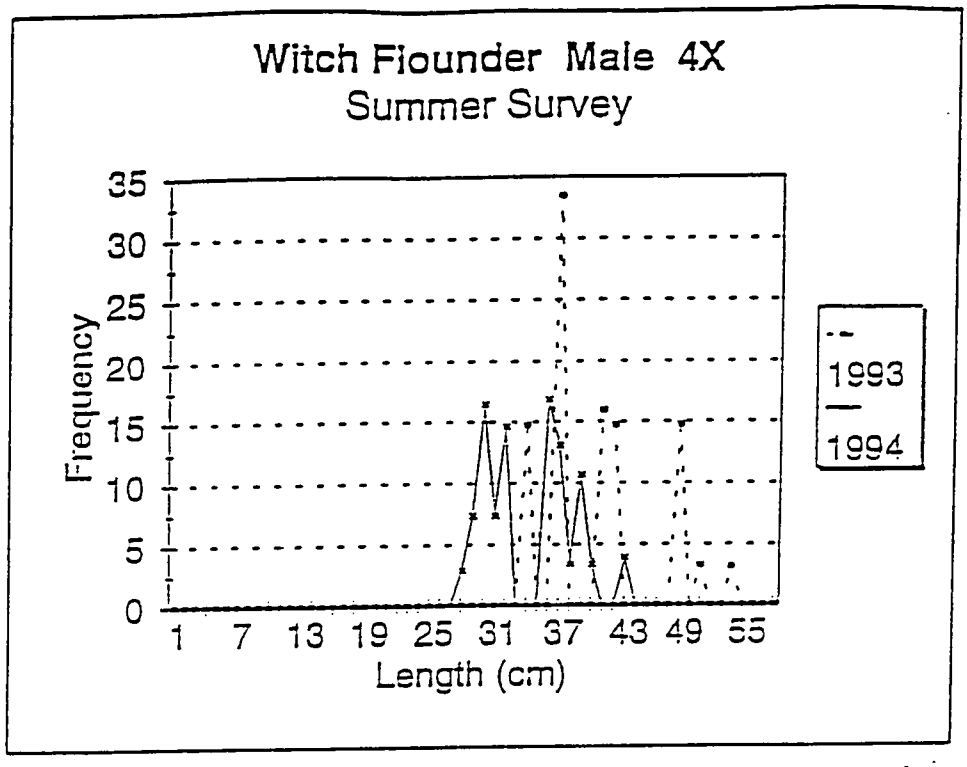


Figure 24a. Survey length frequency.



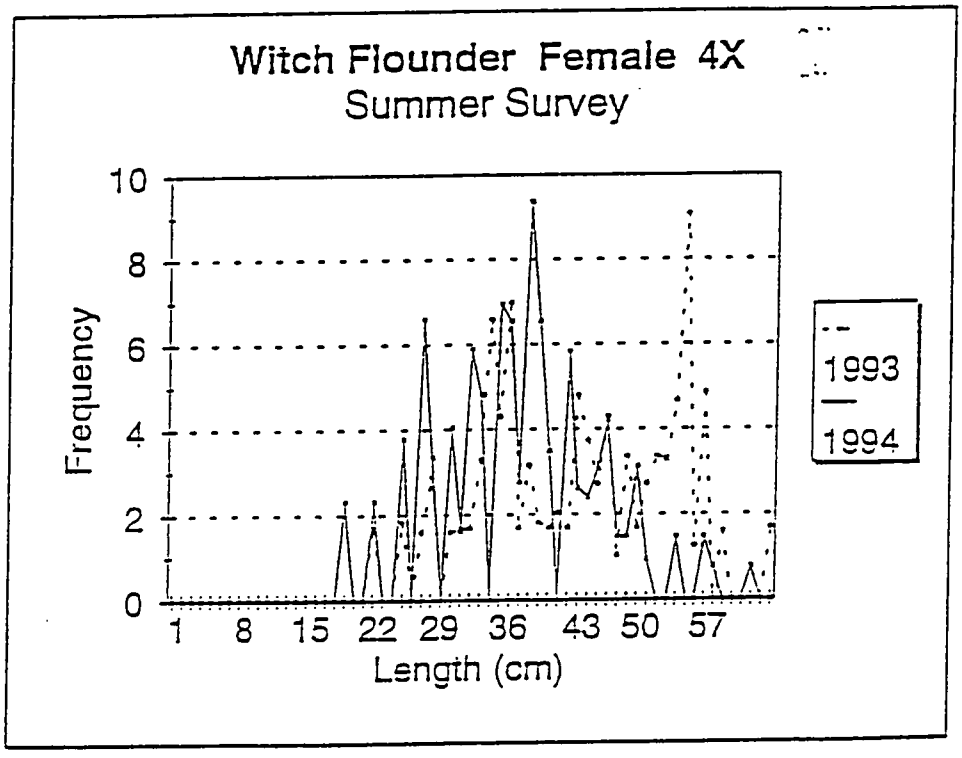
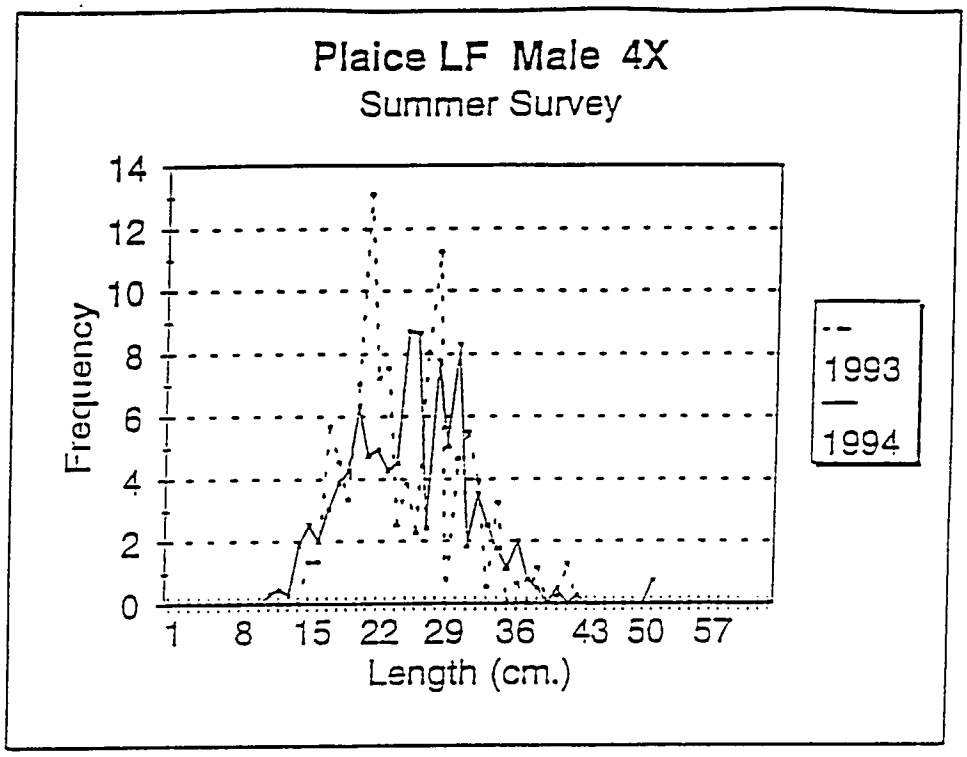


Figure 24b. Survey length frequency.



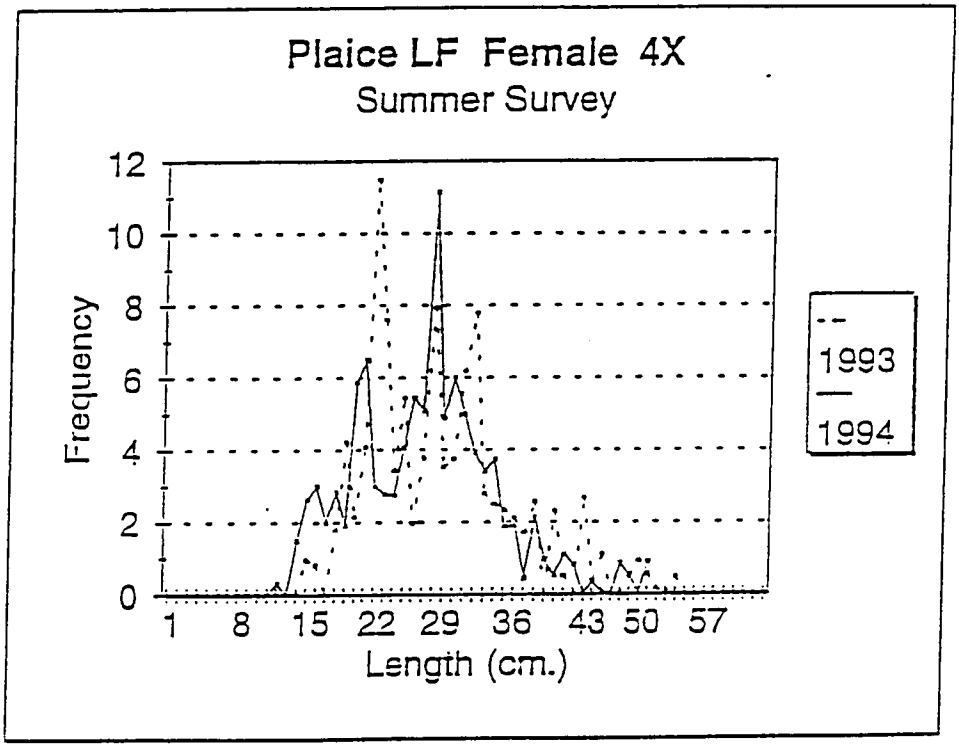
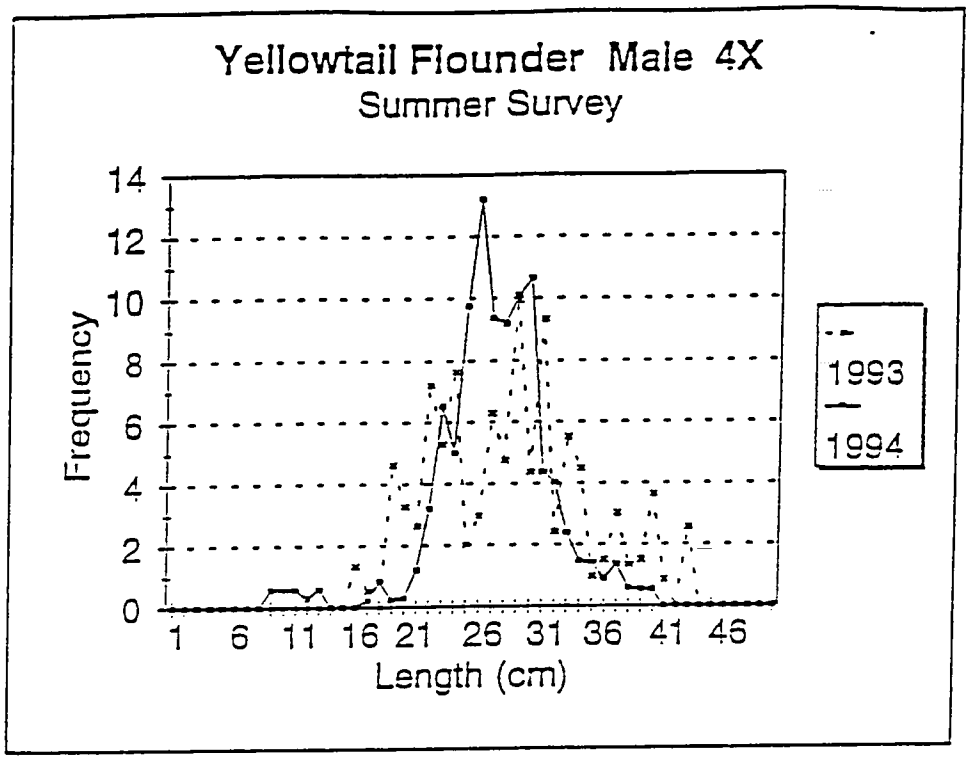


Figure 24c. Survey length frequency.



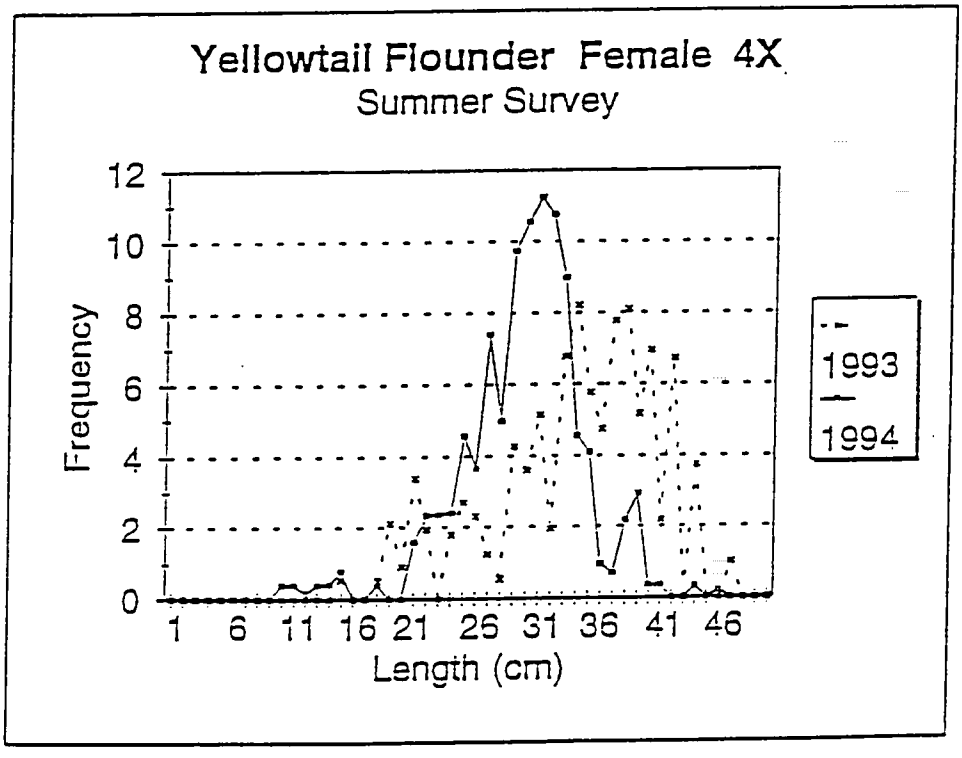
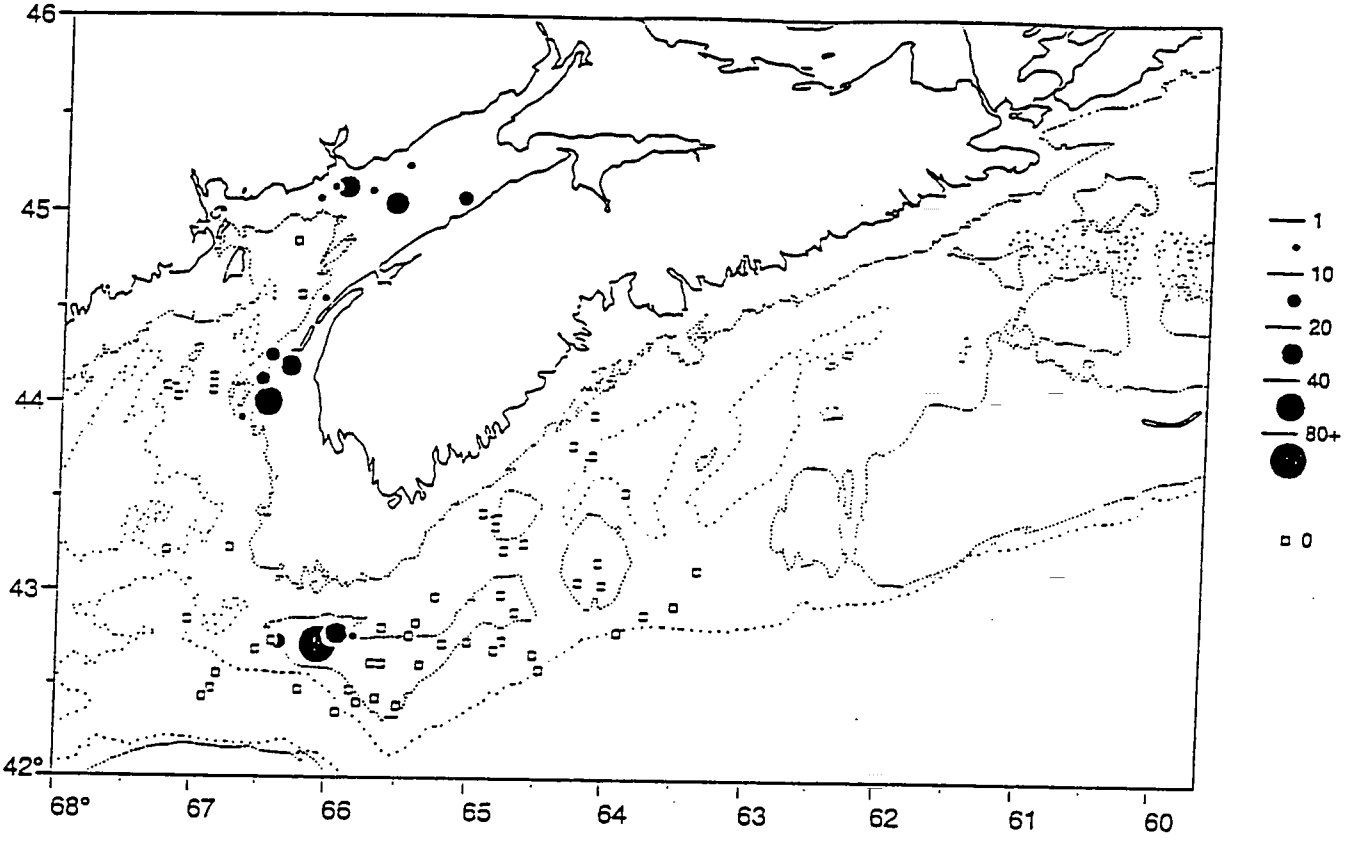


Figure 24d. Survey length frequency.

4X WINTER FLOUNDER CATCHES (KG) IN SCOTIA FUNDY SUMMER 91 GROUNDFISH SURVEY.



4X WINTER FLOUNDER CATCHES (KG) IN SCOTIA FUNDY SUMMER 92 GROUNDFISH SURVEY.

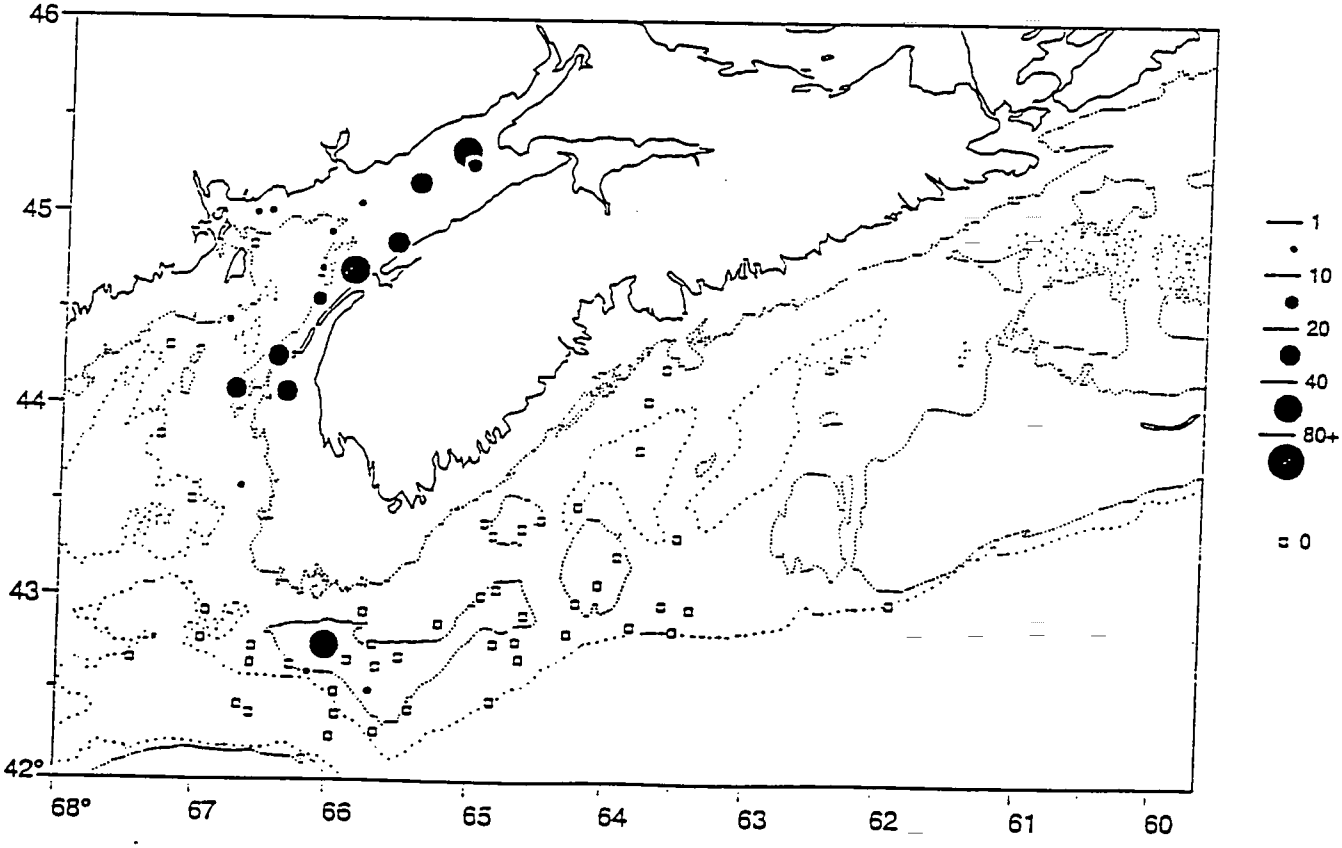
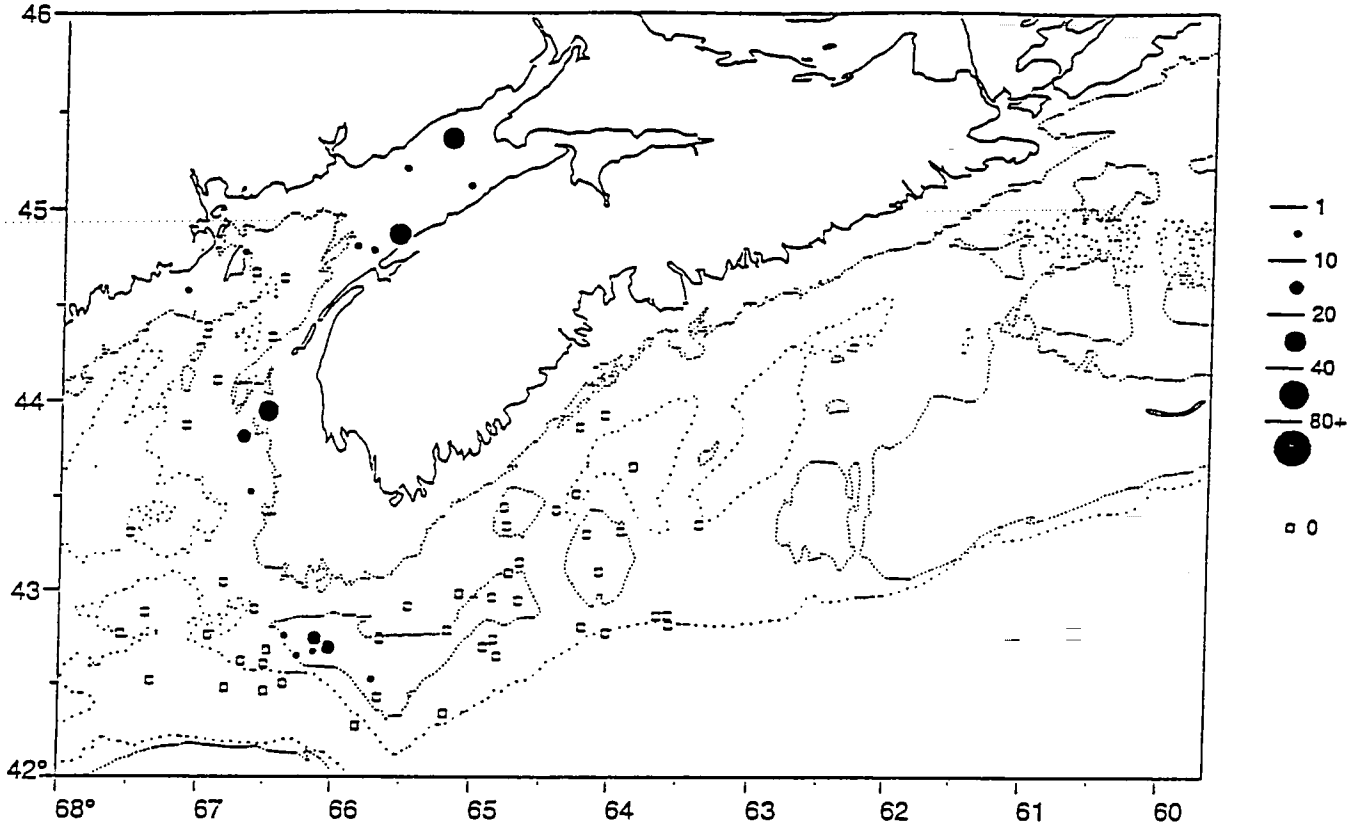


Figure 25a.

4X WINTER FLOUNDER CATCHES (KG) IN SCOTIA FUNDY SUMMER 93 GROUNDFISH SURVEY.



4X WINTER FLOUNDER CATCHES (KG) IN SCOTIA FUNDY SUMMER 94 GROUNDFISH SURVEY.

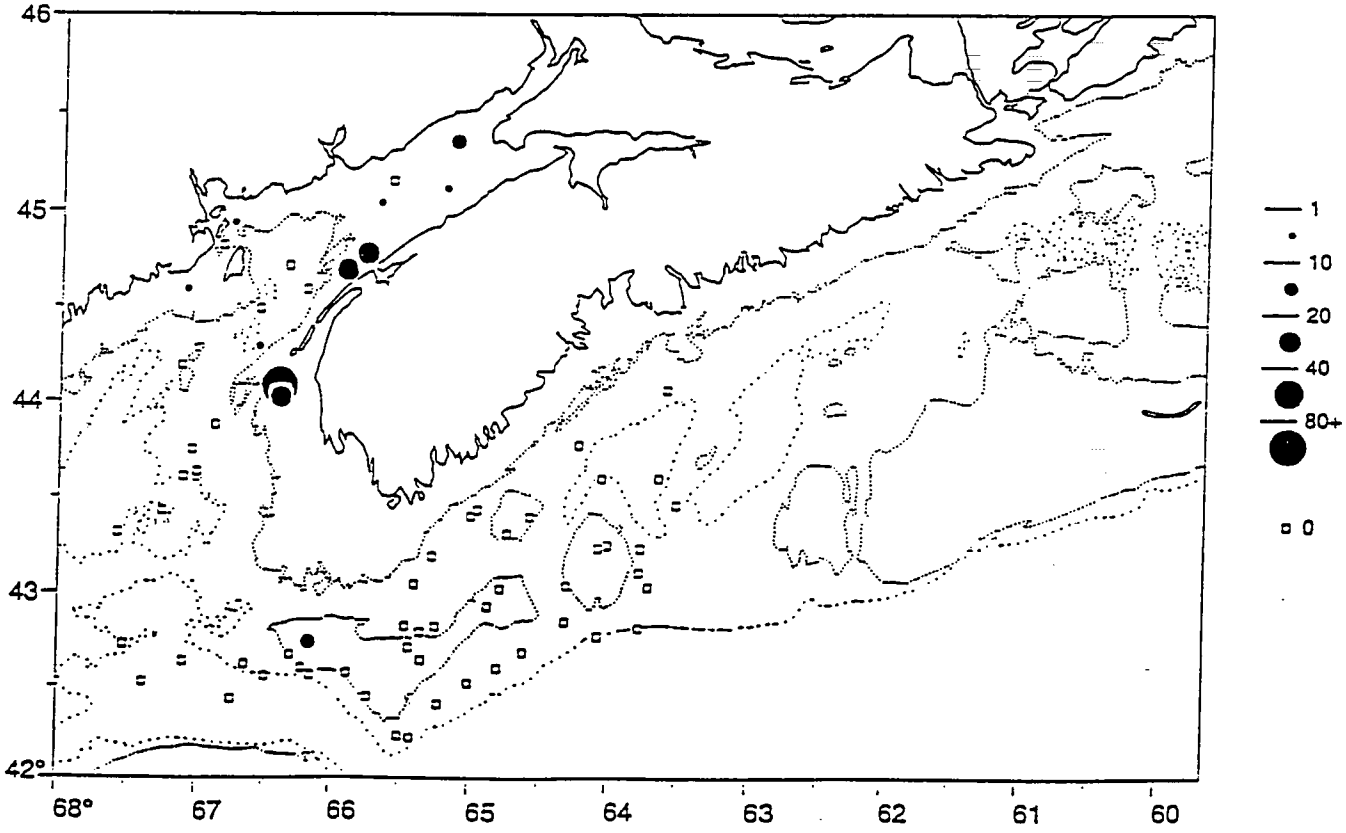
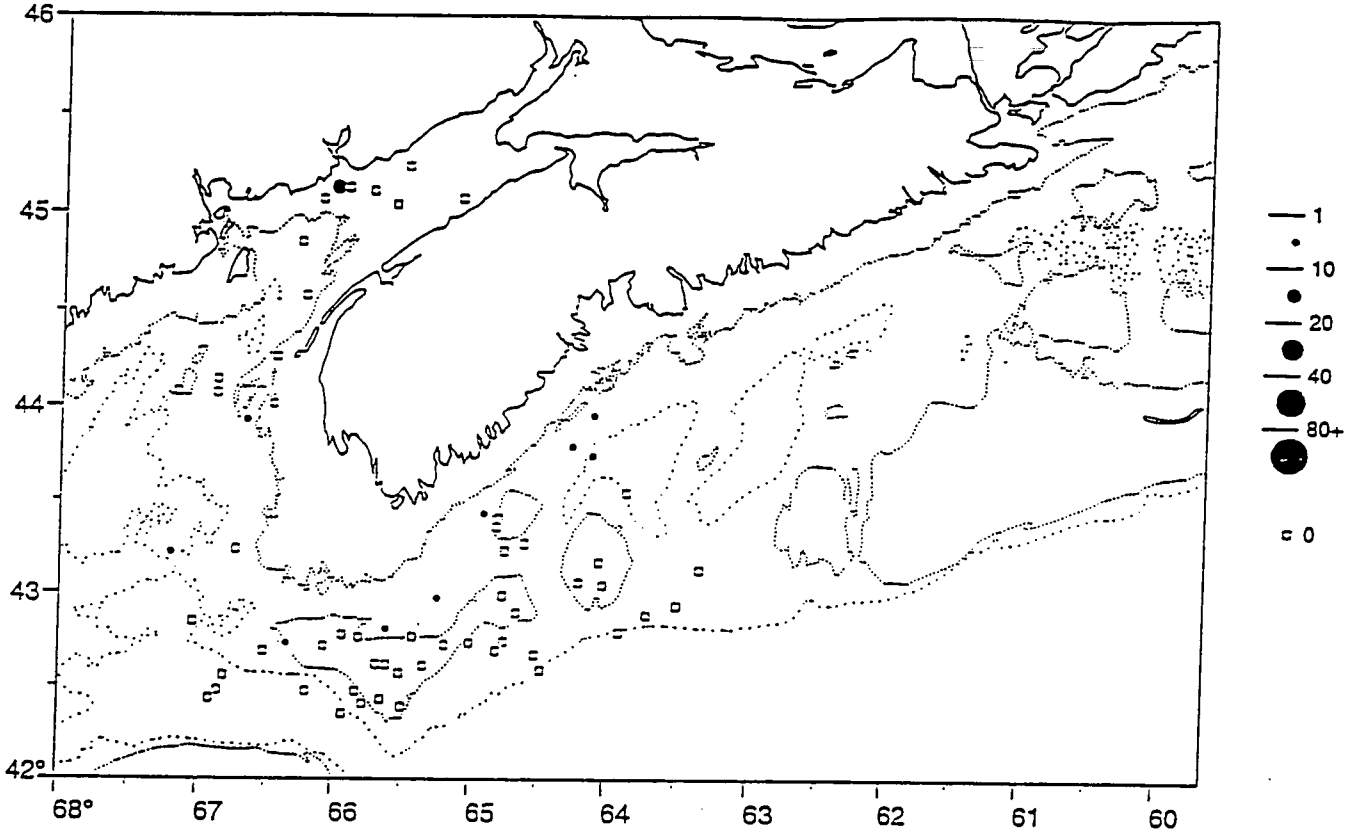


Figure 25a. (Continued)

4X WITCH CATCHES (KG) IN SCOTIA FUNDY SUMMER 91 GROUNDFISH SURVEY.



4X WITCH CATCHES (KG) IN SCOTIA FUNDY SUMMER 92 GROUNDFISH SURVEY.

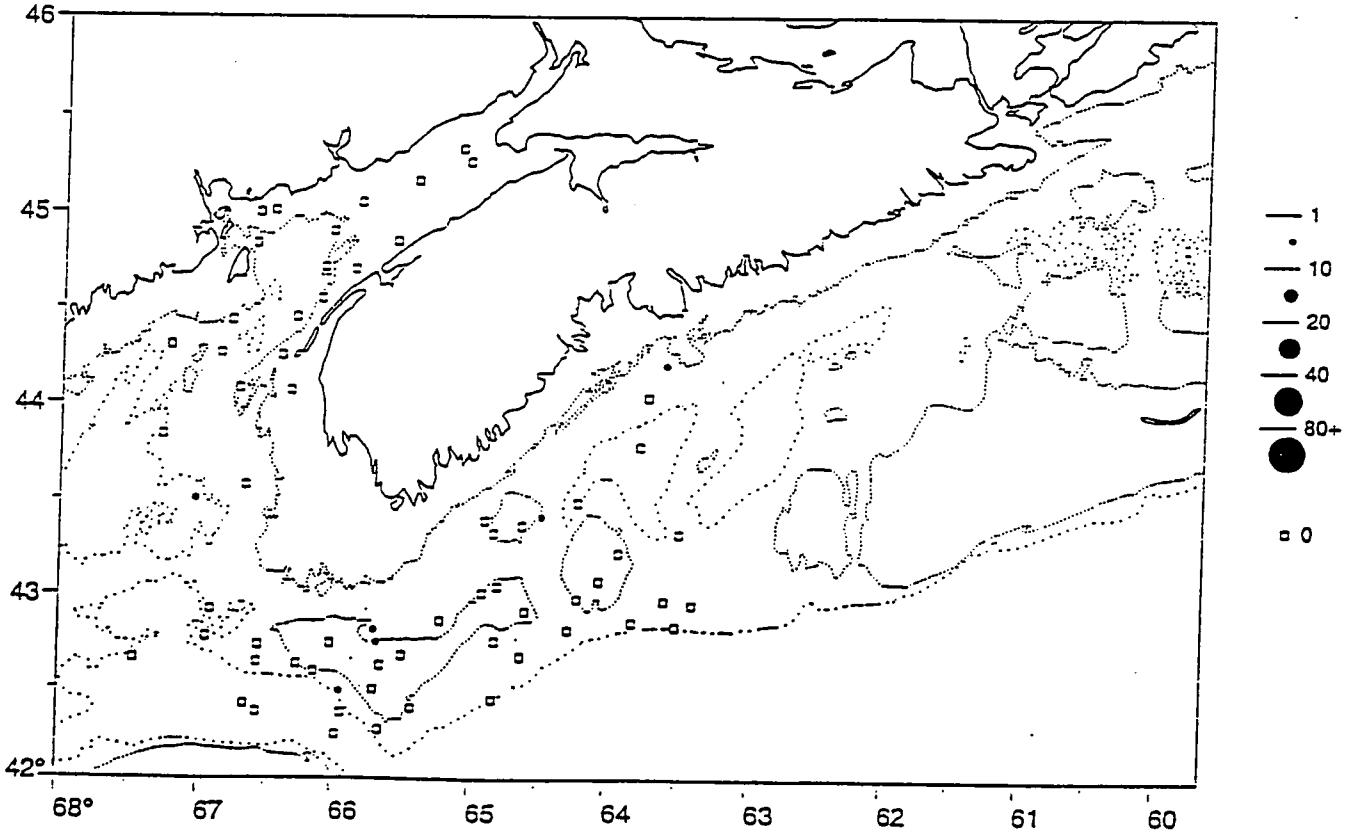
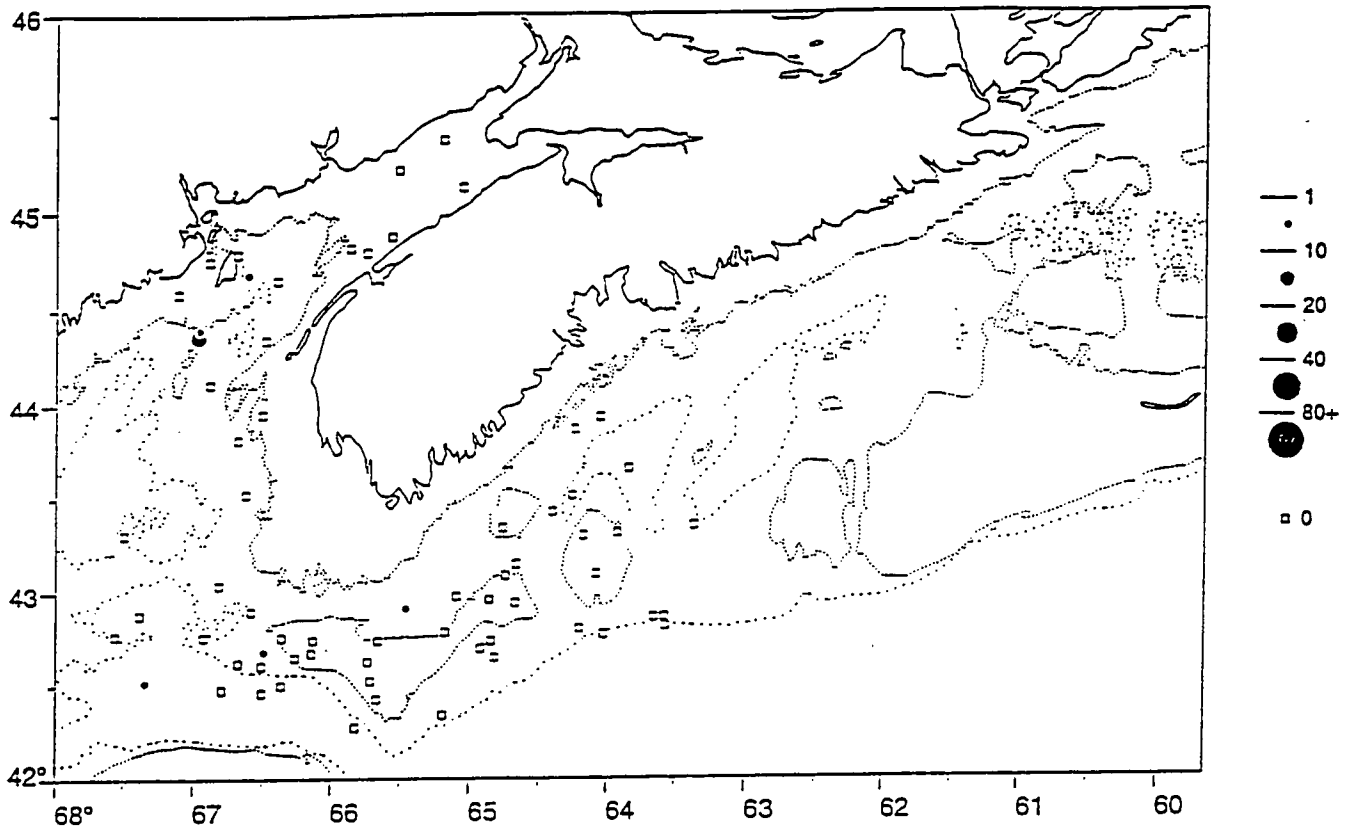


Figure 25b.

4X WITCH CATCHES (KG) IN SCOTIA FUNDY SUMMER 93 GROUNDFISH SURVEY.



4X WITCH CATCHES (KG) IN SCOTIA FUNDY SUMMER 94 GROUNDFISH SURVEY.

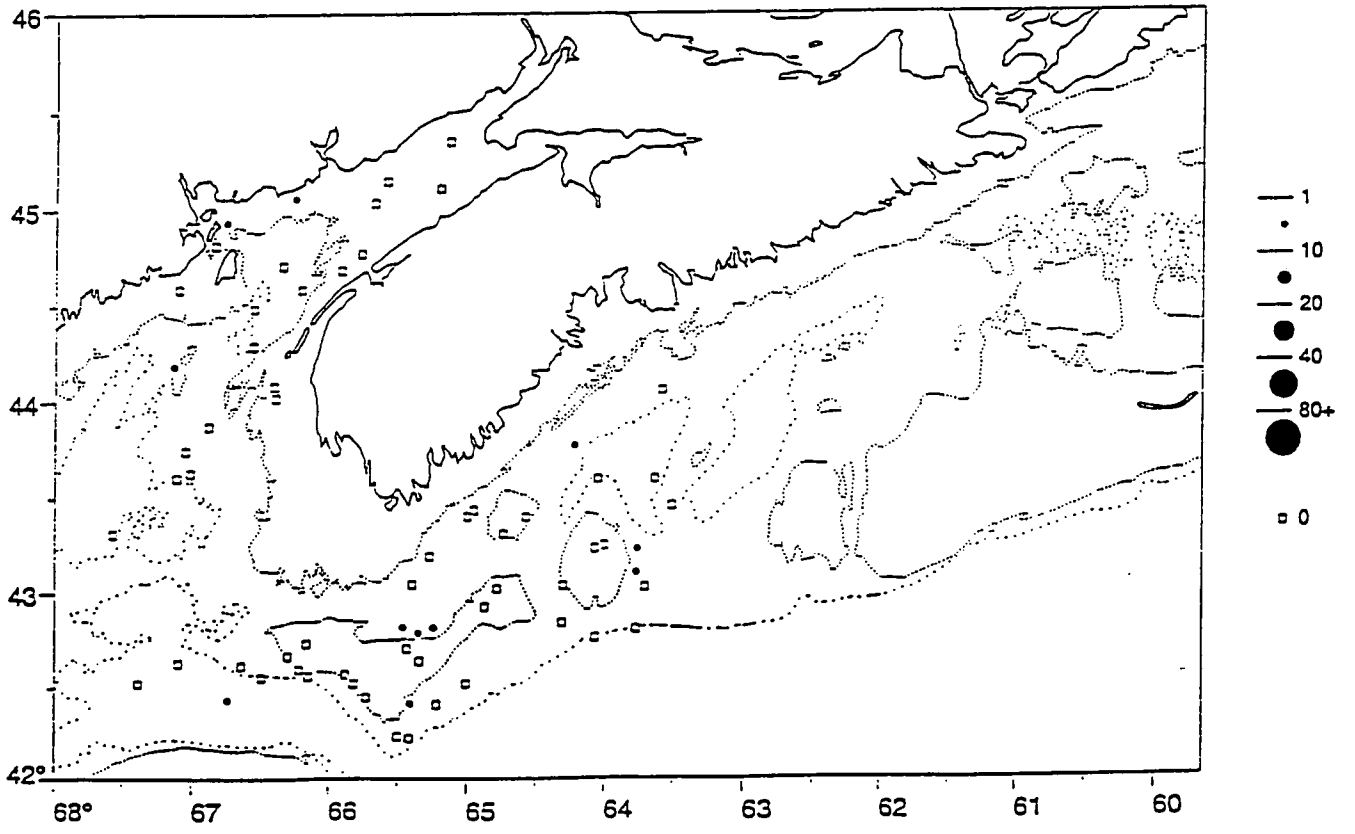
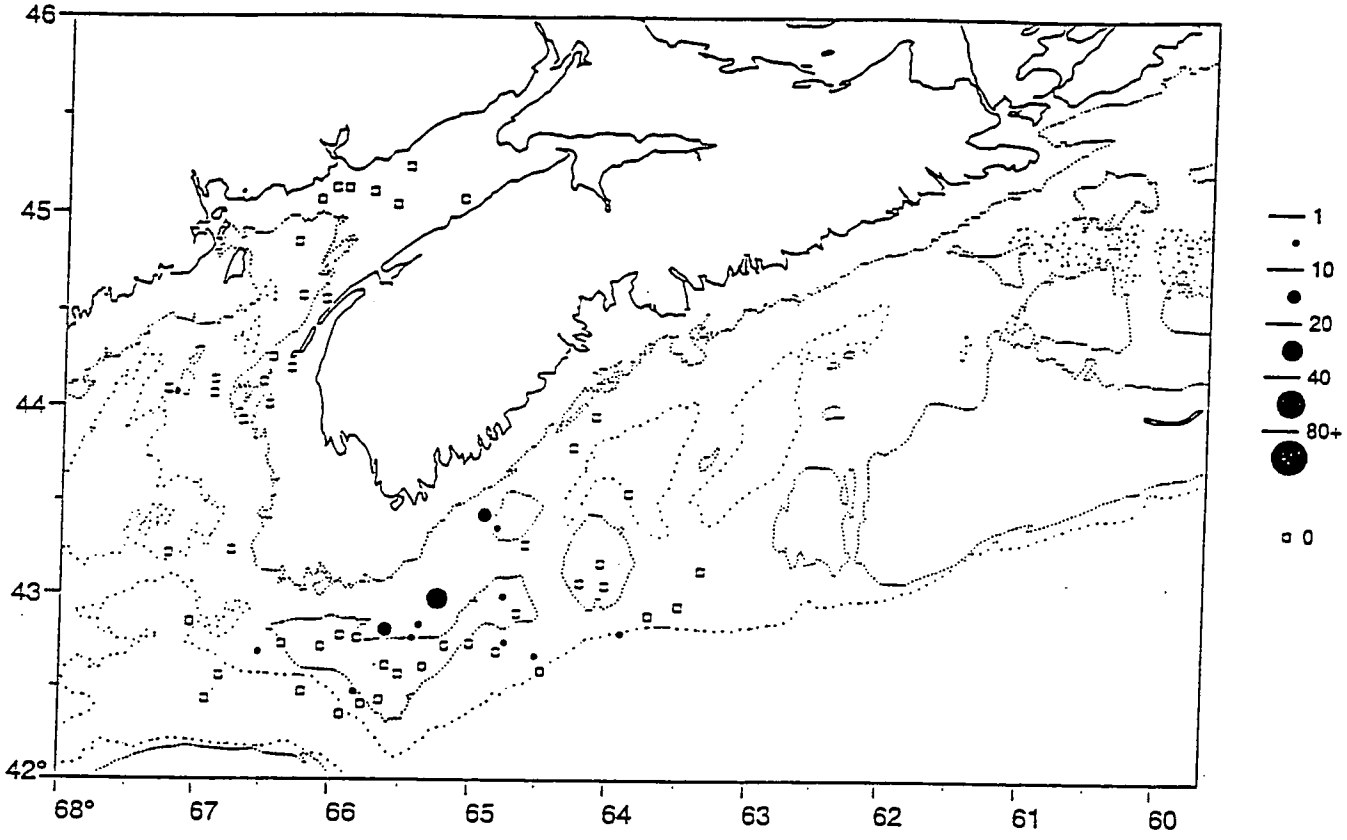


Figure 25b. (Continued)

4X PLAICE CATCHES (KG) IN SCOTIA FUNDY SUMMER 91 GROUNDFISH SURVEY.



4X PLAICE CATCHES (KG) IN SCOTIA FUNDY SUMMER 92 GROUNDFISH SURVEY.

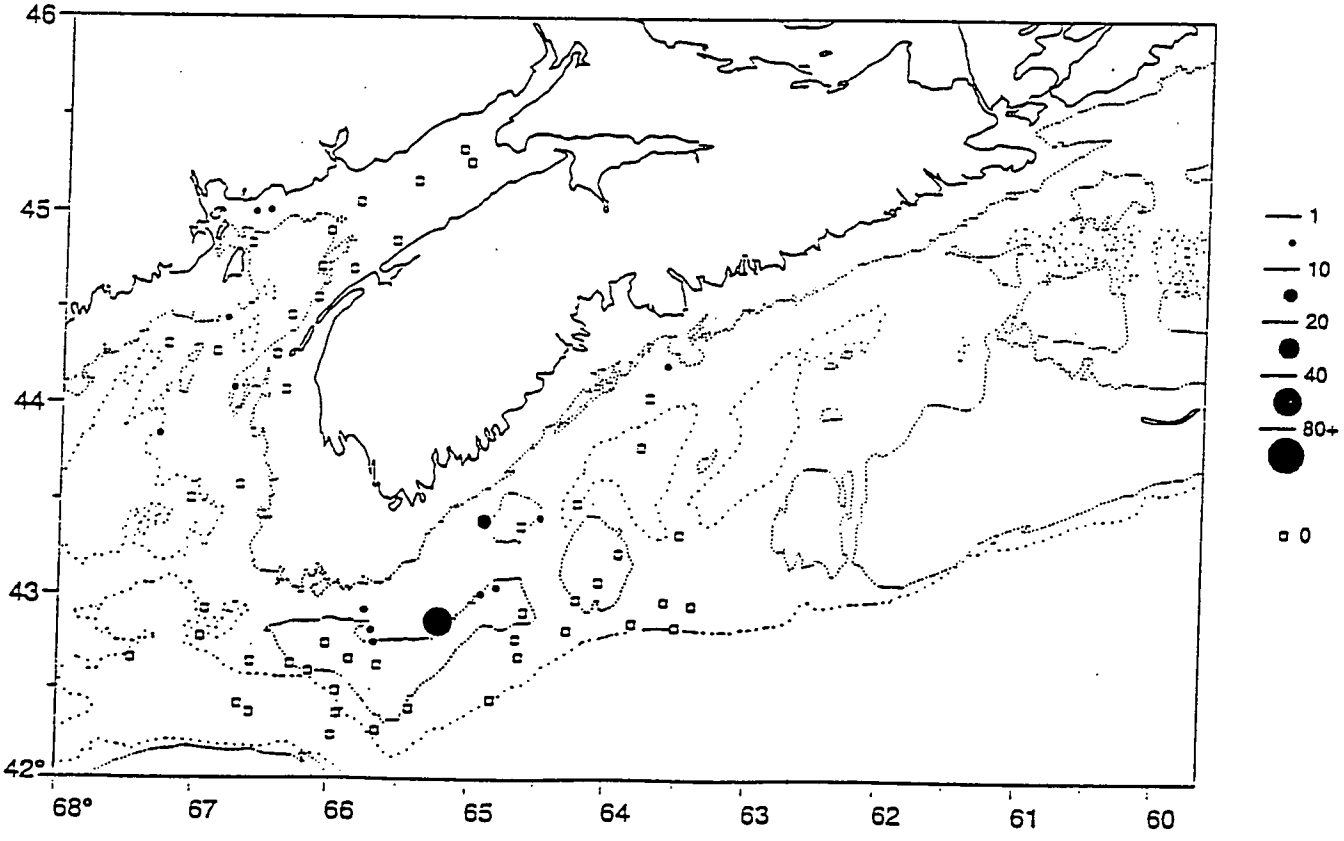
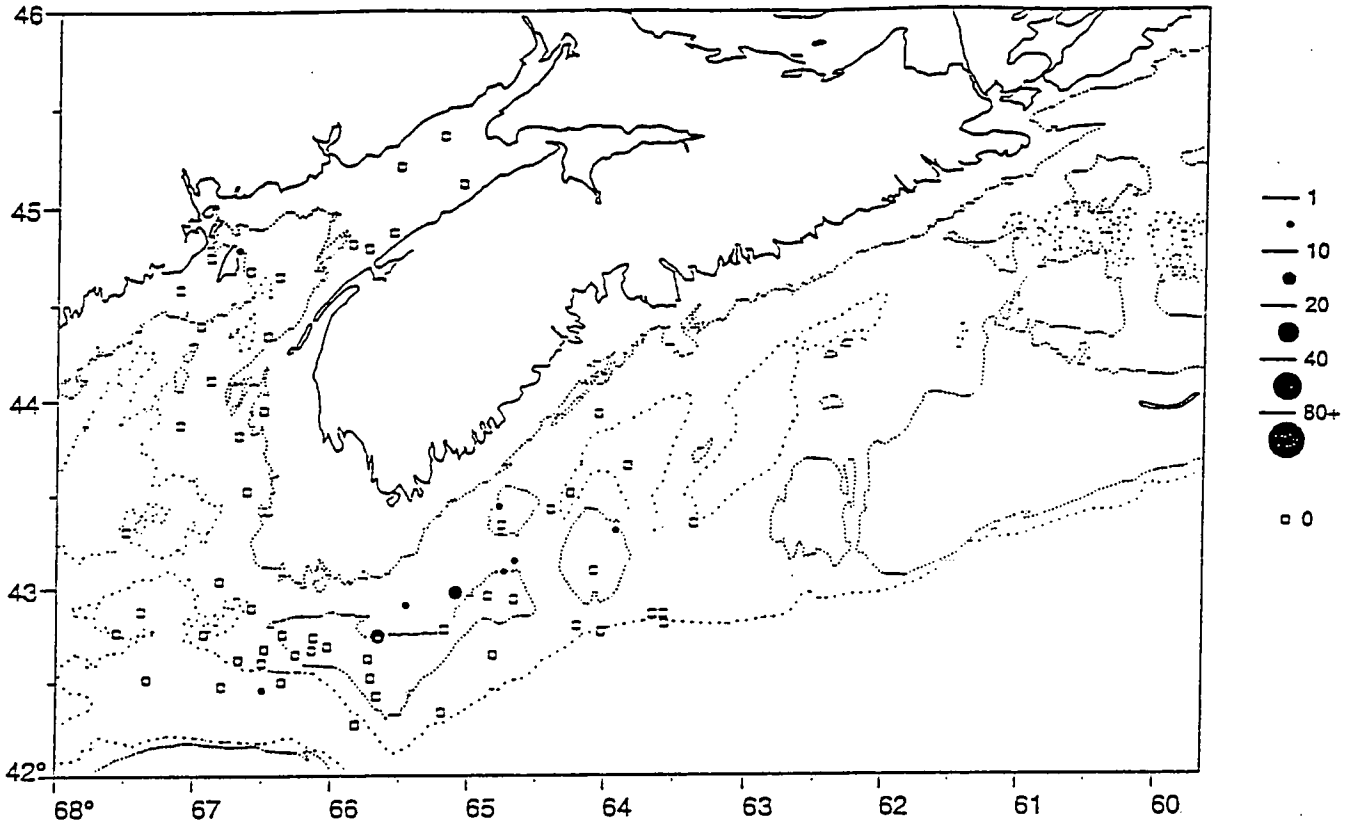


Figure 25c.

4X PLAICE CATCHES (KG) IN SCOTIA FUNDY SUMMER 93 GROUNDFISH SURVEY.



4X PLAICE CATCHES (KG) IN SCOTIA FUNDY SUMMER 94 GROUNDFISH SURVEY.

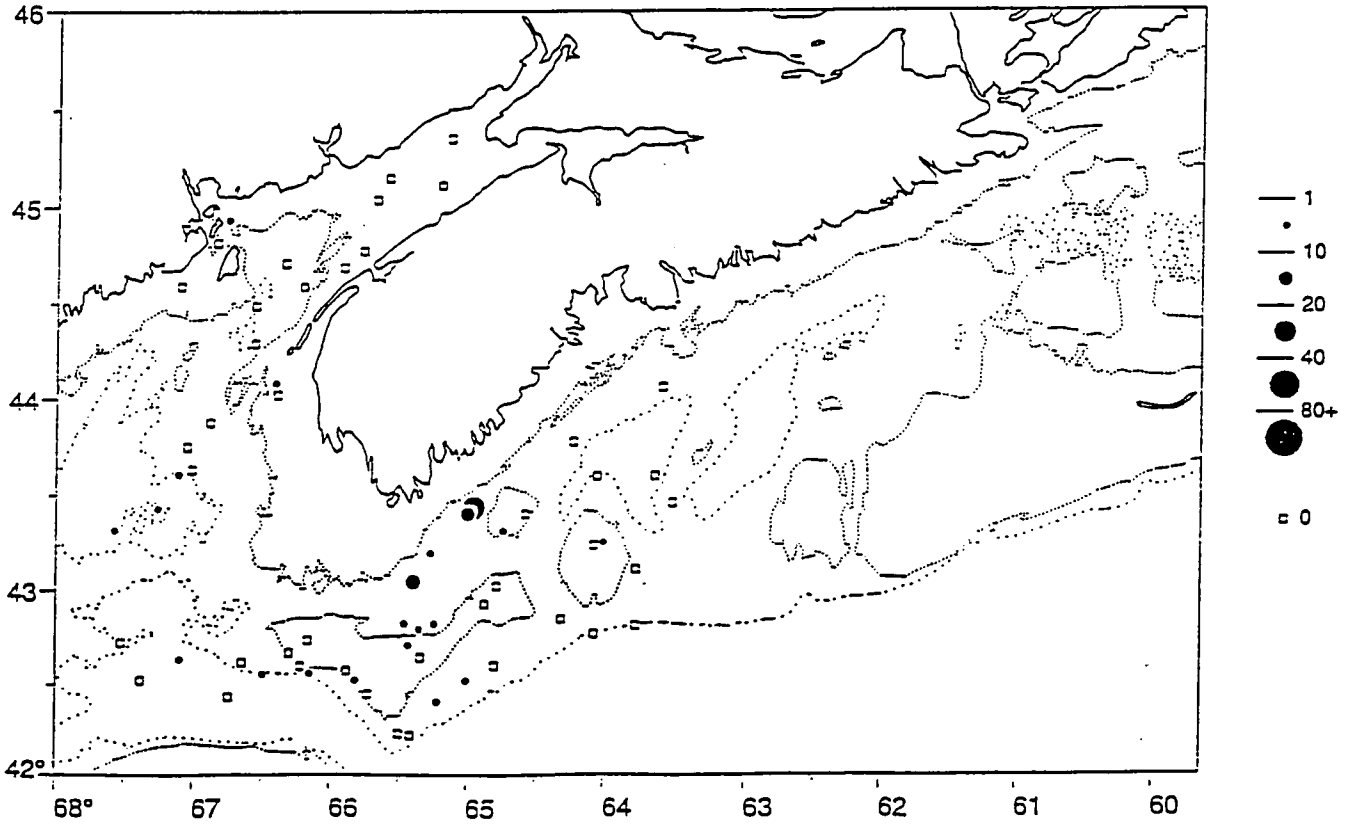
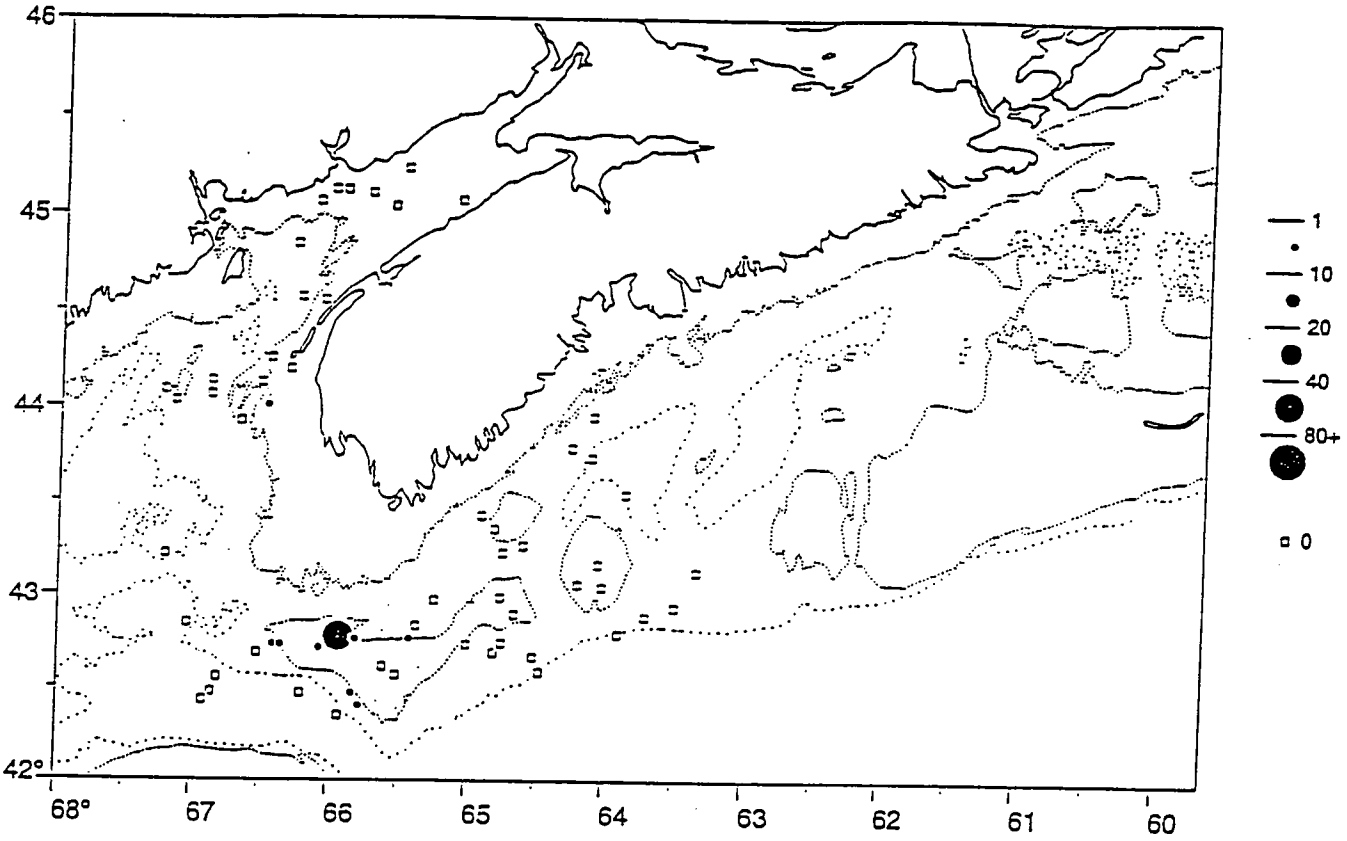


Figure 25c. (Continued)

4X YELLOWTAIL CATCHES (KG) IN SCOTIA FUNDY SUMMER 91 GROUNDFISH SURVEY.



4X YELLOWTAIL CATCHES (KG) IN SCOTIA FUNDY SUMMER 92 GROUNDFISH SURVEY.

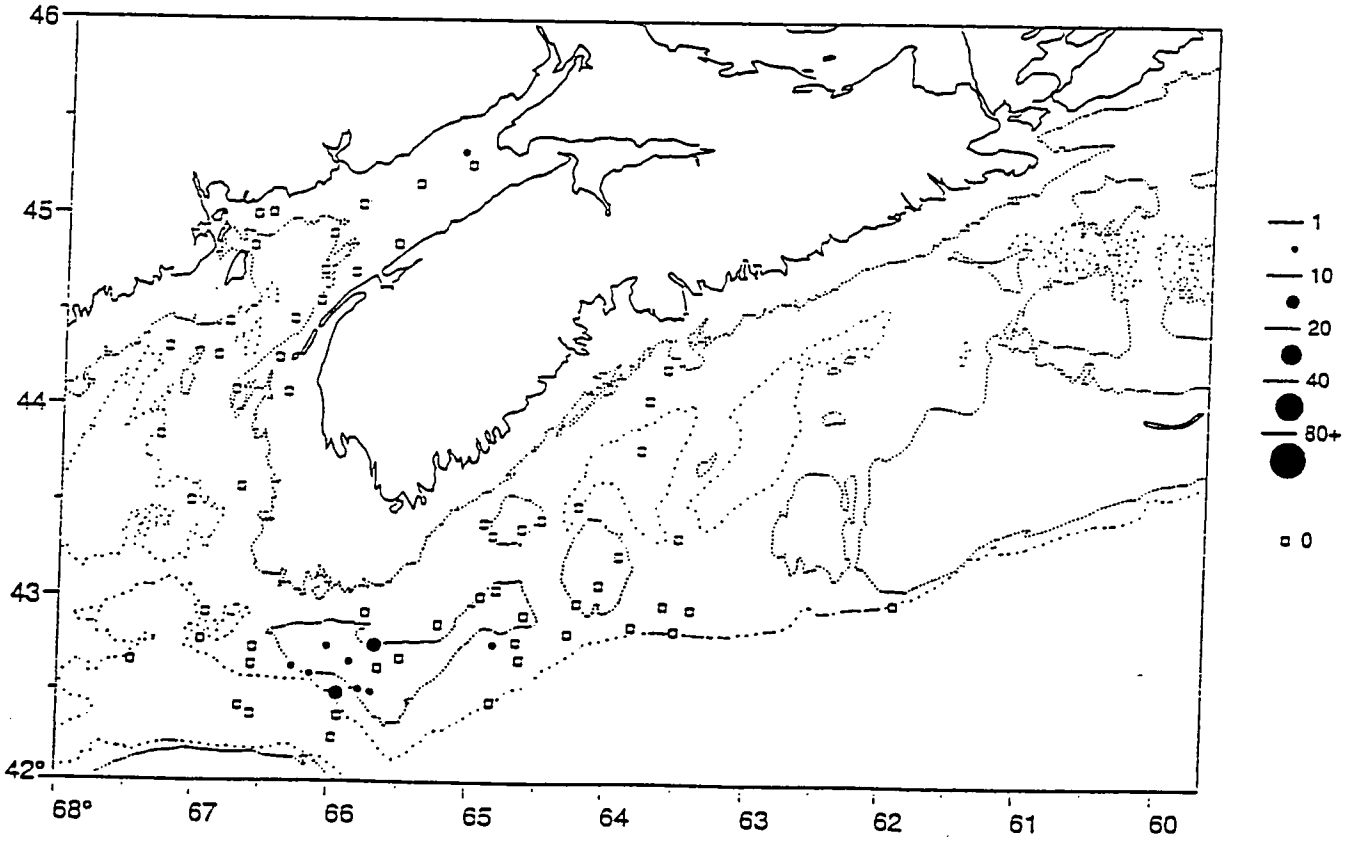
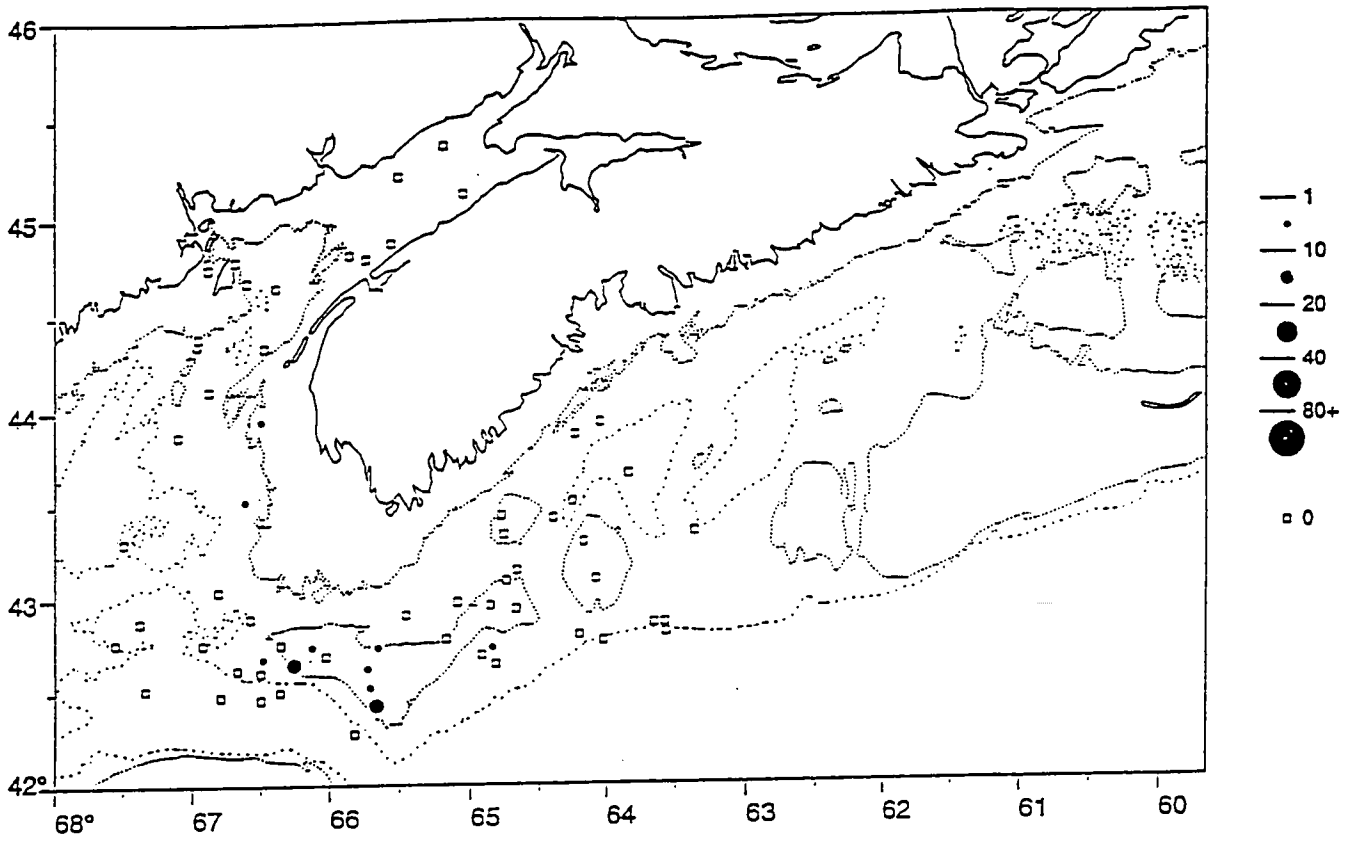


Figure 25d.

4X YELLOWTAIL CATCHES (KG) IN SCOTIA FUNDY SUMMER 93 GROUNDFISH SURVEY.



4X YELLOWTAIL CATCHES (KG) IN SCOTIA FUNDY SUMMER 94 GROUNDFISH SURVEY.

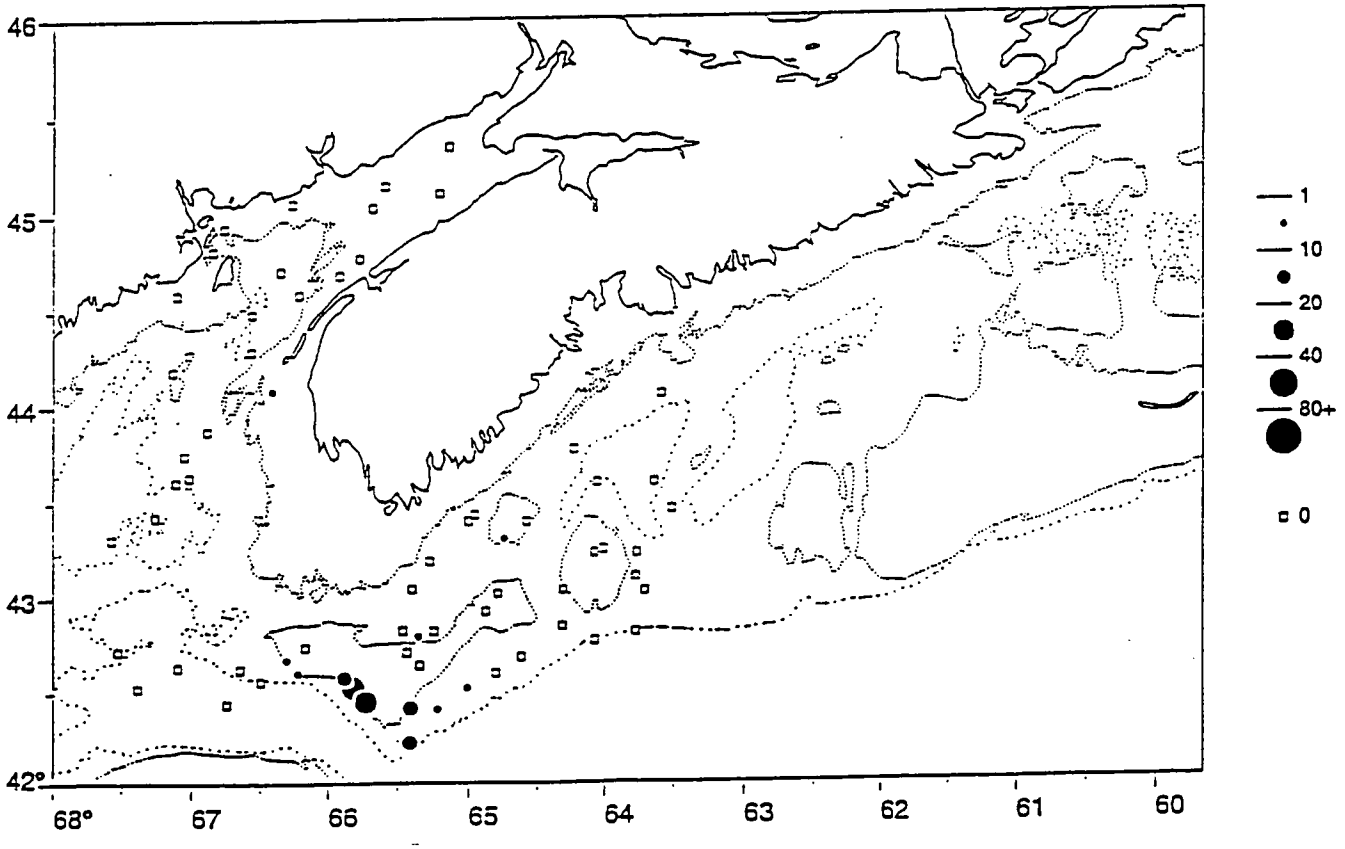


Figure 25d. (Continued)

4VWX5 Halibut (C. Annand, BIO)

1. Abundance

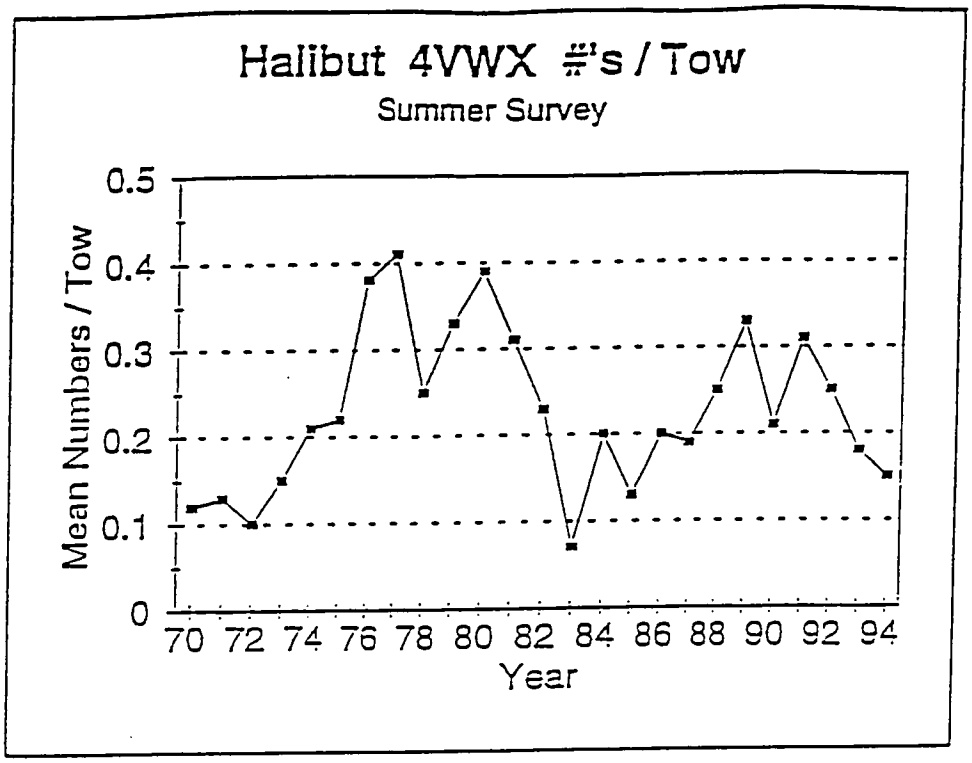
Mean numbers per tow declined from .18 fish per tow in 1993 to .15 fish per tow in 1994. Mean weight per tow declined from .85 kgs per tow in 1993 to .50 kgs per tow in 1994 (Fig. 26). The survey gear catches a different size distribution of halibut (generally smaller) than those directed for in the longline fishery (>81 cm). The survey catch rates may prove to be an indicator of future recruitment rather than fishable biomass.

2. Recruitment and Size Composition

Survey length frequencies indicated no significant differences between 1993 and 1994 size compositions (Fig. 27) although the few numbers of halibut caught make valid comparison difficult..

3. Distribution

Halibut summer distributions do not appear to have changed over time; however, in both 1993 and 1994 fewer halibut were caught east of the Gully and along the edge in 4VSc (Fig. 28).



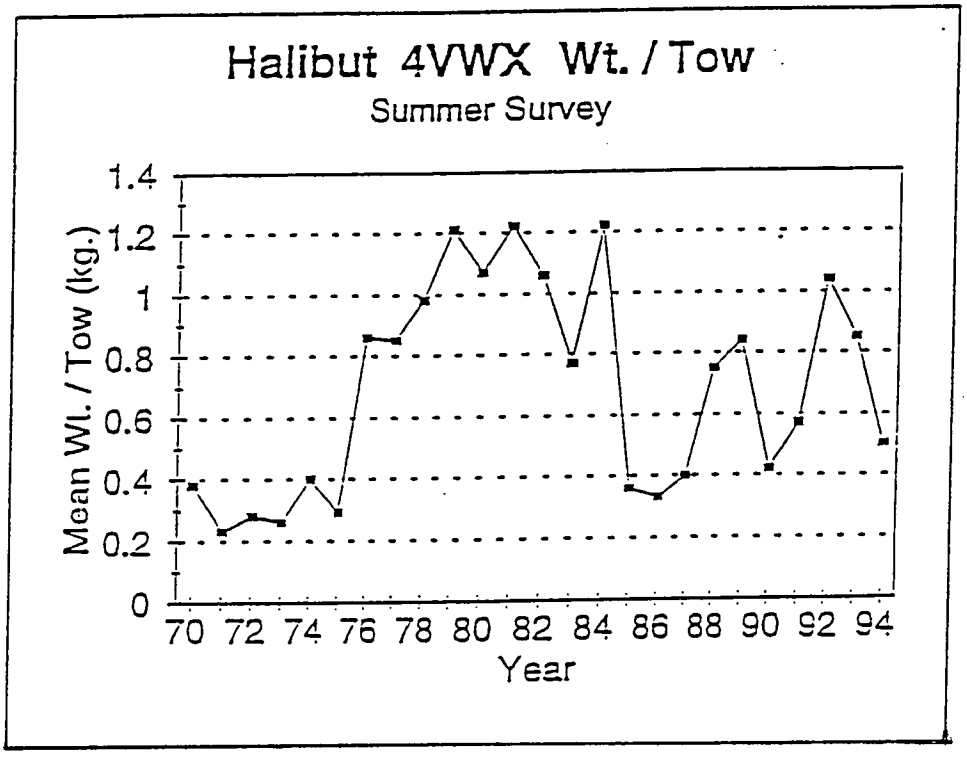
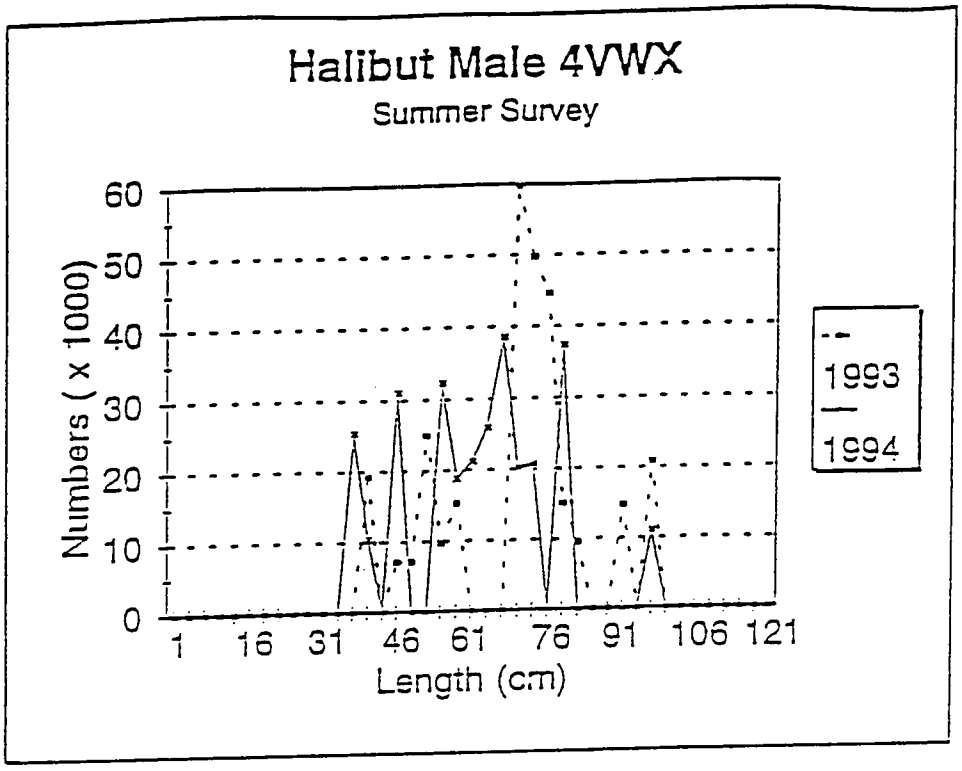


Figure 26. Halibut numbers and weights per tow.



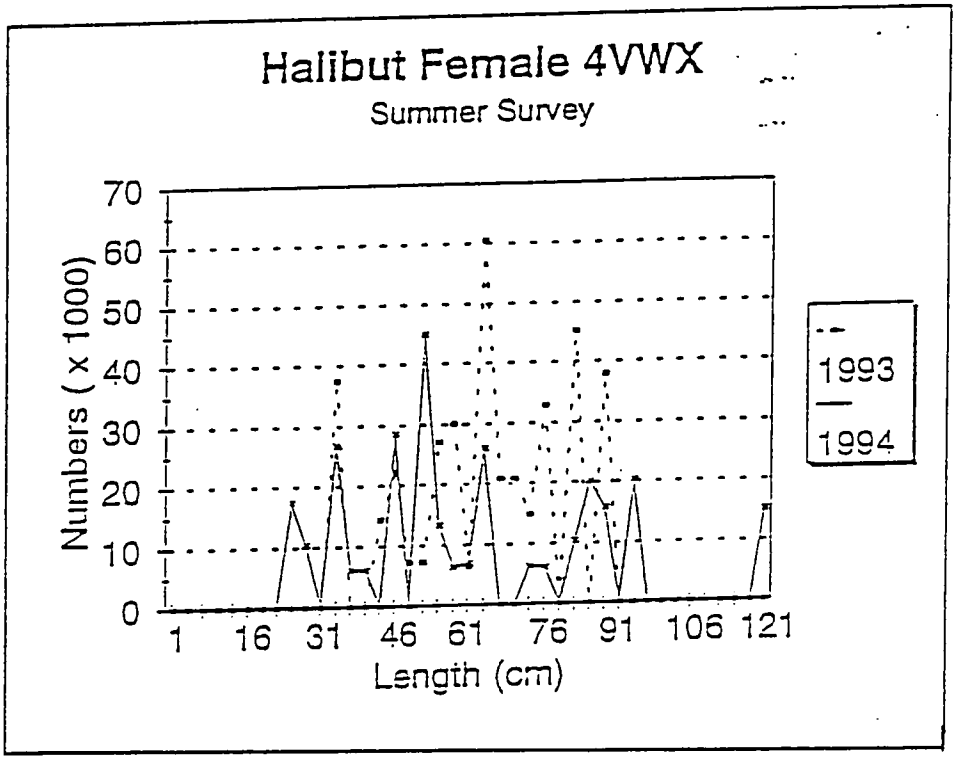
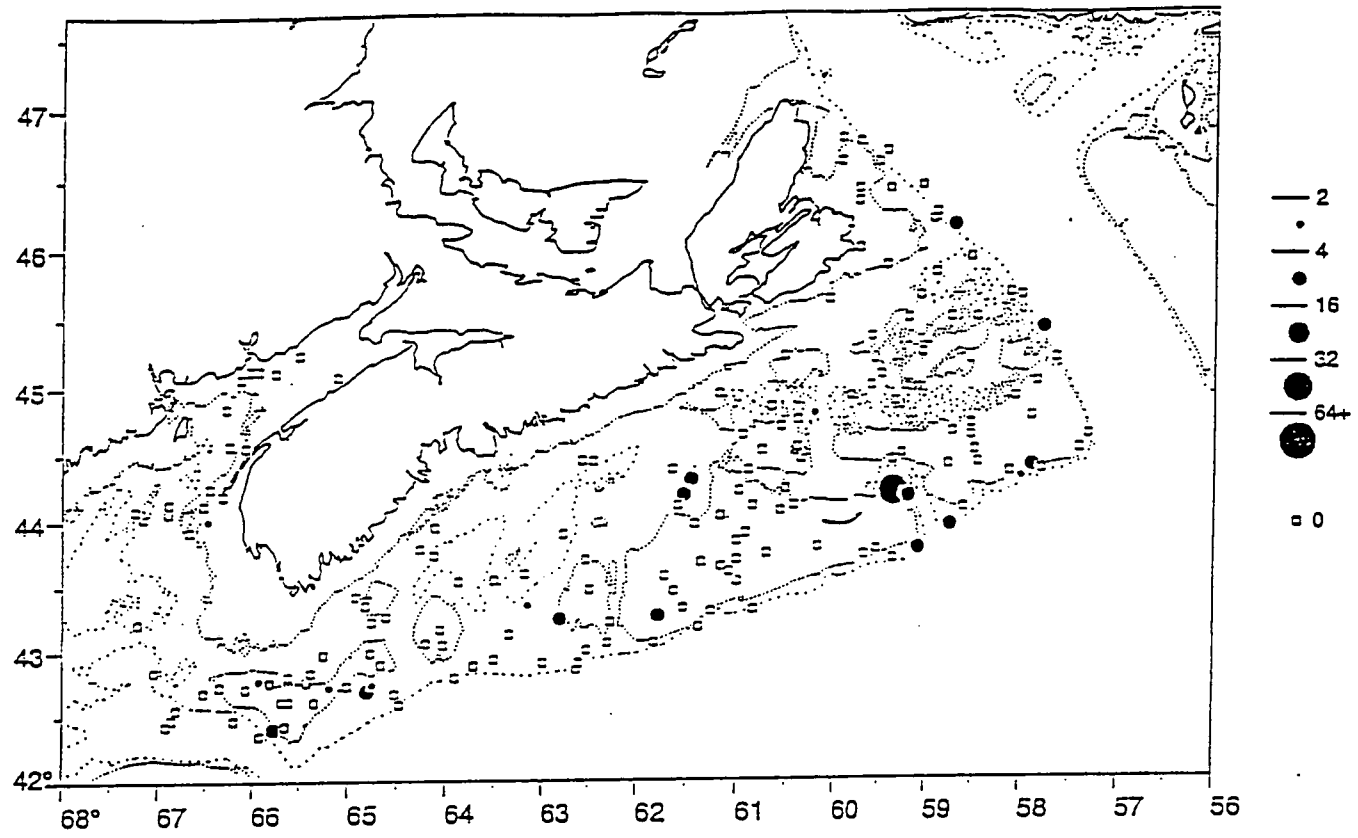


Figure 27. Survey length frequency.

4VWX HALIBUT CATCHES (KG) IN SCOTIA FUNDY SUMMER 91 GROUNDFISH SURVEY.



4VWX HALIBUT CATCHES (KG) IN SCOTIA FUNDY SUMMER 92 GROUNDFISH SURVEY.

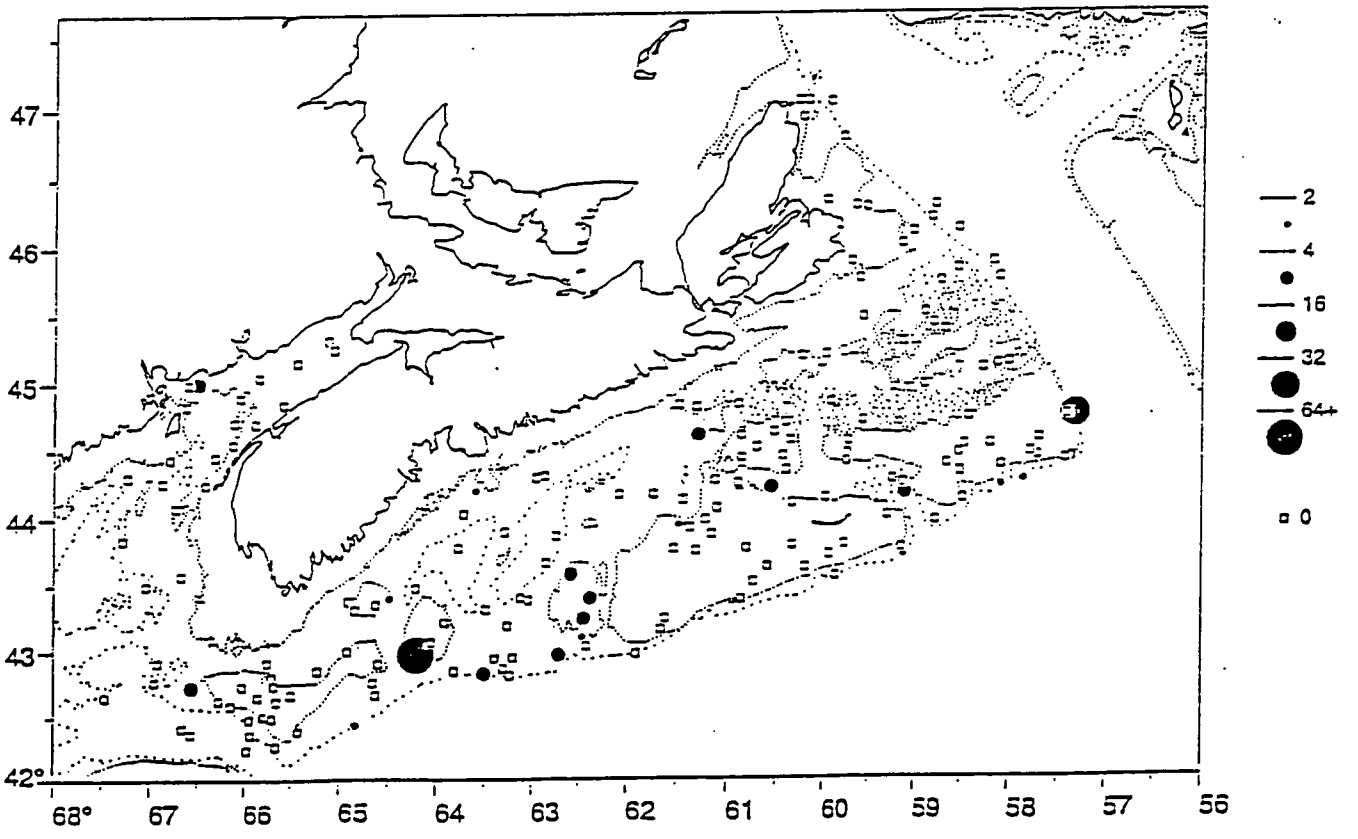
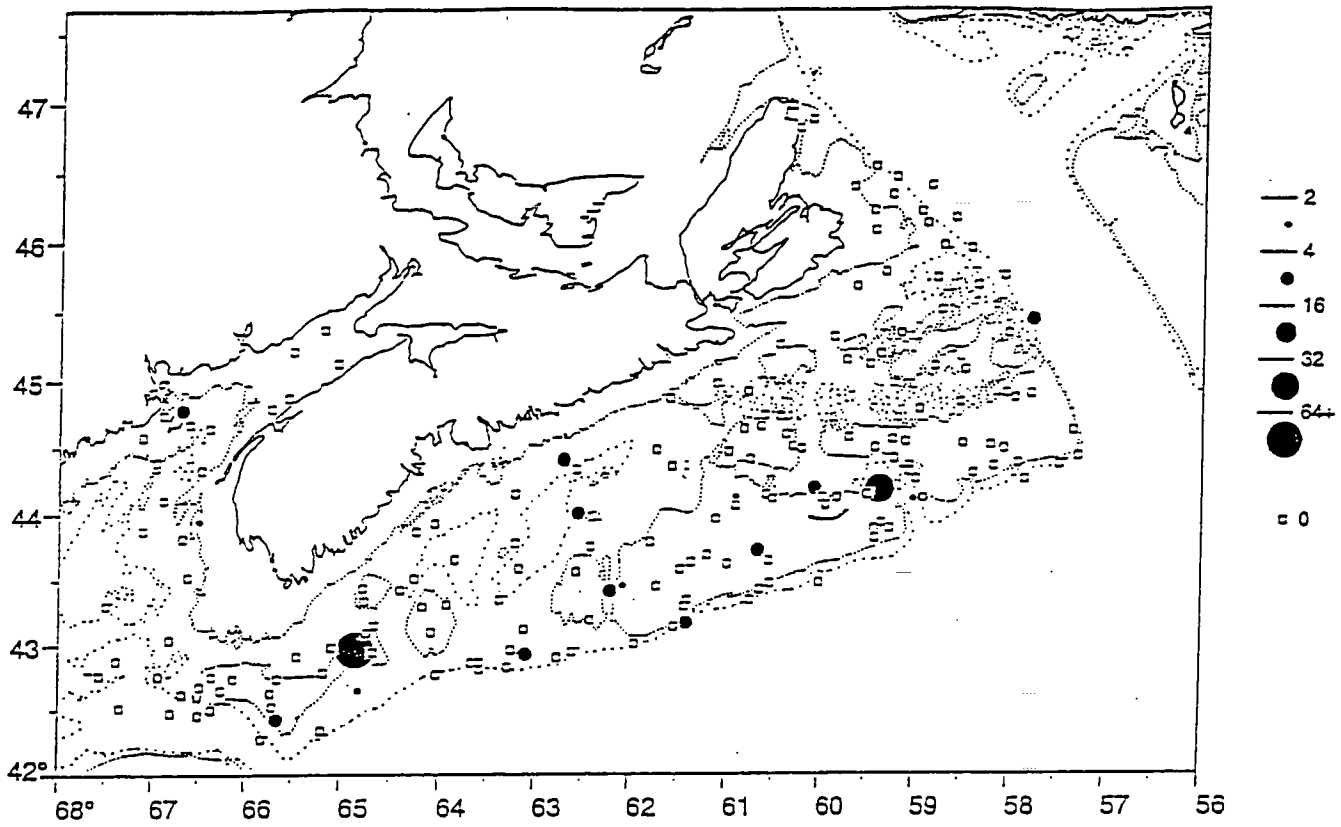


Figure 28.

4VWX HALIBUT CATCHES (KG) IN SCOTIA FUNDY SUMMER 93 GROUNDFISH SURVEY.



4VWX HALIBUT CATCHES (KG) IN SCOTIA FUNDY SUMMER 94 GROUNDFISH SURVEY.

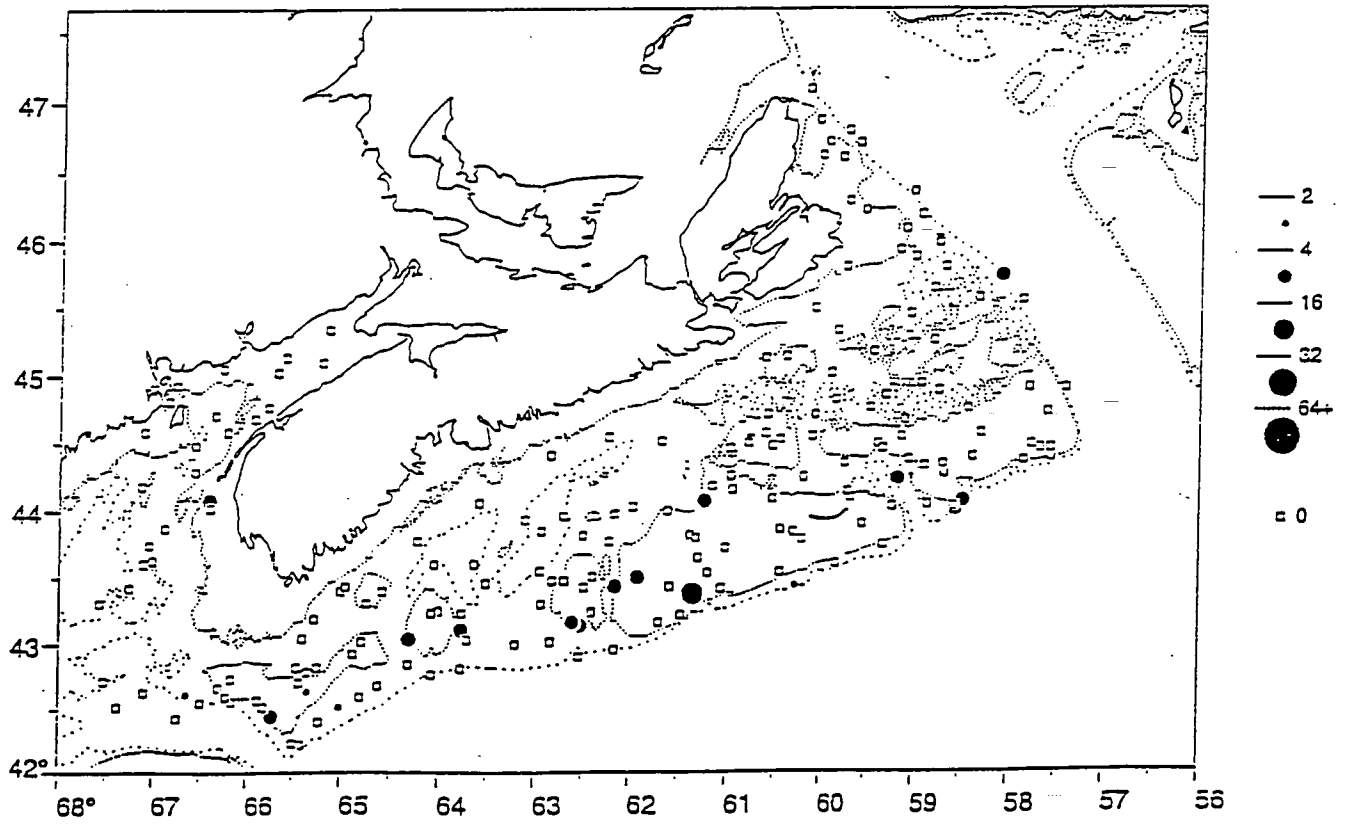


Figure 28. (Continued)