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Survey Update For Selected Scotia-Fundy Groundfish Stocks

by

J. D. Neilson (Ed.)
D. Clark
E. Trippel

St. Andrews Biological Station
Brandy Cove Road, St. Andrews
New Brunswick, E0G 2X0
Canada

and

C. Annand
R. Branton
P. Fanning
P. Hurley
J. McRuer
K. Zwanenburg

Bedford Institute of Oceanography
P.O. Box 1006
Dartmouth, Nova Scotia, B2Y 4A2
Canada

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

¹La 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 1995 summer bottom trawl survey on the Scotian Shelf and Bay of Fundy 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 relevé de recherche au chalut de fond réalisé en été 1995 sur le plateau néo-écossais et dans la baie de Fundy. Il servira de source fondamentale de renseignements sur certains stocks de poisson de fond lors des prochaines réunions d'évaluation des stocks.

Introduction

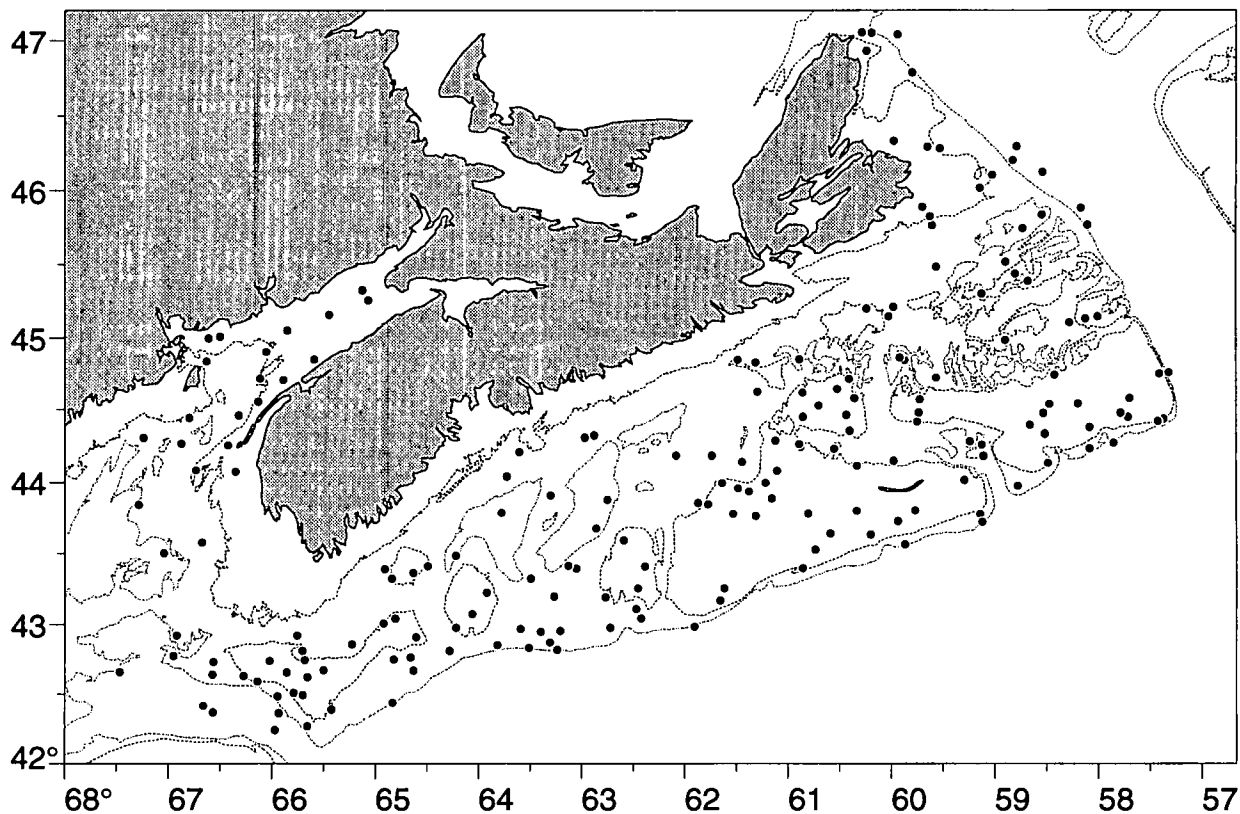
The annual groundfish bottom trawl survey was conducted on the Scotian Shelf and Bay of Fundy as planned from June 25 to July 21, 1995. The results of this survey were compiled to provide clients with a preliminary view of the resource trends as determined by the survey. More comprehensive interpretations of stock status are contained in stock assessment documents prepared annually for the stocks described here. Such reports contain information on commercial fishery catch rates and other survey results when available. Therefore, the abundance trends reported here, based on the survey information only, are not directly comparable to those provided in recent assessments.

Survey Description

The 26th annual Scotia Fundy groundfish survey was conducted from the research vessel CSS *Alfred Needler* out of the Bedford Institute of Oceanography, Dartmouth, N.S. on two trips, N226 (June 25 to July 7) and N227 (July 9 to July 21). Two hundred and twenty-four fishing stations, from the Upper Bay of Fundy to the northern tip of Cape Breton and offshore to the 400 fathom contour were completed. The distribution of sampling effort compared with the past three years is shown on Fig. 1.

Samples were obtained with a Western IIA bottom trawl towed for 30 minutes at a speed of 3.5 knots. The trawl has a 106' roller-rigged footrope and 2000 pound Portuguese doors. The codend is lined with 3/4" mesh to retain smaller fish. All finfish caught were sampled for length and weight and some species were sampled additionally for otoliths to determine age and for evidence of sexual maturity. Over one hundred different species were encountered.

The area of coverage was expanded this year to include depths between 200 and 400 fathoms in response to a request for improved sampling of potential redfish habitat. Environmental sampling was also expanded this year to include nutrient and oxygen profiles as well as the standard CTD casts. A highlight of the survey was the implementation of the new Groundfish Survey Entry (GSE) system to interactively edit and electronically capture sampling data. Quality of the data collected was enhanced with real time editing and the time between collection and having the data available for analyses has been substantially reduced.



Summer Groundfish Survey Station Positions July 1992

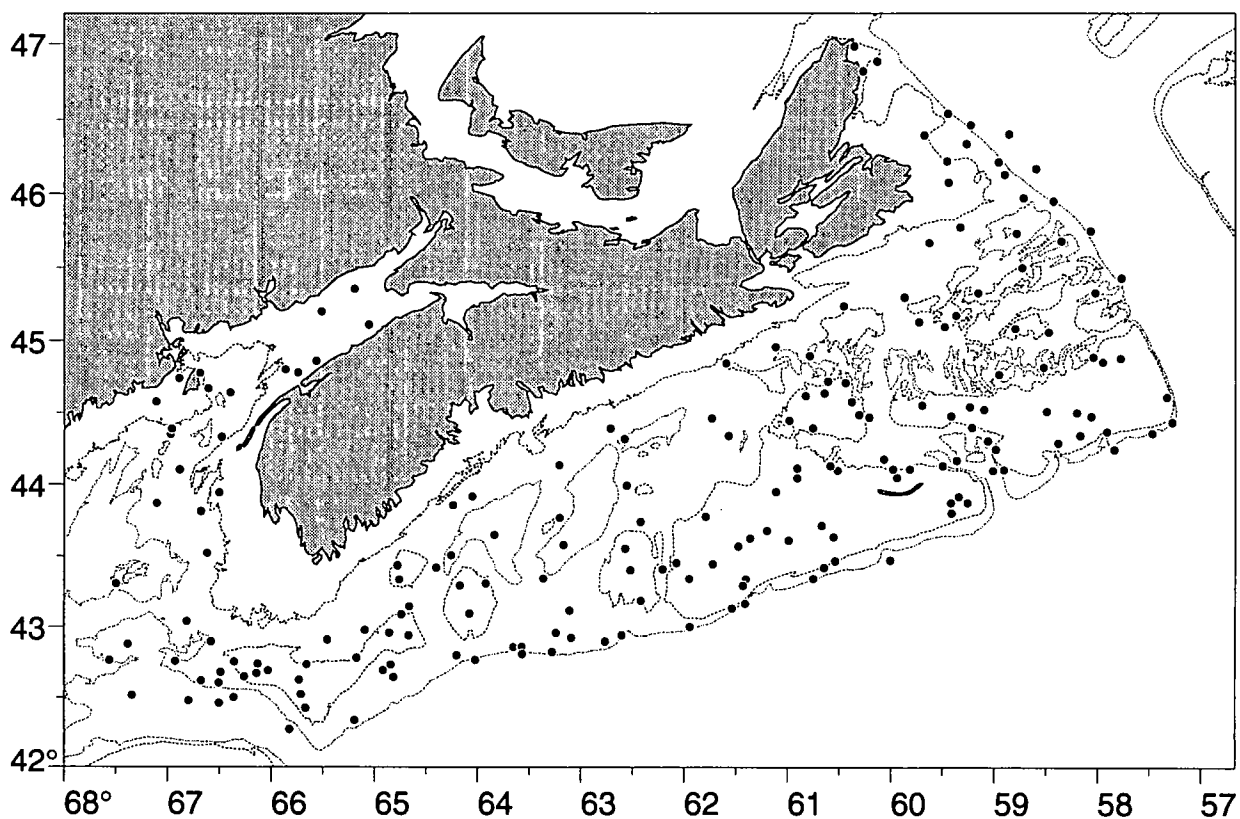
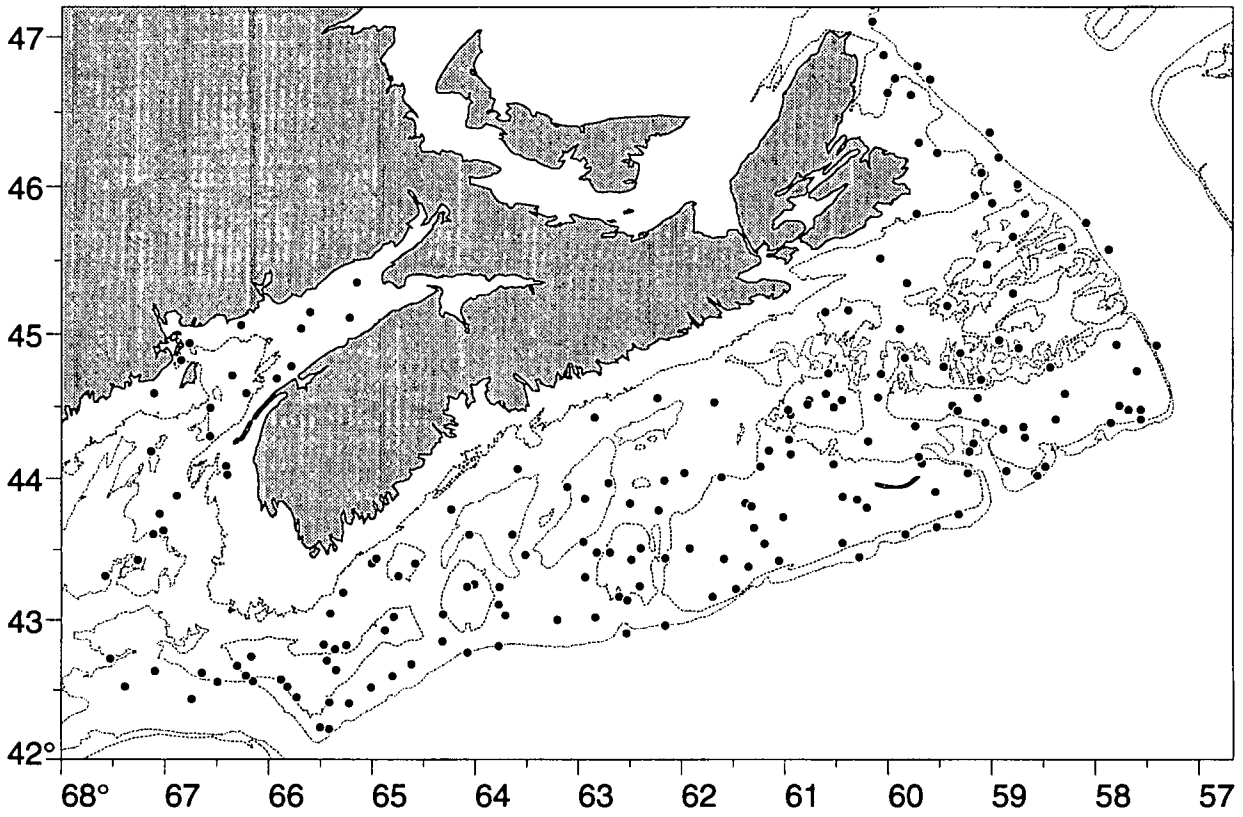
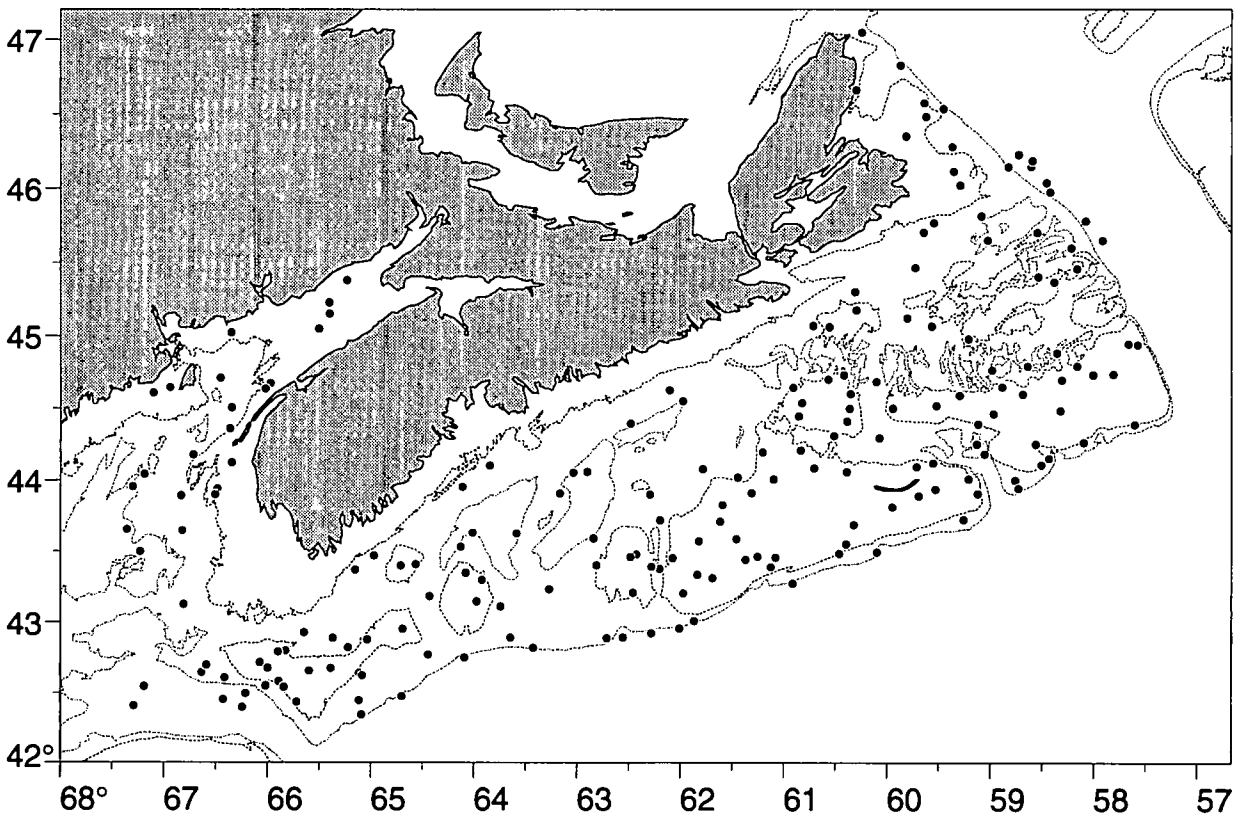


Fig. 1. Summer Groundfish Survey Station Positions July 1993



Summer Groundfish Survey Station Positions July 1994



Summer Groundfish Survey Station Positions July 1995

4VsW Cod (P. Fanning, BIO)

1. Abundance

The summer and spring¹ research vessel survey mean numbers per tow (Fig. 2) in 1995 are each slightly higher than in 1994, but remain near the lowest in the respective series. The increase in numbers, although consistent in both surveys, is negligible in terms of indicating a change in the depressed condition of the 4VsW cod stock. Age specific estimates are not available as otoliths from the 1995 survey have not been aged yet.

2. Recruitment and Size Composition

The length frequency of the summer survey catches since 1992 (Fig. 3) has reflected both the declining abundance and the virtual absence of any significant recruitment since the 1990 yearclass (20 cm in 1992). Neither of the modes visible in 1992 and 1993 persisted into 1994 in spite of the fishery closure in September 1993. Although there is some increase in the modal size from 1994 to 1995 it is minimal and the number of fish over the legal limit of 43 cm is essentially unchanged.

3. Distribution

Over the last four years (1992-1995, Fig. 4) the distribution has remained fairly consistent with cod widely distributed over the area although more concentrated in the Sable, Western and Middle Banks, and less abundant in 4Vs.

¹ For this resource, a second survey, conducted each spring since 1979, is available and discussed here.

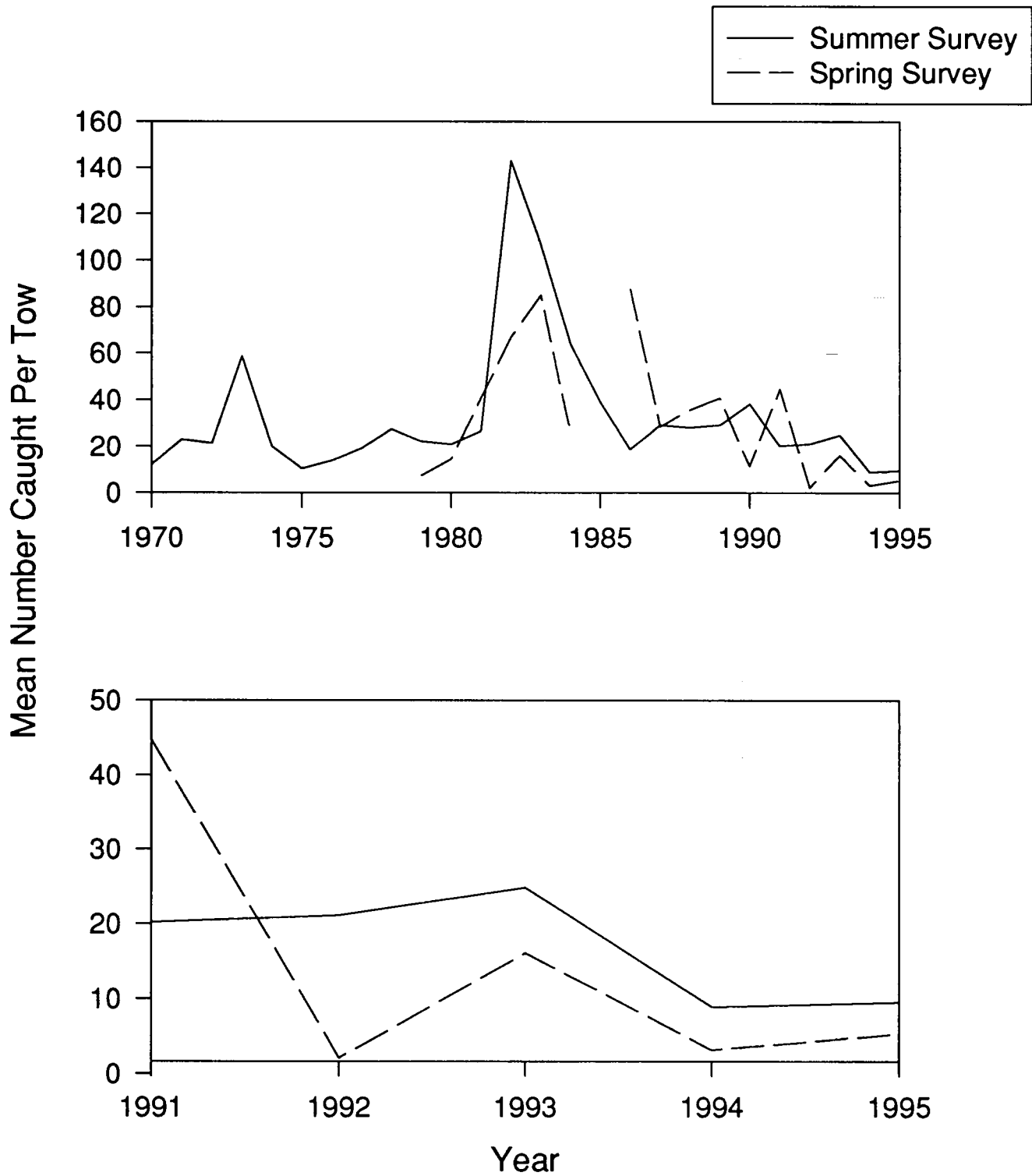


Fig. 2. 4VsW cod. Stratified mean number caught per tow from spring (1979-1995) and summer (1970-1995) surveys. The top panel shows the entire series, and the bottom panel shows the last five years only.

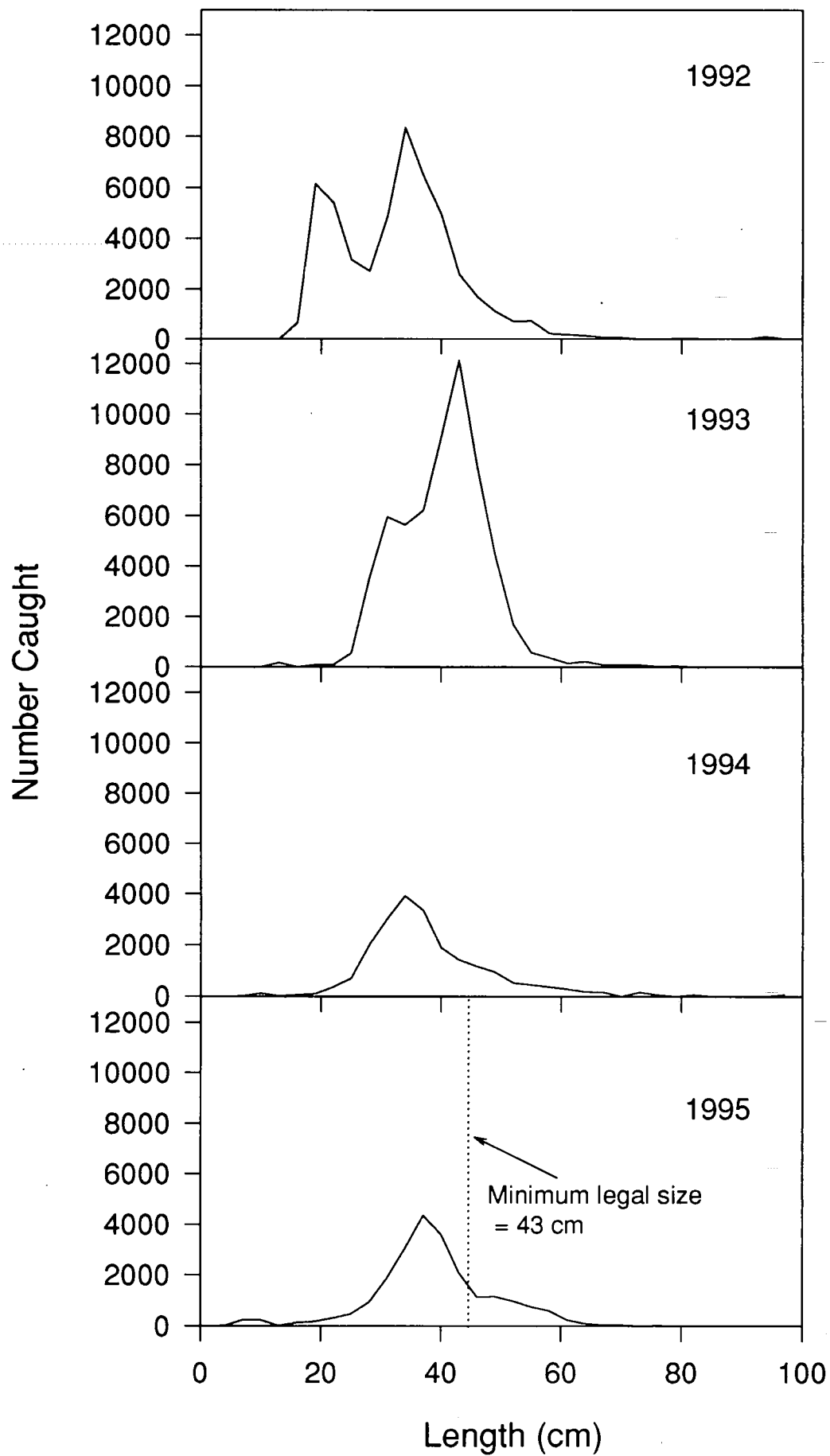
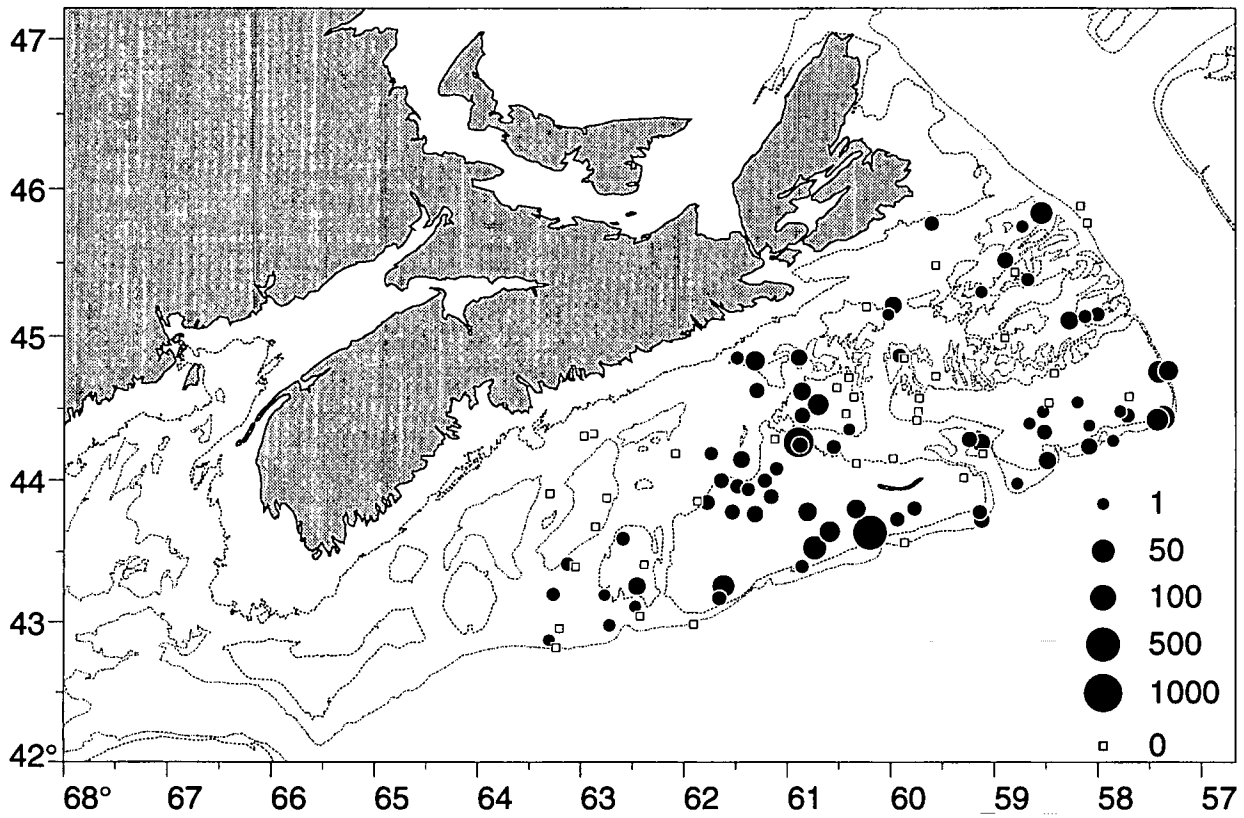


Fig. 3. 4VsW Cod. Length frequency distributions from summer groundfish surveys, 1992-1995.



Summer Groundfish Survey 4VsW Cod Biomass (kg/tow) July 1992

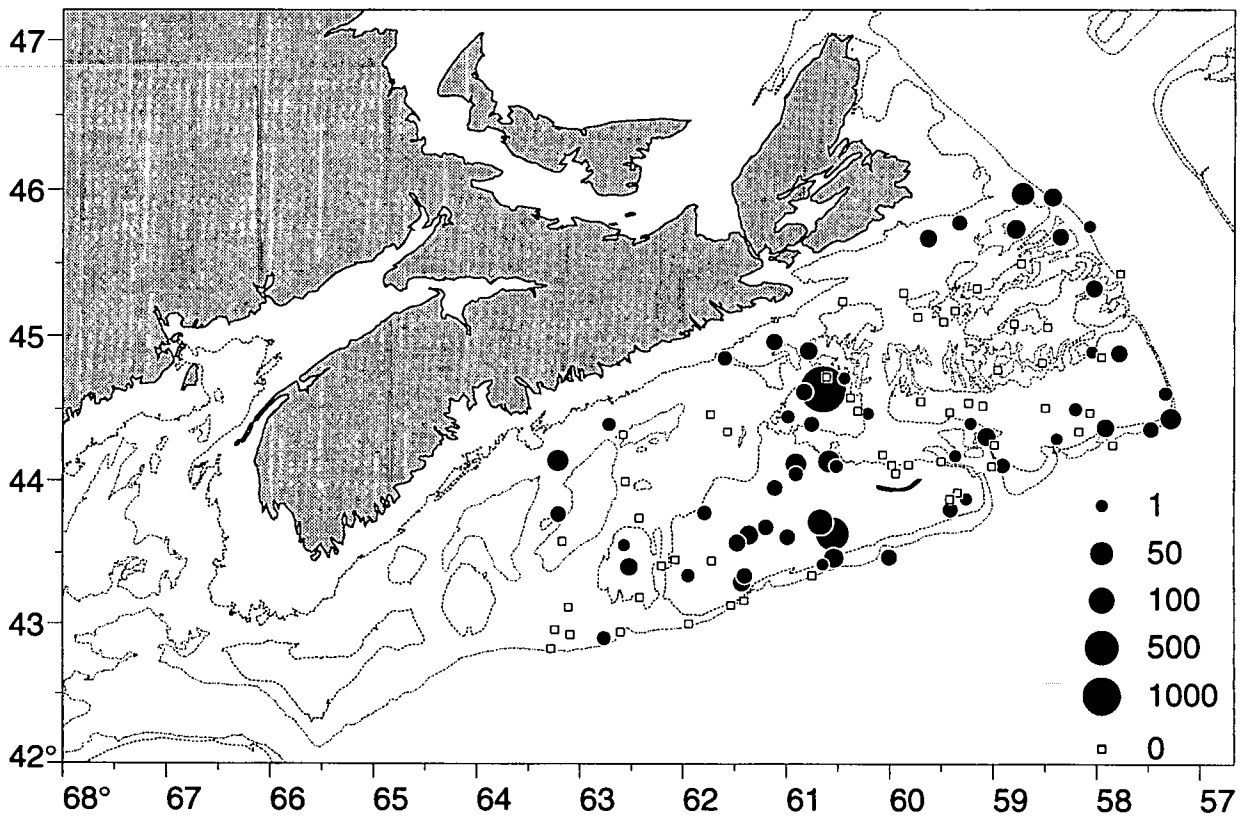
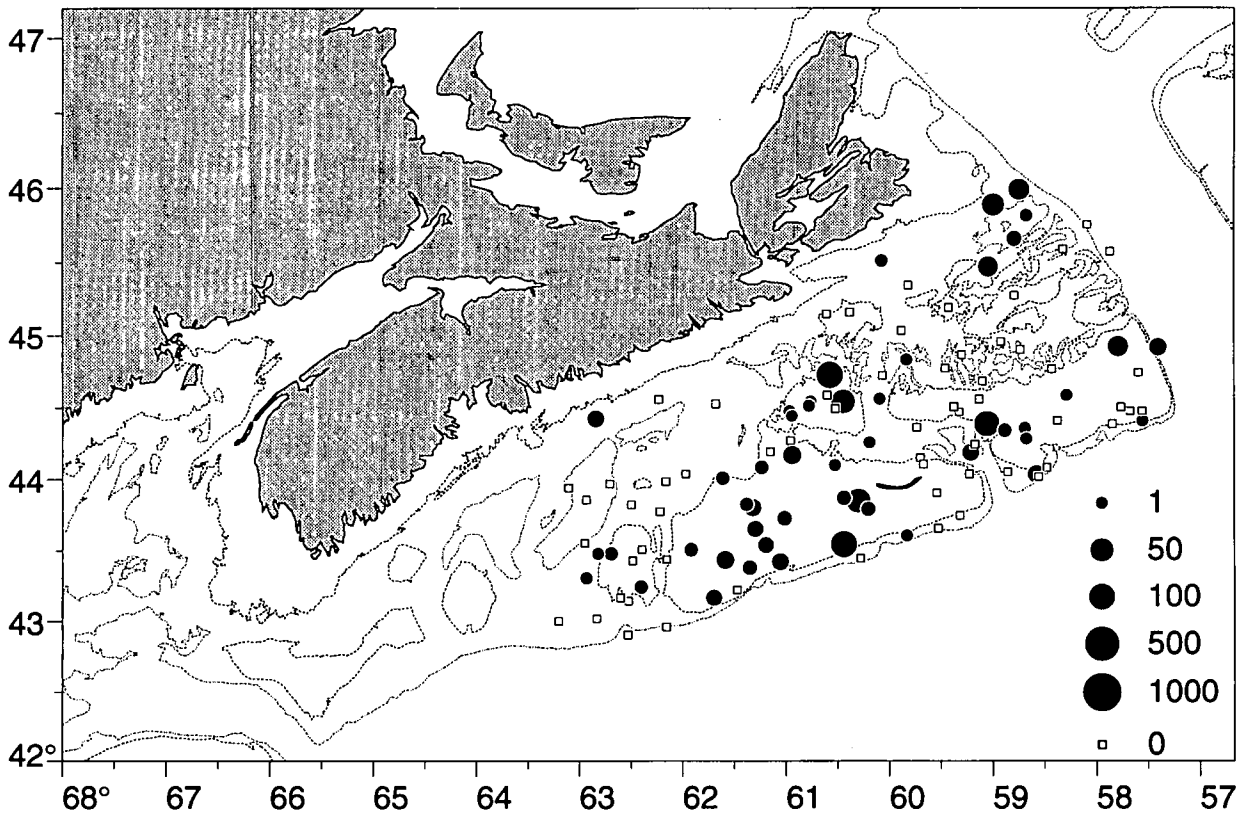
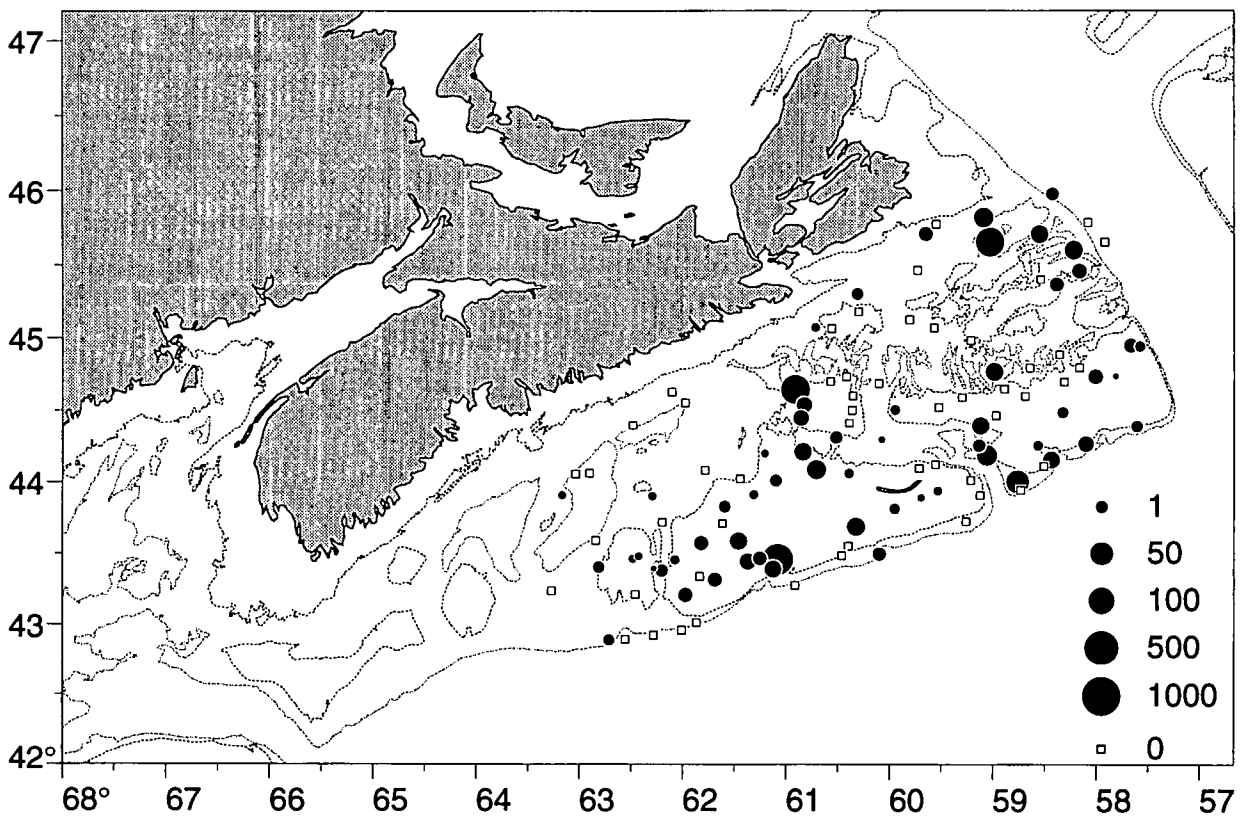


Fig. 4. Summer Groundfish Survey 4VsW Cod Biomass (kg/tow) July 1993



Summer Groundfish Survey 4VsW Cod Biomass (kg/tow) July 1994



Summer Groundfish Survey 4VsW Cod Biomass (kg/tow) July 1995

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

1. Abundance

The results from the 1995 summer groundfish survey suggest a continued increase in biomass of 4X cod (Fig. 5); this trend is consistent with the results of the recent analytical assessment. Much of the increase in the total abundance of 4X cod in the most recent survey is due to good catches of age 3 fish (Fig. 6). This cohort, the 1992 year-class, was estimated to be above average in the April 1995 assessment, but the high catch in this year's survey suggests that it may be even stronger than first estimated. An analytical assessment which will incorporate the results of the 1995 survey, along with information from the commercial fishery to the end of June, is presently being prepared. Results from this are anticipated by mid-September.

2. Recruitment and Size Composition

The length frequency for cod from the 1995 survey peaks between 40 and 60 cm (Fig. 7) but catches of cod greater than 75 cm and between 15 and 40 cm were quite low. The peak at 10 cm represents fish from the 1994 year-class. Although the presence of large numbers of these fish may be a positive sign, catches of cod at this size are a poor predictor of recruitment, as is indicated by the absence of this size range in the 1992 survey when the strong 1992 year-class was present. At this age young cod are switching from pelagic to bottom dwelling, so their availability to the survey gear from year to year is variable.

The age disaggregated results show that the catch of age 3 cod was the second highest in the series. The catch of age 2 fish (the 1993 year-class), conversely, was low (Fig. 6, age 2), indicating that this cohort, which will recruit to the fishery in 1996, may be quite weak. The abundance of older fish (over age 5) was slightly greater than in 1994, but remains well below levels observed in the 1980's.

3. Distribution

The distribution of sets and cod catches in Division 4X was similar to previous years. Catches of cod were good in the Bay of Fundy, as was the case in 1993 and 1994 (Fig. 8). Catches were not as good on much of the Scotian Shelf, except on and around Brown's Bank where this year's survey catches were higher than observed in 1994.

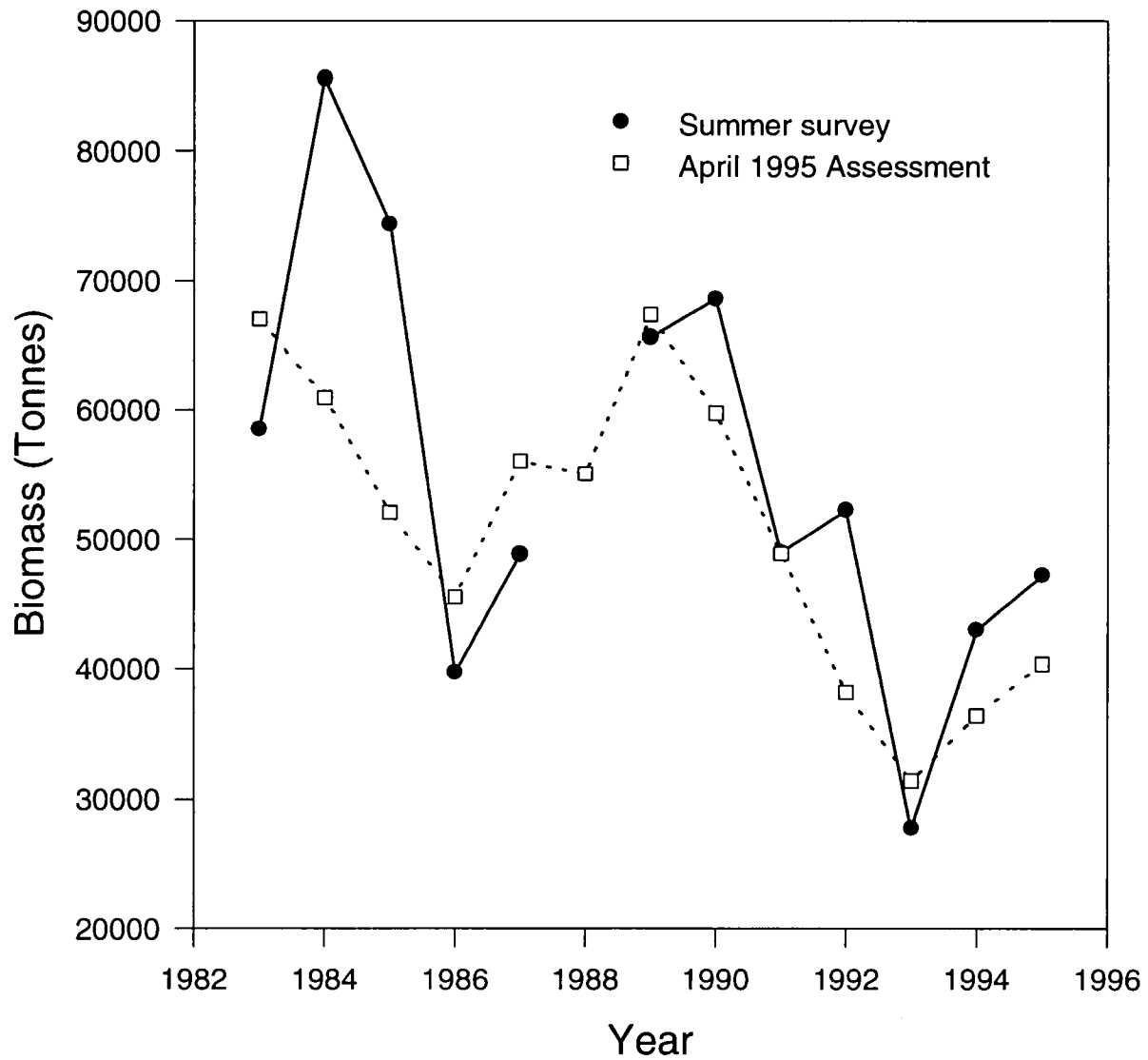


Fig.5. Summer survey estimates of 4X cod biomass (age 2+) compared with mid-year population biomass calculated during the April 1995 stock assessment.

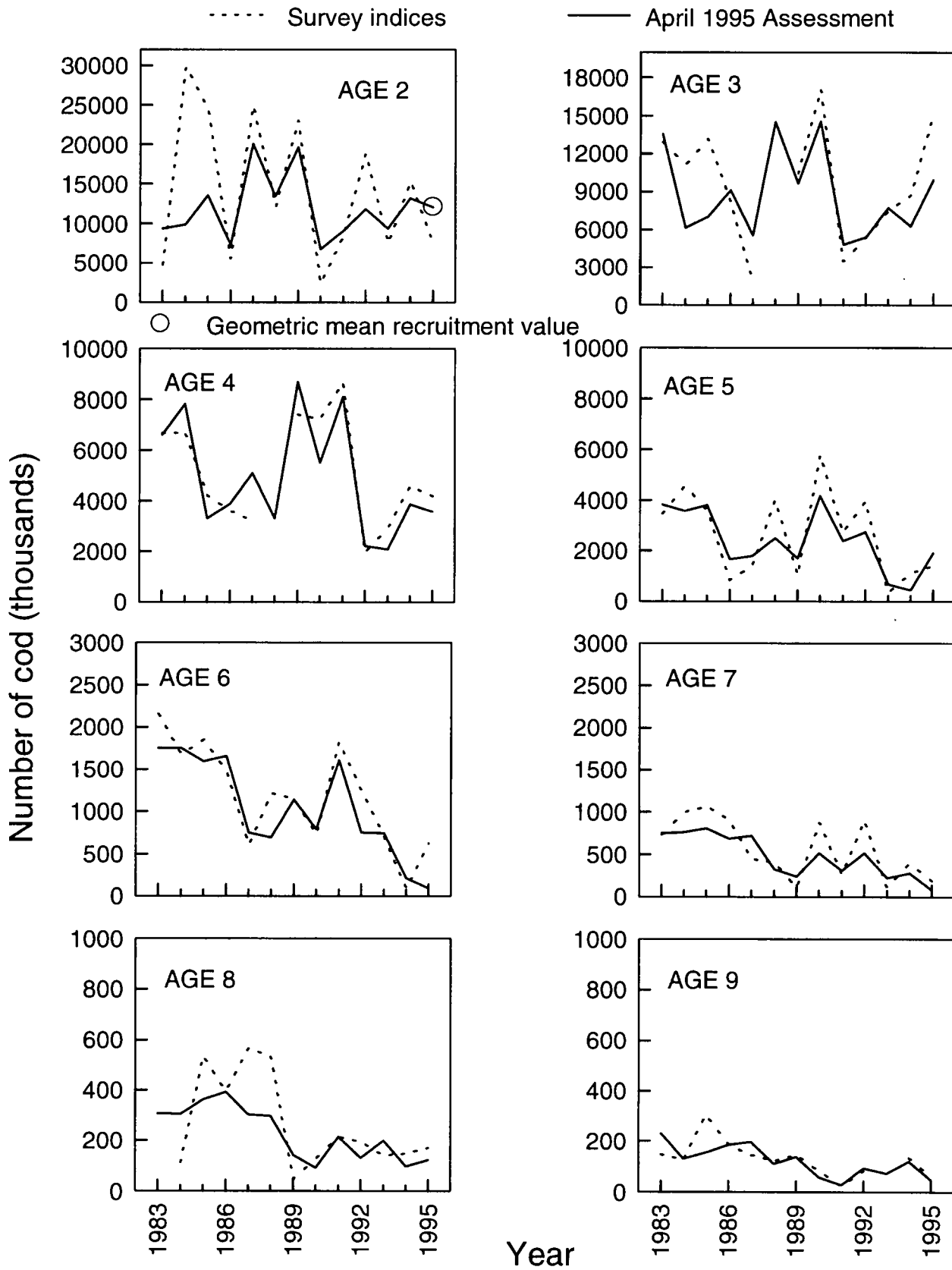


Fig.6. Summer survey estimates of 4X cod numbers by age compared to mid-year population numbers derived during the April 1995 stock assessment.

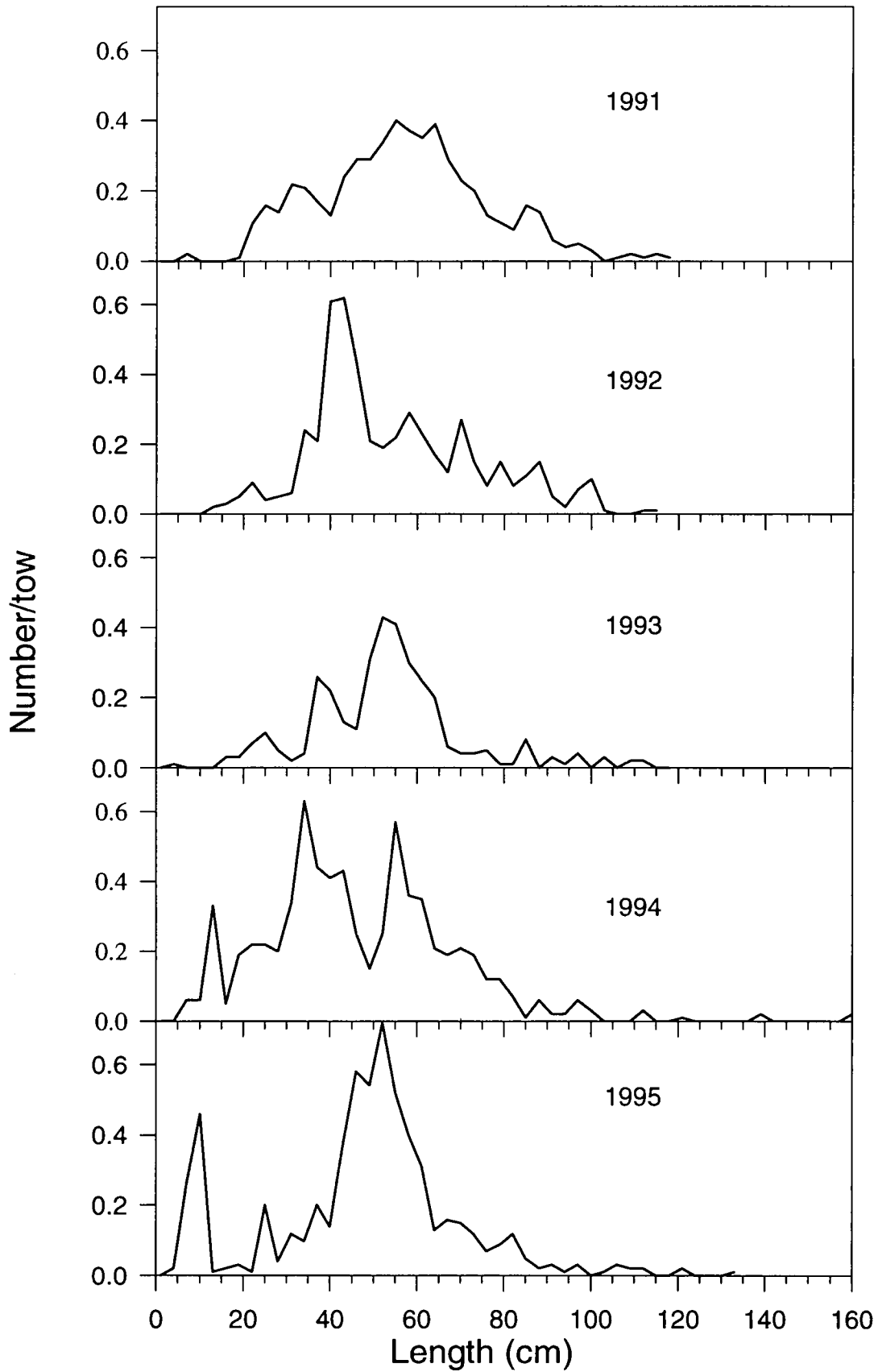
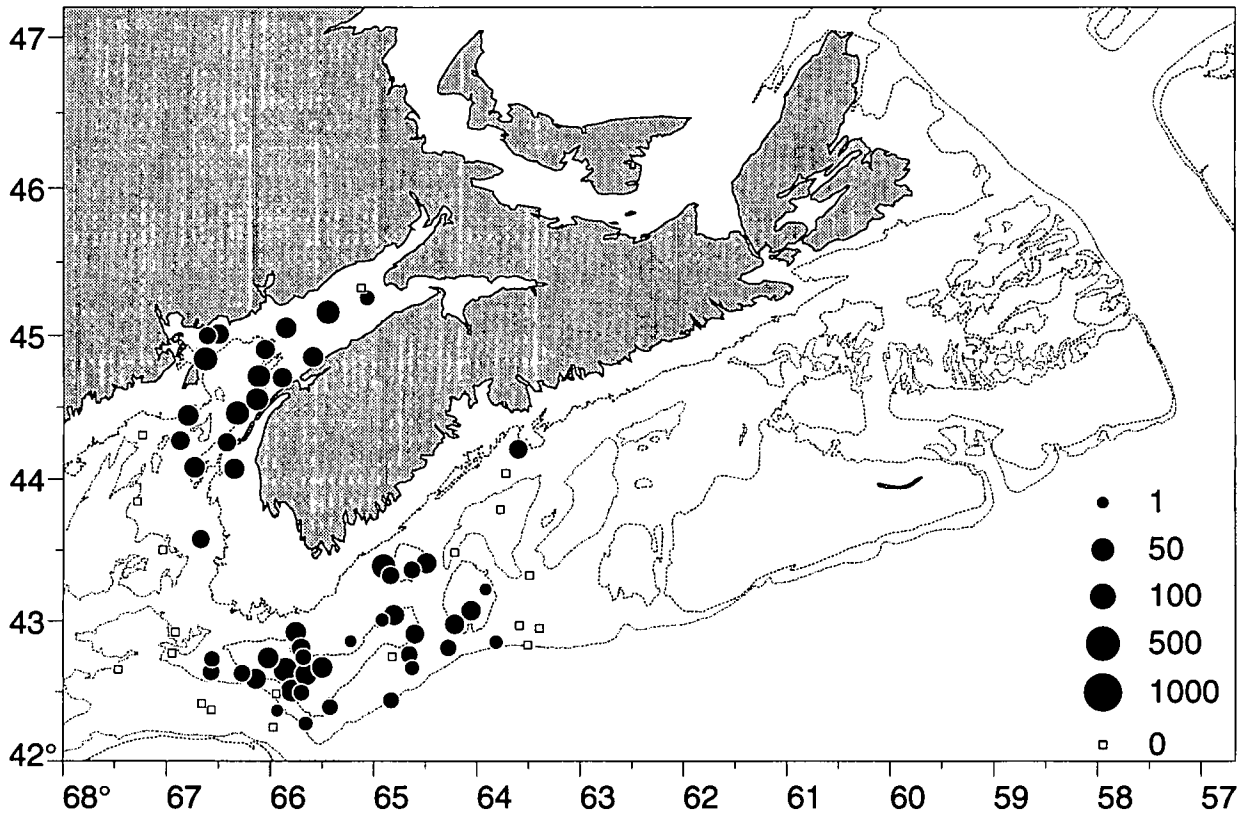


Fig.7 . Mean numbers per tow at length for 4X cod from summer groundfish surveys.



Summer Groundfish Survey 4X Cod Biomass (kg/tow) July 1992

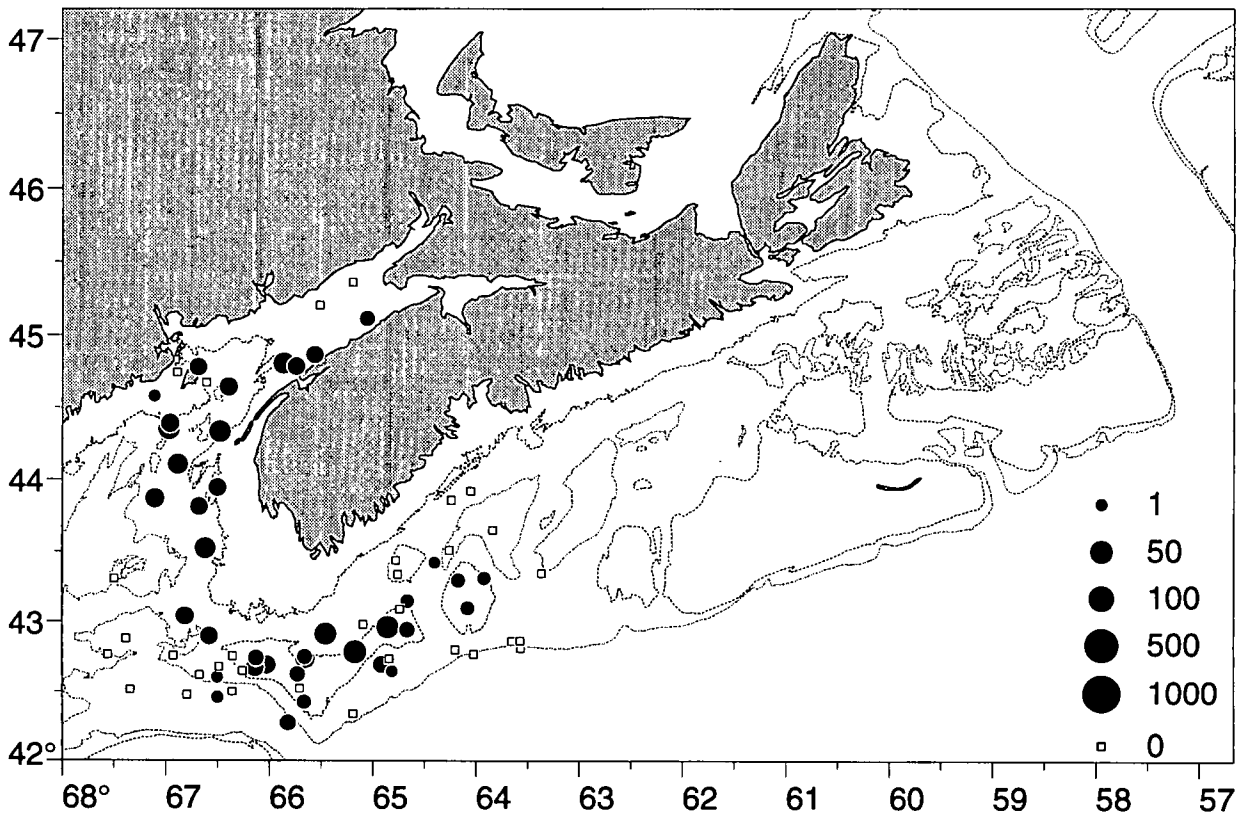
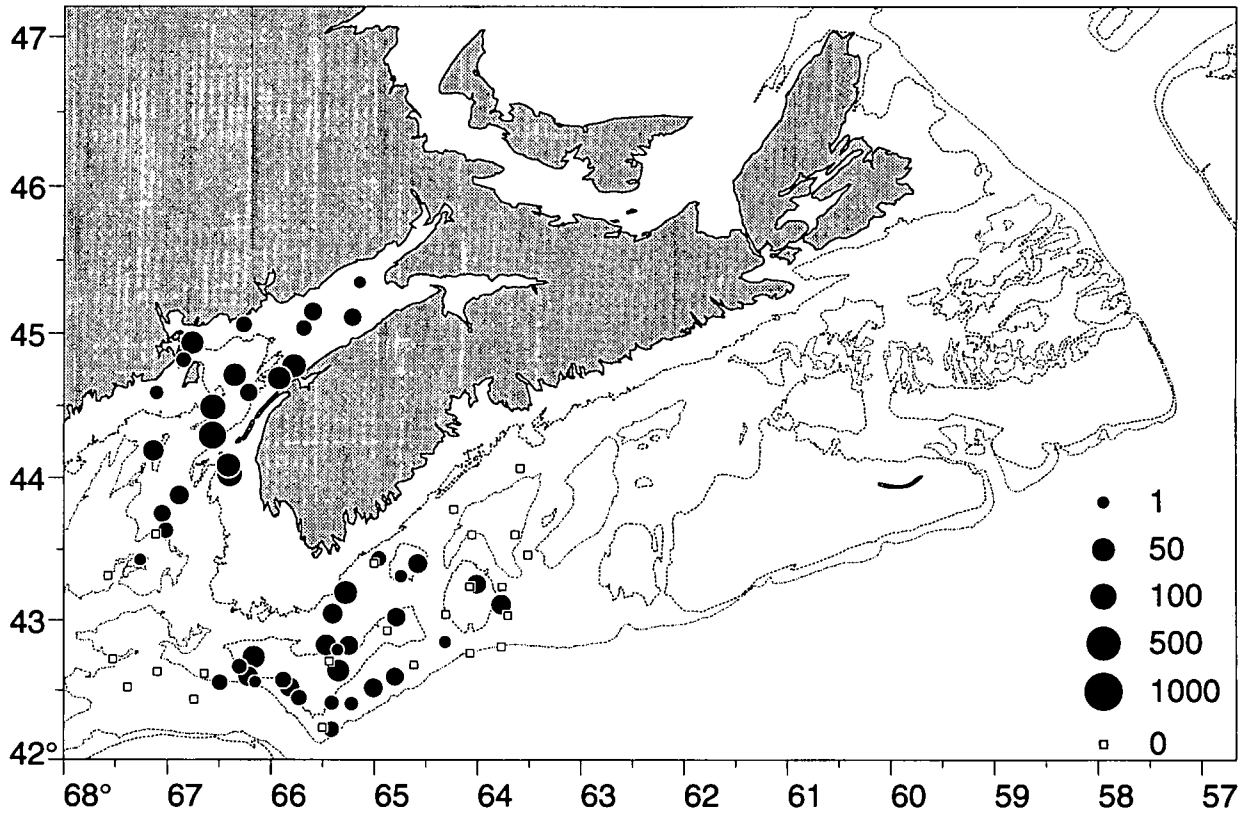
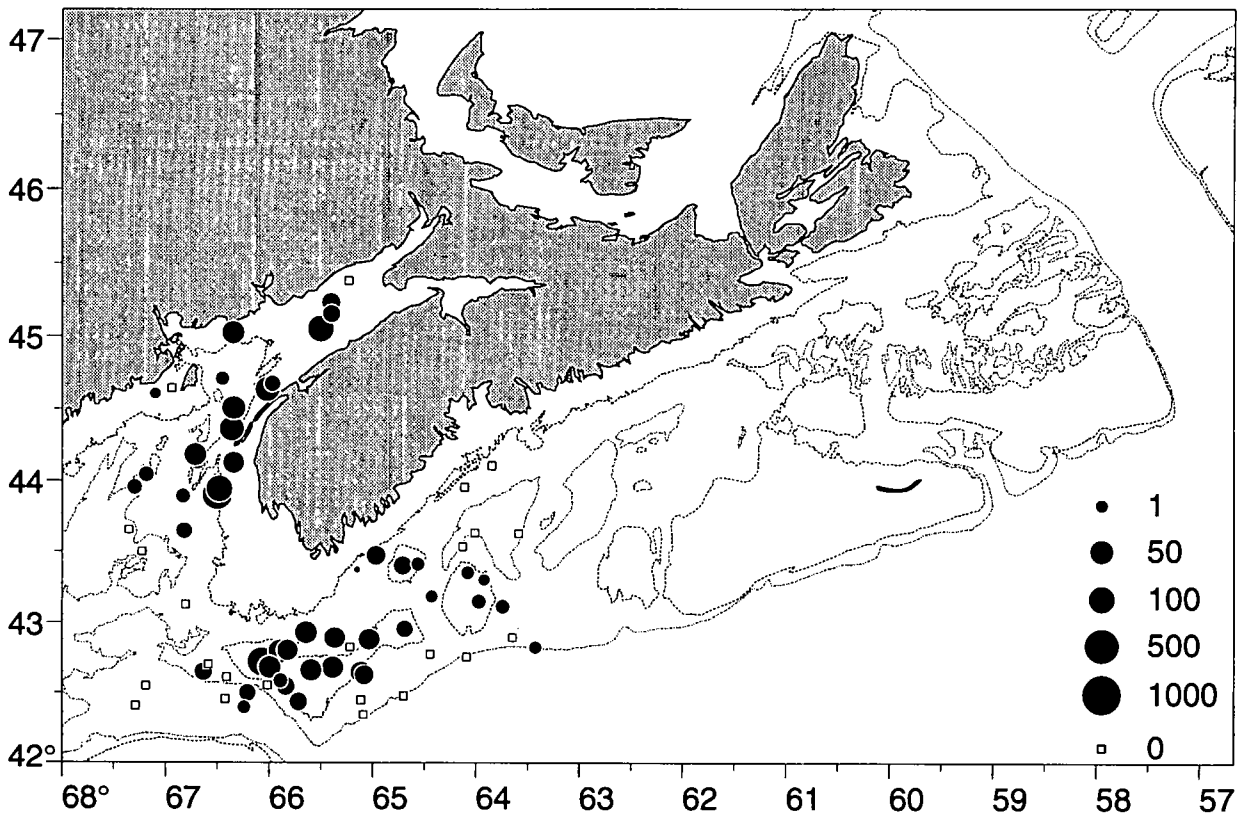


Fig. 8. Summer Groundfish Survey 4X Cod Biomass (kg/tow) July 1993



Summer Groundfish Survey 4X Cod Biomass (kg/tow) July 1994



Summer Groundfish Survey 4X Cod Biomass (kg/tow) July 1995

4TVW Haddock (K. Zwanenburg, BIO)

1. Abundance

Summer survey mean number per tow for the stock area (all sizes combined) has been relatively stable for the past four years (Fig. 9). 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

Fig. 10 shows the mean number caught per tow at length. There are modes at 22.5 and 30.5 cm length classes, corresponding with the 1994 and 1993 year classes respectively, and both appear somewhat more abundant than the average from surveys conducted from 1970-1994. However, small fish at a mode of 8.5 cm are less abundant than the long term average. Fewer market-sized (>43 cm) individuals were caught in the 1995 survey than the long term average.

3. Distribution

The surveys indicate that this resource is centered in the Emerald, Western, Sable Island Bank area (Fig. 11). Survey catches on the eastern end of the Scotian Shelf (Banquereau Bank) have been low since the decline of the abundant early 1980s yearclasses.

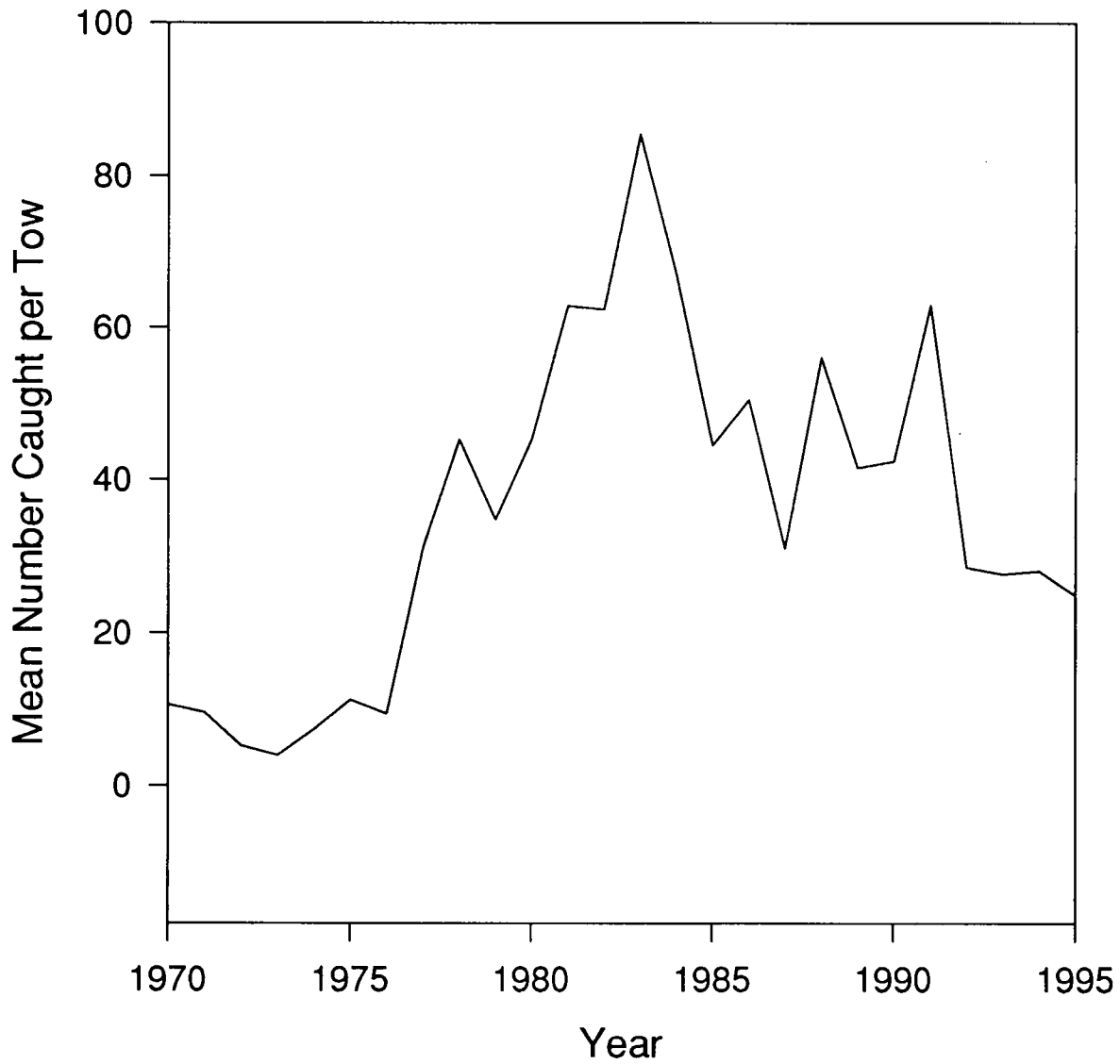


Fig. 9. 4VW haddock. Stratified mean number caught per tow during summer surveys, 1970-1995.

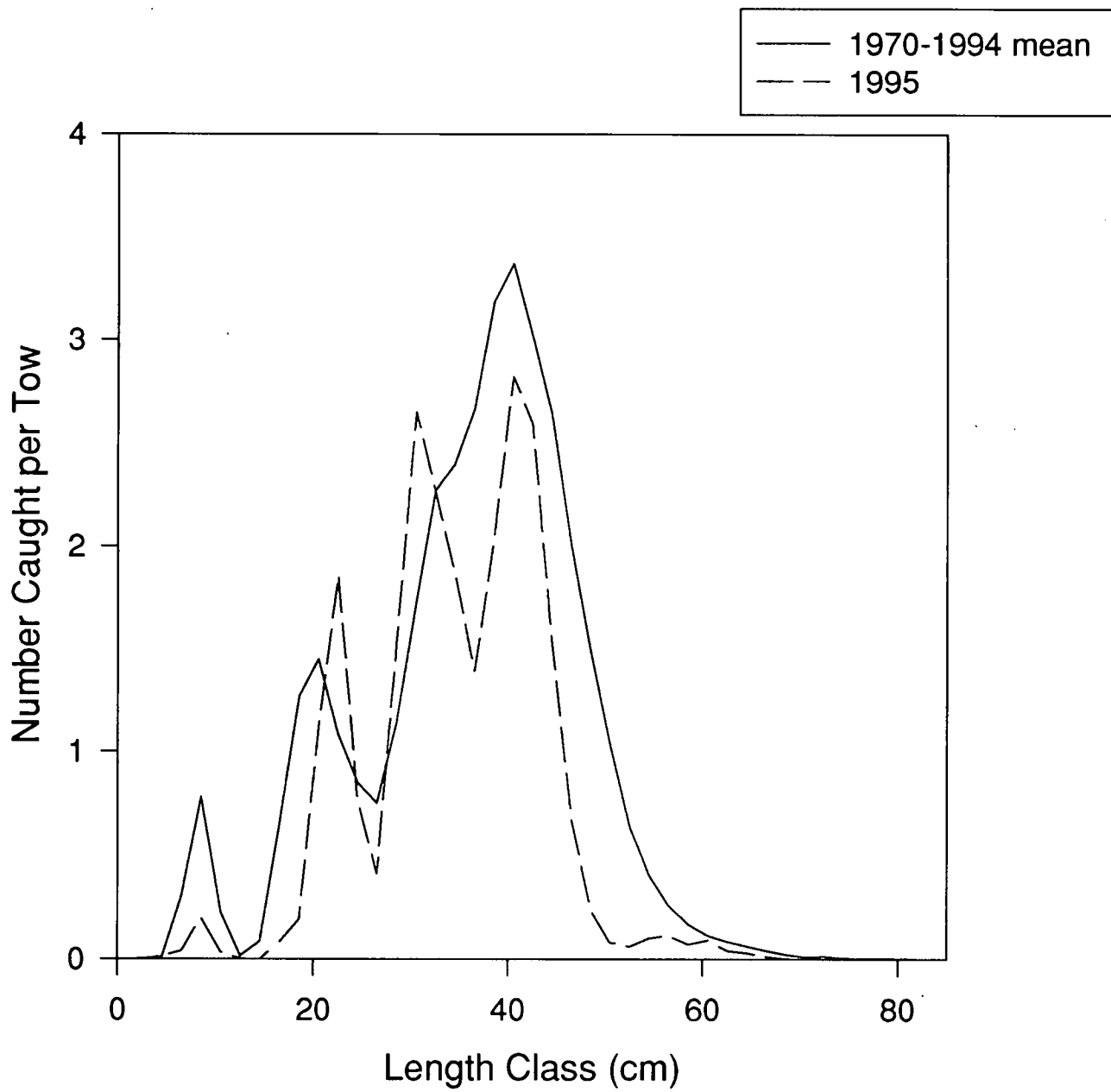
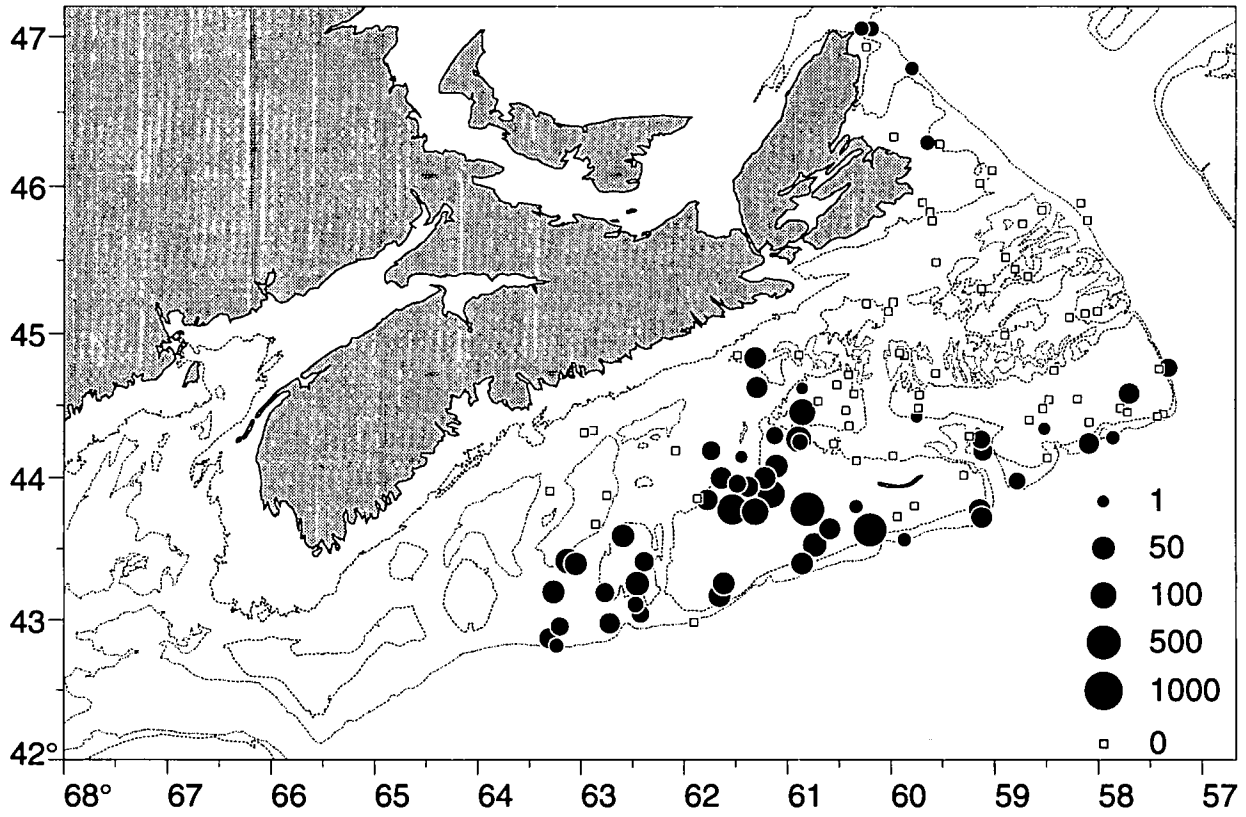


Fig.10. 4VW haddock. Comparison of length-frequency distribution obtained during the 1995 survey to the average distribution observed from 1970-1994.



Summer Groundfish Survey 4VW Haddock Biomass (kg/tow) July 1992

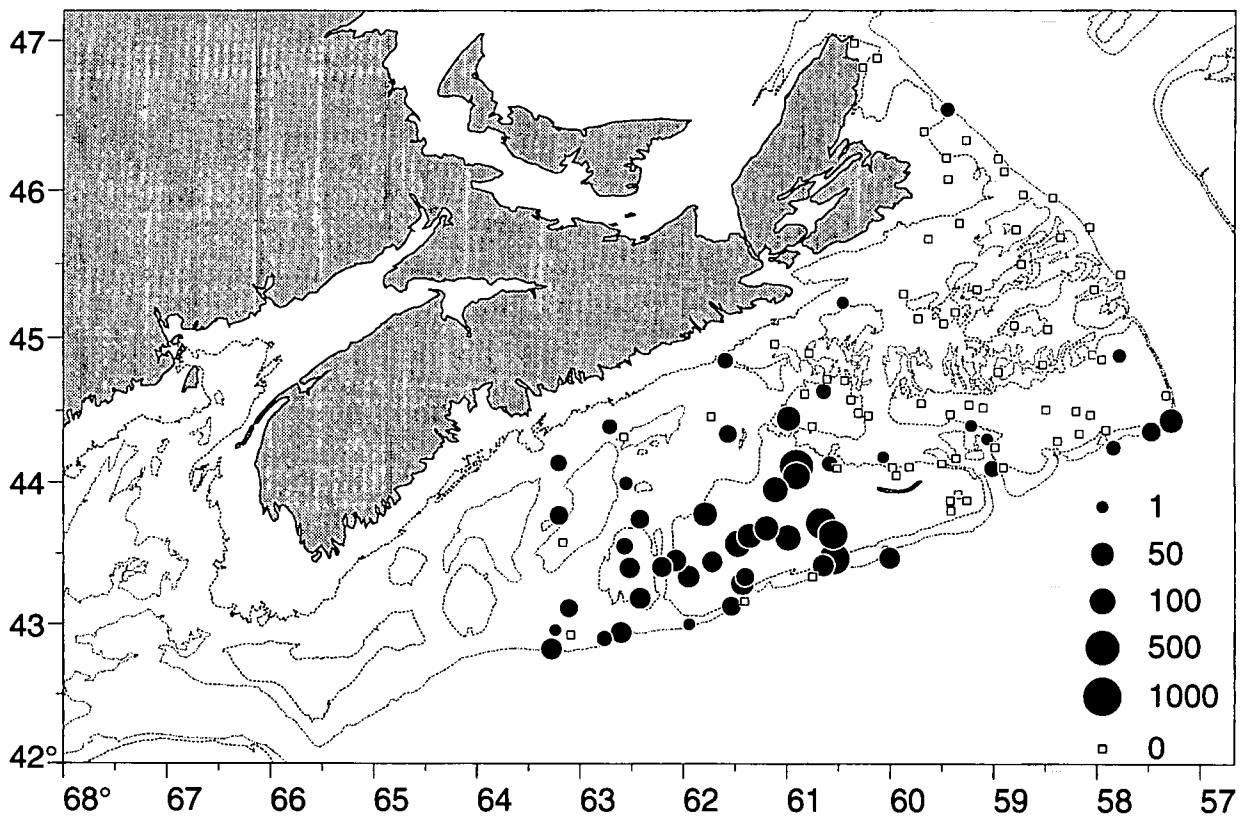
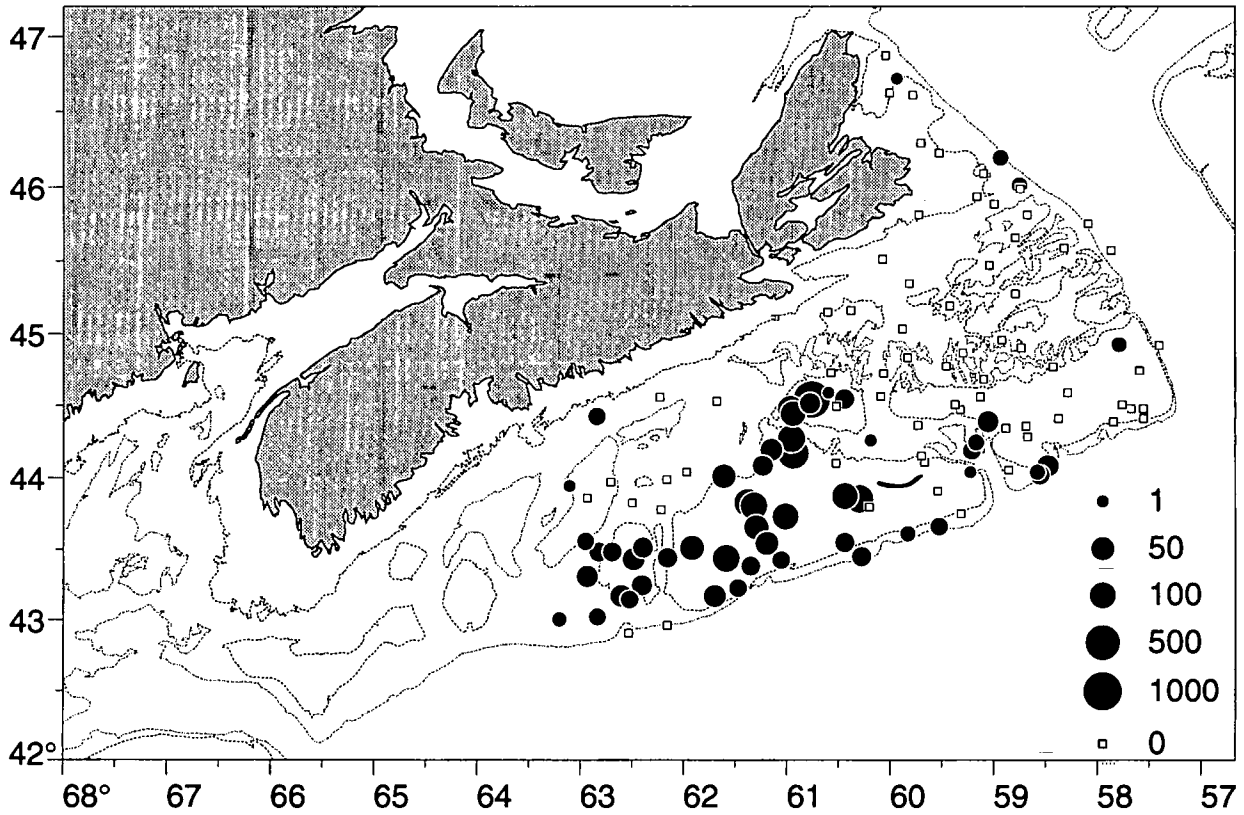
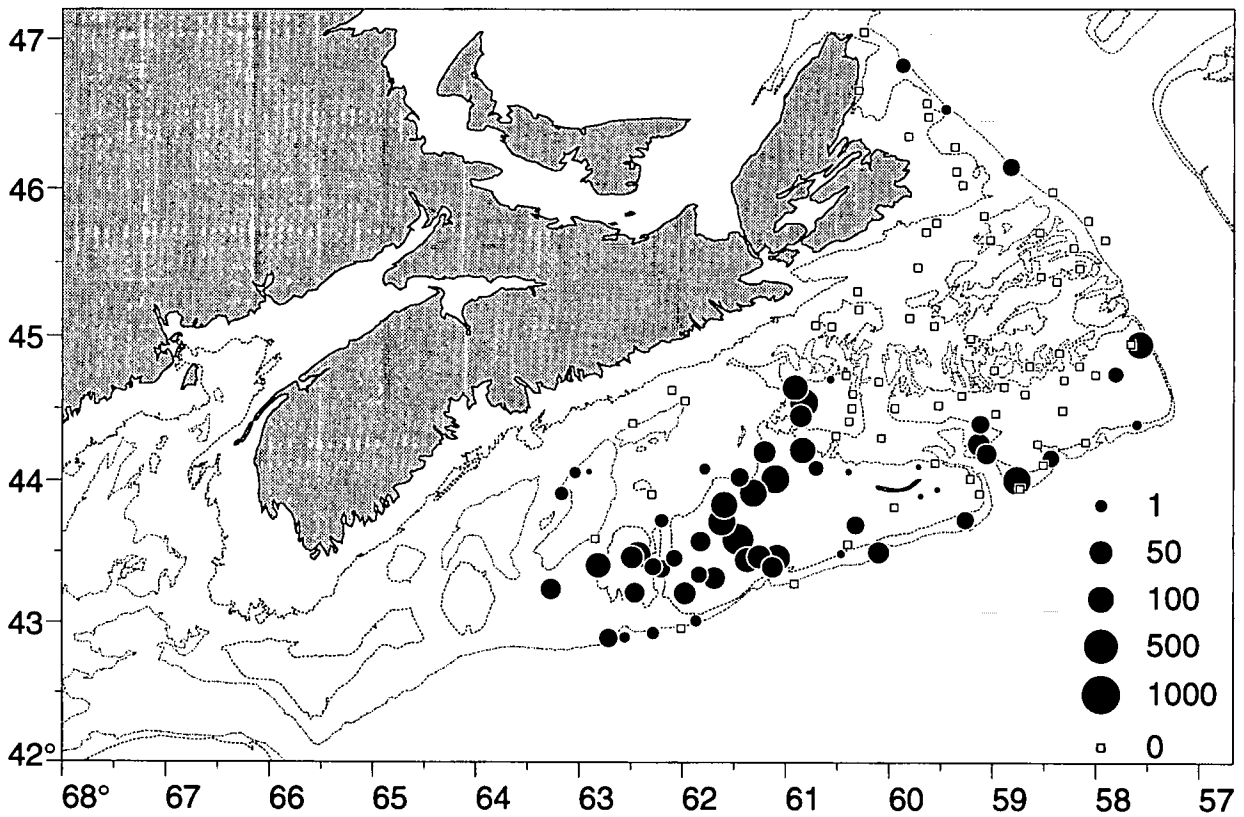


Fig. 11. Summer Groundfish Survey 4VW Haddock Biomass (kg/tow) July 1993



Summer Groundfish Survey 4VW Haddock Biomass (kg/tow) July 1994



Summer Groundfish Survey 4VW Haddock Biomass (kg/tow) July 1995

4X Haddock (P. Hurley, BIO)

1. Abundance

Mean number per tow of 4X haddock in the summer research vessel survey increased from 37 per tow in 1994 to 93 fish per tow in 1995 (Fig. 12), more than twice the long term mean of 44 per tow and the second highest value in the survey series. The mean weight per tow, however, increased from 16 kg per tow in 1994 to 35 kg per tow in 1995, relative to the long term mean of 36 kg per tow. The substantial increase in mean numbers per tow, relative to mean weight per tow, was due to record catches of small haddock. The catch of haddock at modal lengths of 18 and 30 cm respectively (haddock aged 1 and 2 years old) was much larger than average (Fig. 13). This is consistent with the result in the 1994 survey, when these haddock were 0 and 1 years old. The 1995 survey indicates that the abundance of market size haddock (>43cm) has increased. The catch of haddock in the length range 38 to 48 cm were at or slightly above average, while the catch in the length range of 50 to 58 cm was slightly higher than last year but still lower than average. The catch in the length range 60 to 70 cm was still well below average and no haddock greater than 70 cm in length were caught.

2. Recruitment and Size Composition

Length frequency distributions from the last four summer surveys (Fig. 13) indicate that the 1993 and 1994 yearclasses are much stronger than average and that the 1992 yearclass may be average in strength.

3. Distribution

Haddock were more widely distributed in the 1995 summer survey than in recent years (Fig. 14). Haddock were encountered in the eastern portion of the survey area and in the upper part of the Bay of Fundy, where they had not been encountered in recent years. Abundance increased throughout the survey area, but the increase in the eastern and central portions of the survey area consisted primarily of small haddock. The increase in the Bay of Fundy, however, consisted of both small and market sized haddock.

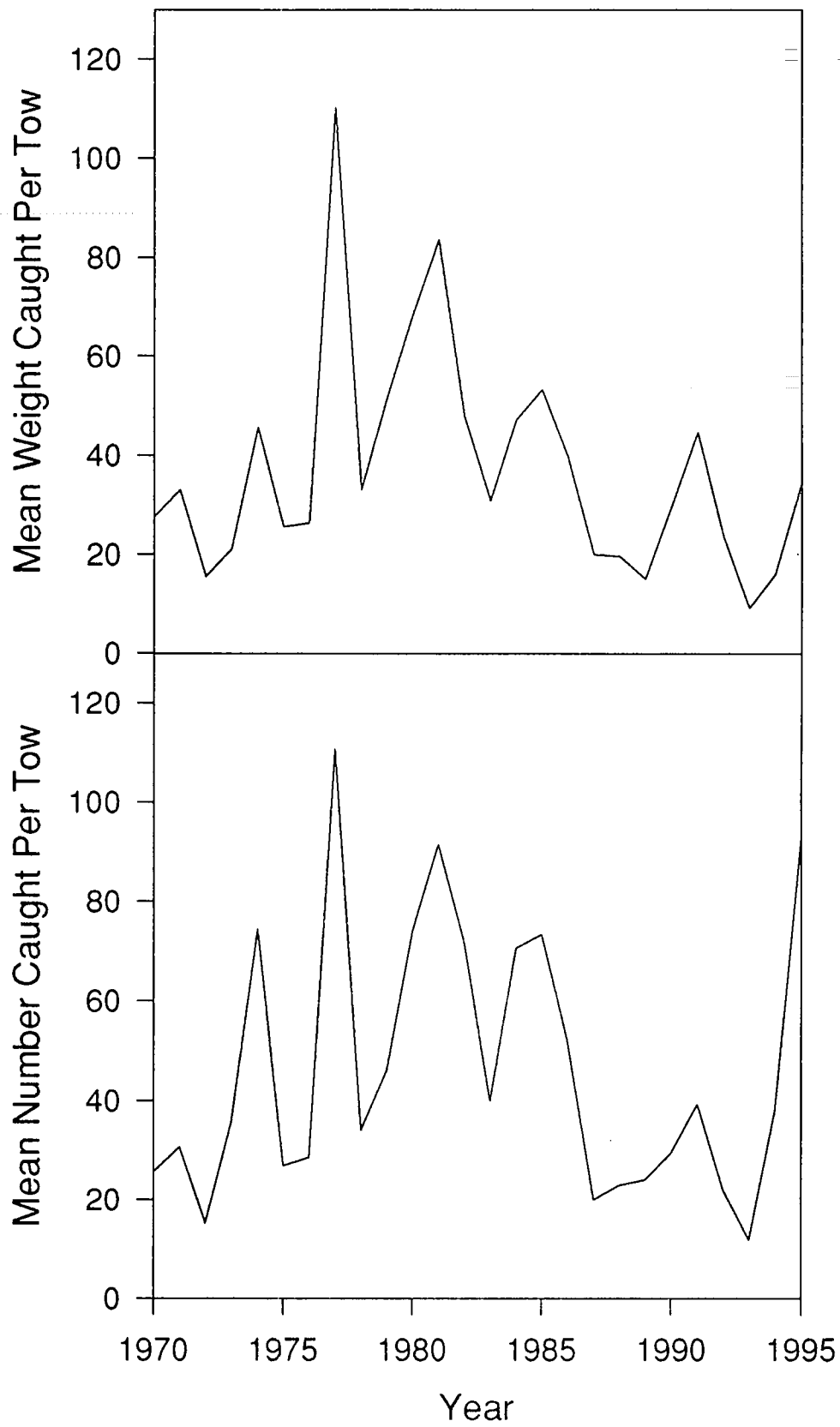


Fig.12 4X haddock. Stratified mean weight and number caught per tow from summer surveys, 1970-1995.

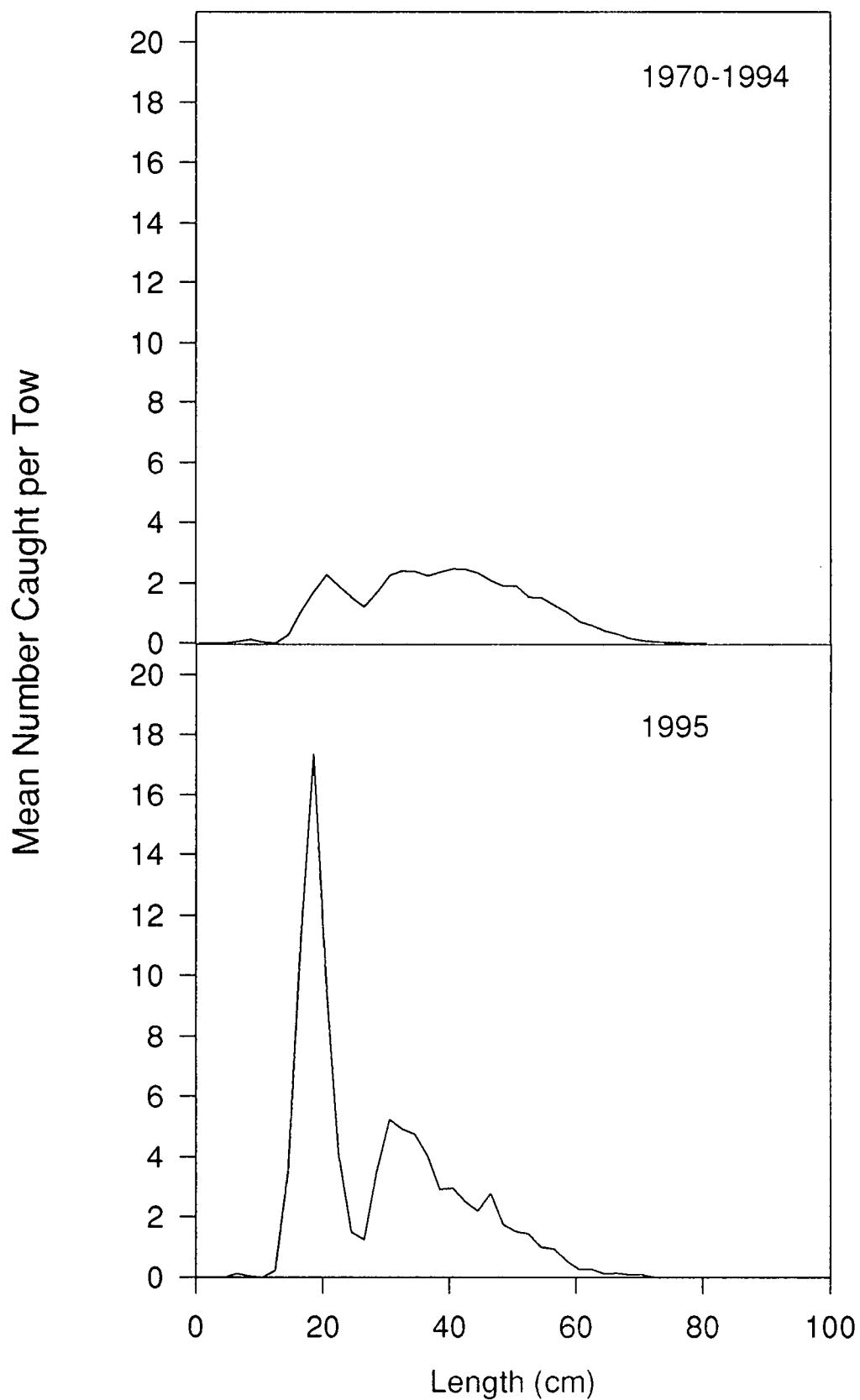
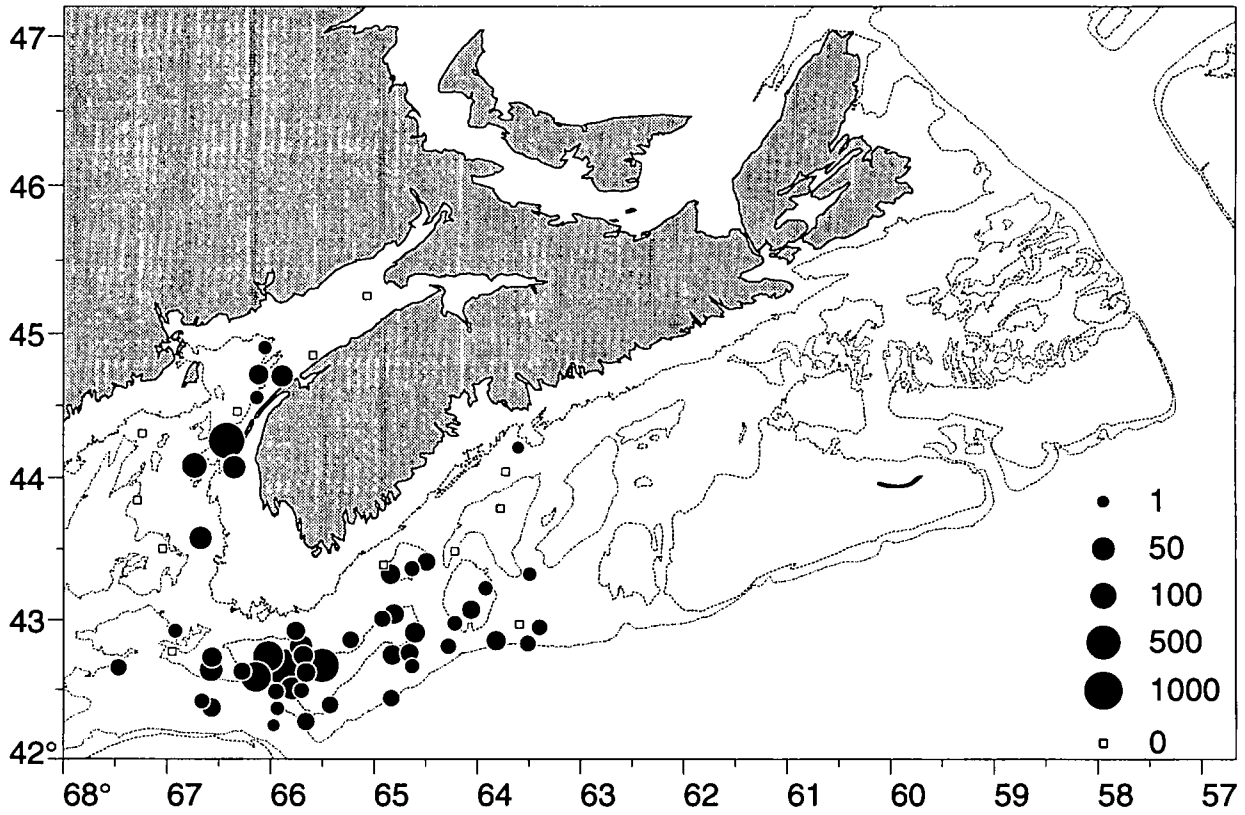


Fig.13. 4X Haddock. Length-frequency distribution from the summer 1995 survey (bottom panel), compared with average from surveys conducted from 1970-1994.



Summer Groundfish Survey 4X Haddock Biomass (kg/tow) July 1992

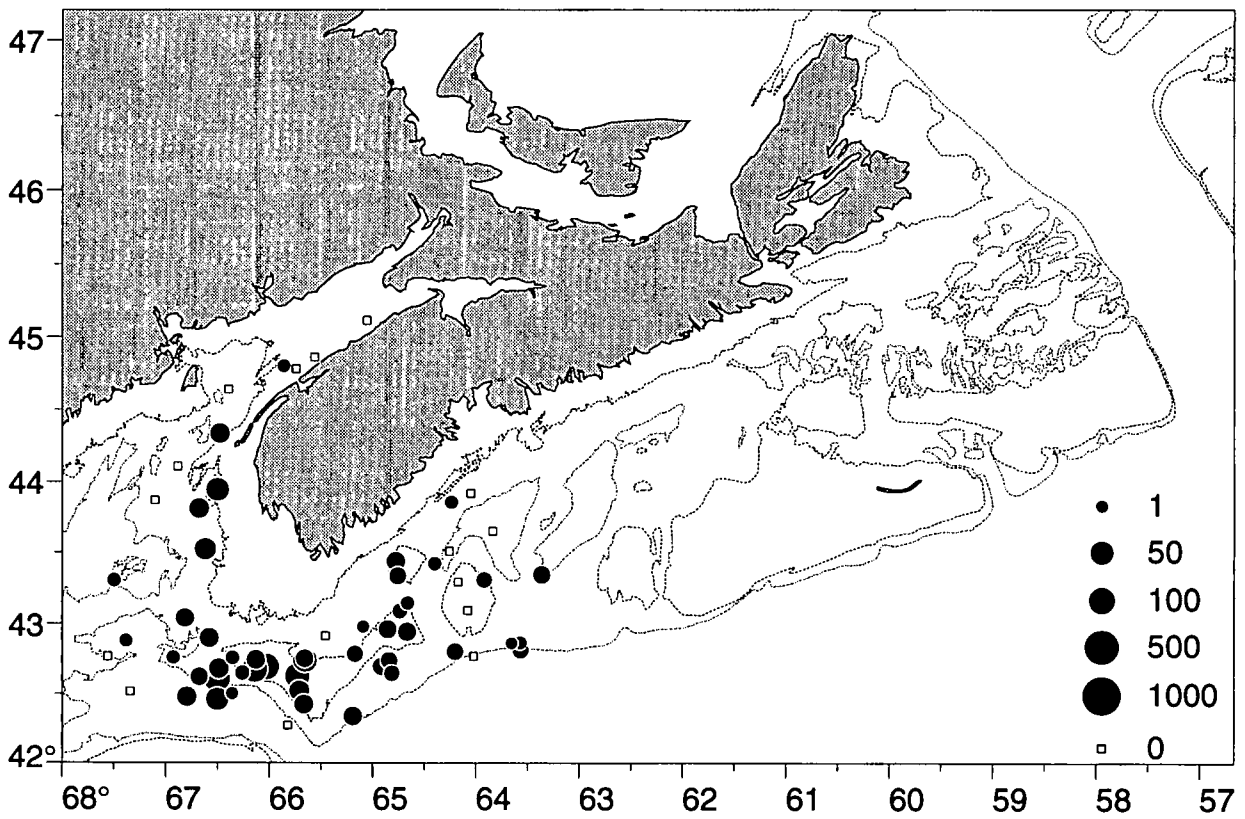
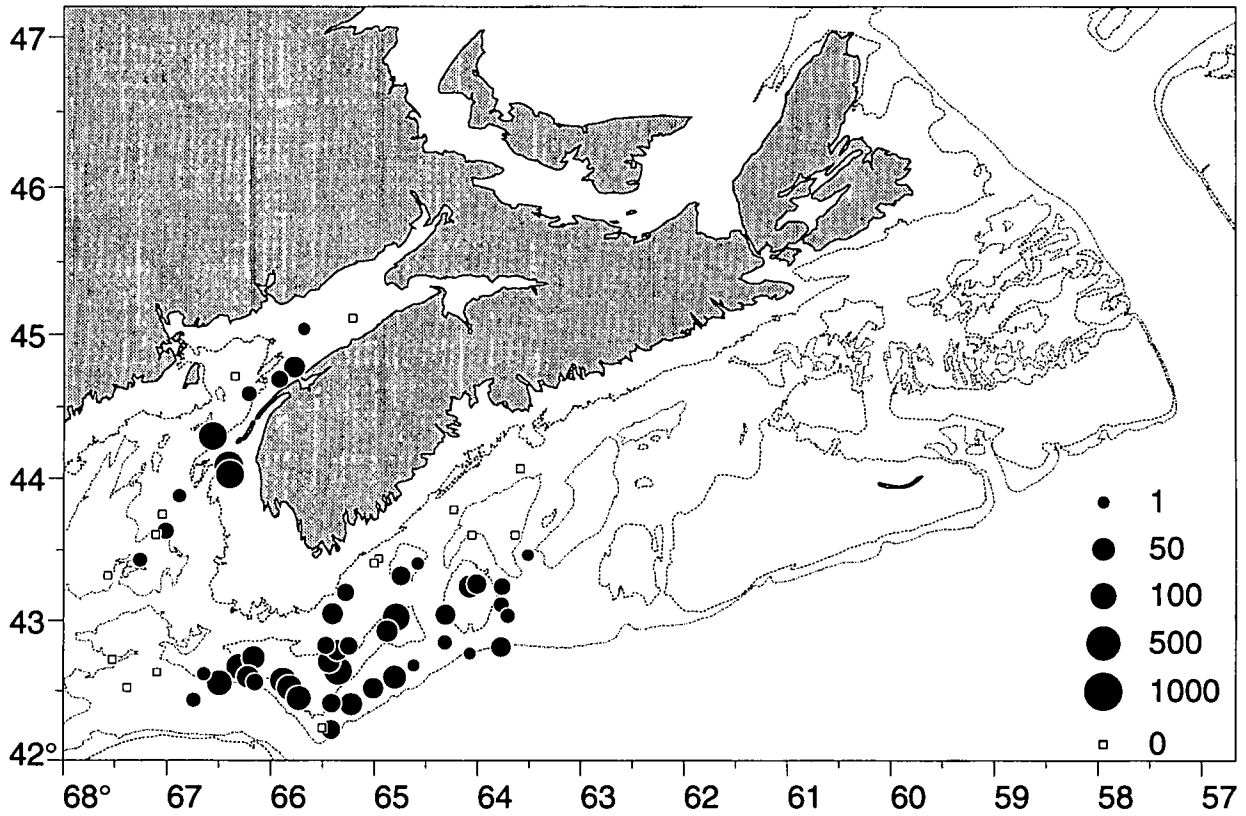
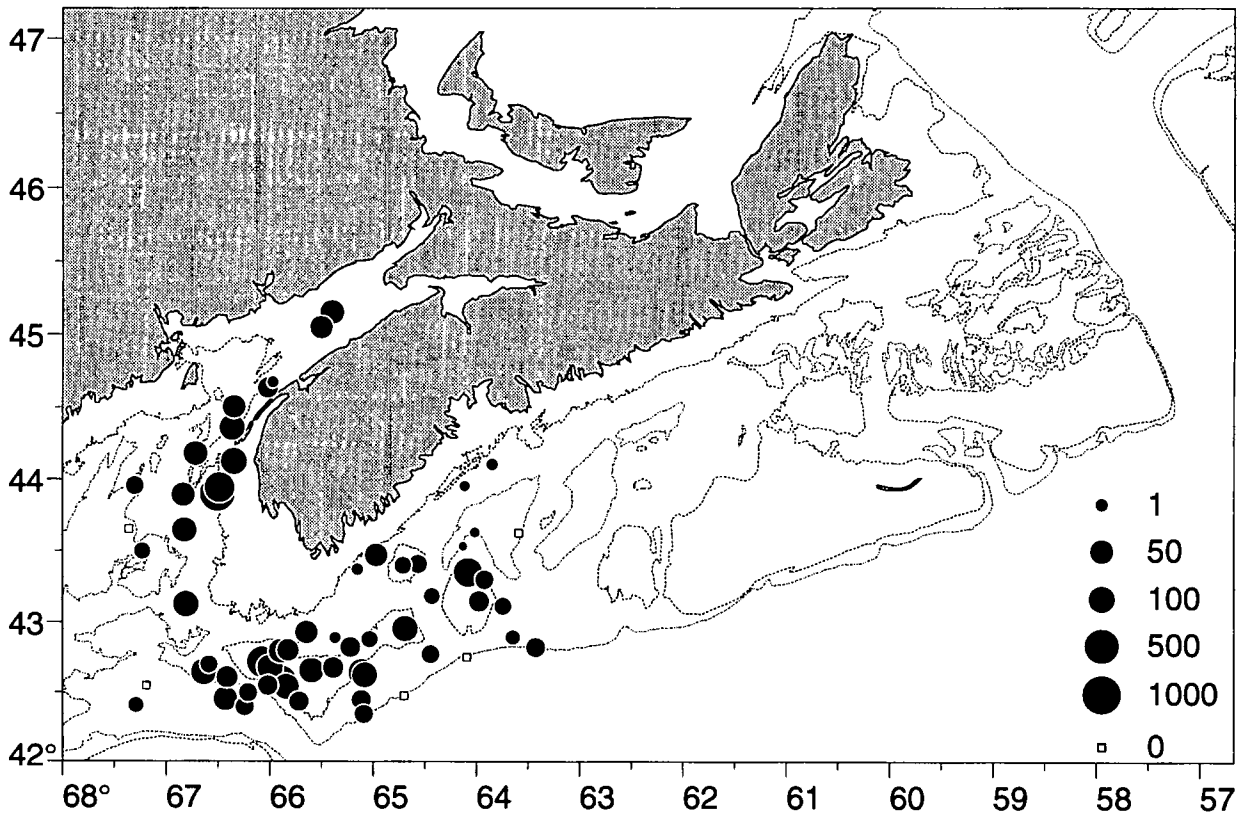


Fig. 14. Summer Groundfish Survey 4X Haddock Biomass (kg/tow) July 1993



Summer Groundfish Survey 4X Haddock Biomass (kg/tow) July 1994



Summer Groundfish Survey 4X Haddock Biomass (kg/tow) July 1995

4VWX5Ze Pollock (J. Neilson, SABS)

1. Abundance

Survey results for pollock have been highly variable from year to year (Fig. 15), and are not used as an index of abundance in the most recent stock assessment.

2. Recruitment and Size Composition

The length-frequency distributions from summer research vessel surveys are shown in Fig. 16. The strong interannual variability in surveys persist from 1994 to 1995. Apparently strong younger yearclasses in 1993 do not persist in 1994 and 1995. As indicated on the bottom panel of Fig. 16, the abundance of smaller pollock from the 1995 survey is comparable to the 10-year mean (1985-1994), but larger fish are considerably less abundant than in the past.

3. Distribution

The distribution of pollock catches compared with the previous three years of survey results is shown in Fig. 17. In general, the 1995 distribution appears comparable with previous years. Pollock were more common in the NAFO 4WX area compared with 4V.

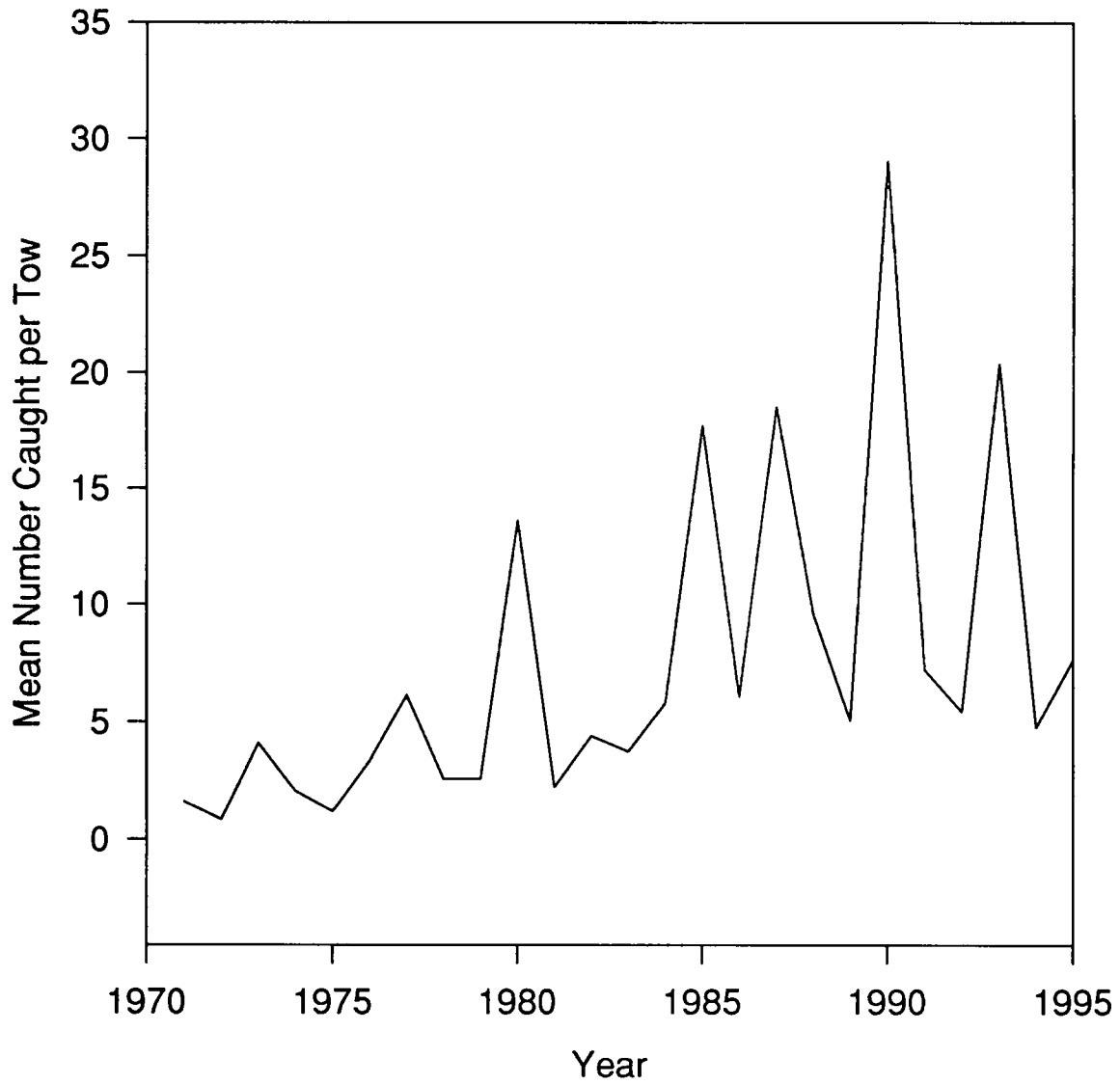


Fig.15. 4VWX5Zc Pollock. Stratified mean number caught per tow during summer surveys, 1970-1995.

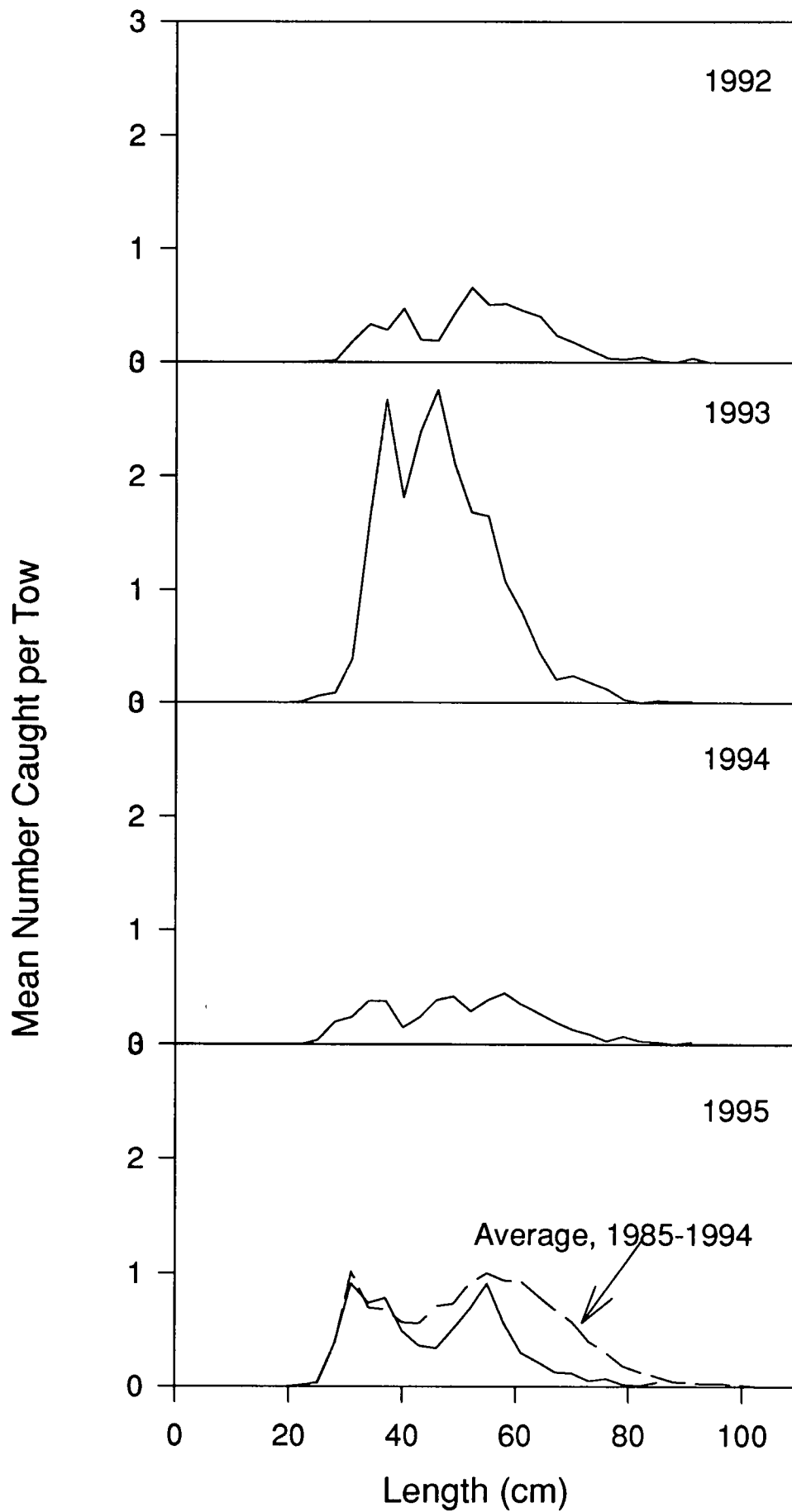
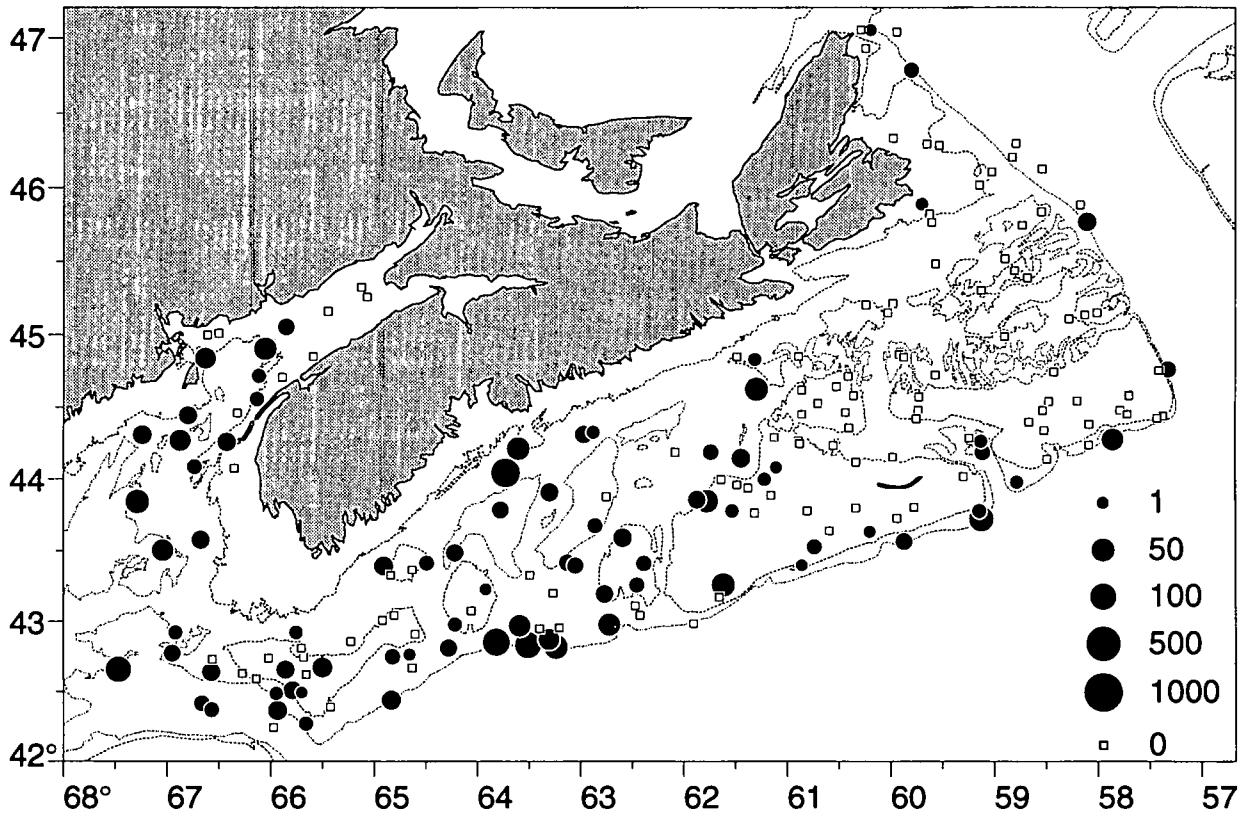


Fig. 16 Pollock length frequency distributions from summer groundfish surveys, 1992-1995. The average from surveys conducted from 1985 to 1994 is compared with the 1995 data, bottom panel.



Summer Groundfish Survey 4VWX Pollock Biomass (kg/tow) July 1992

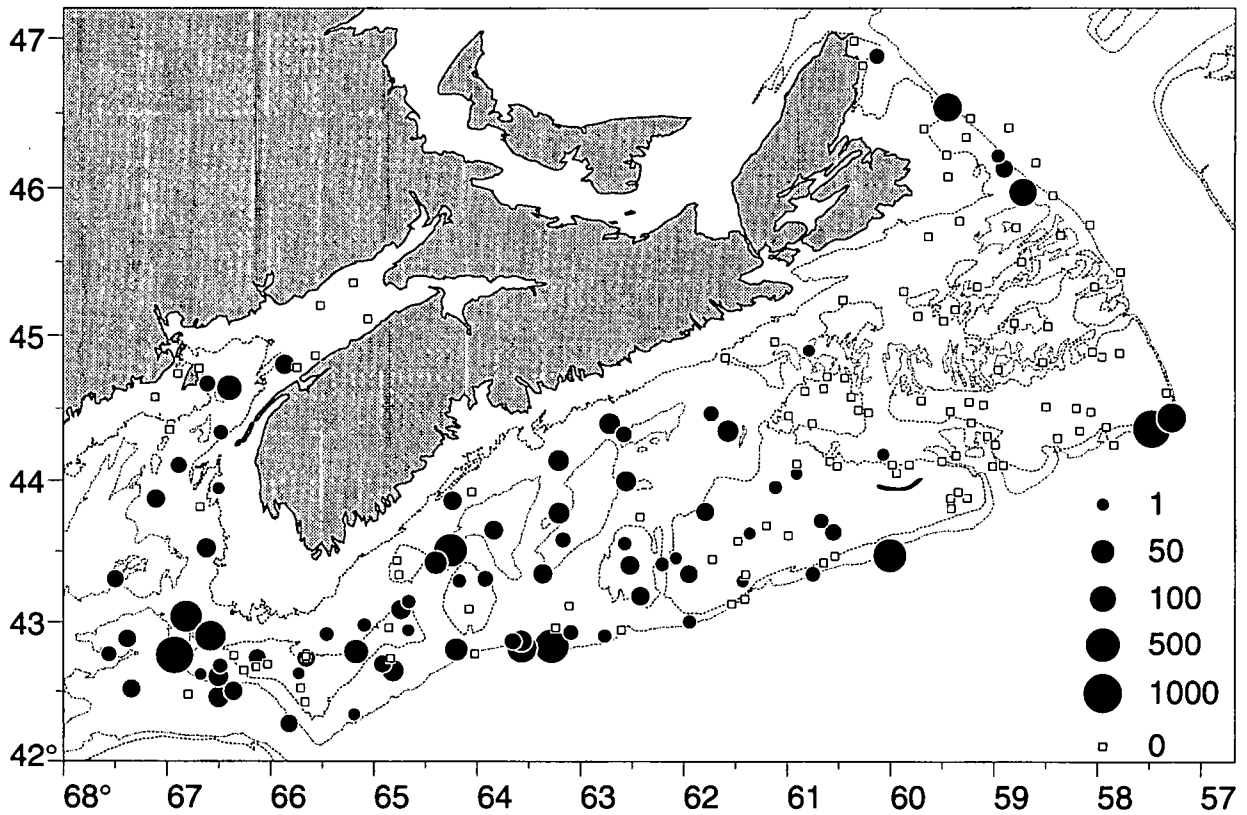
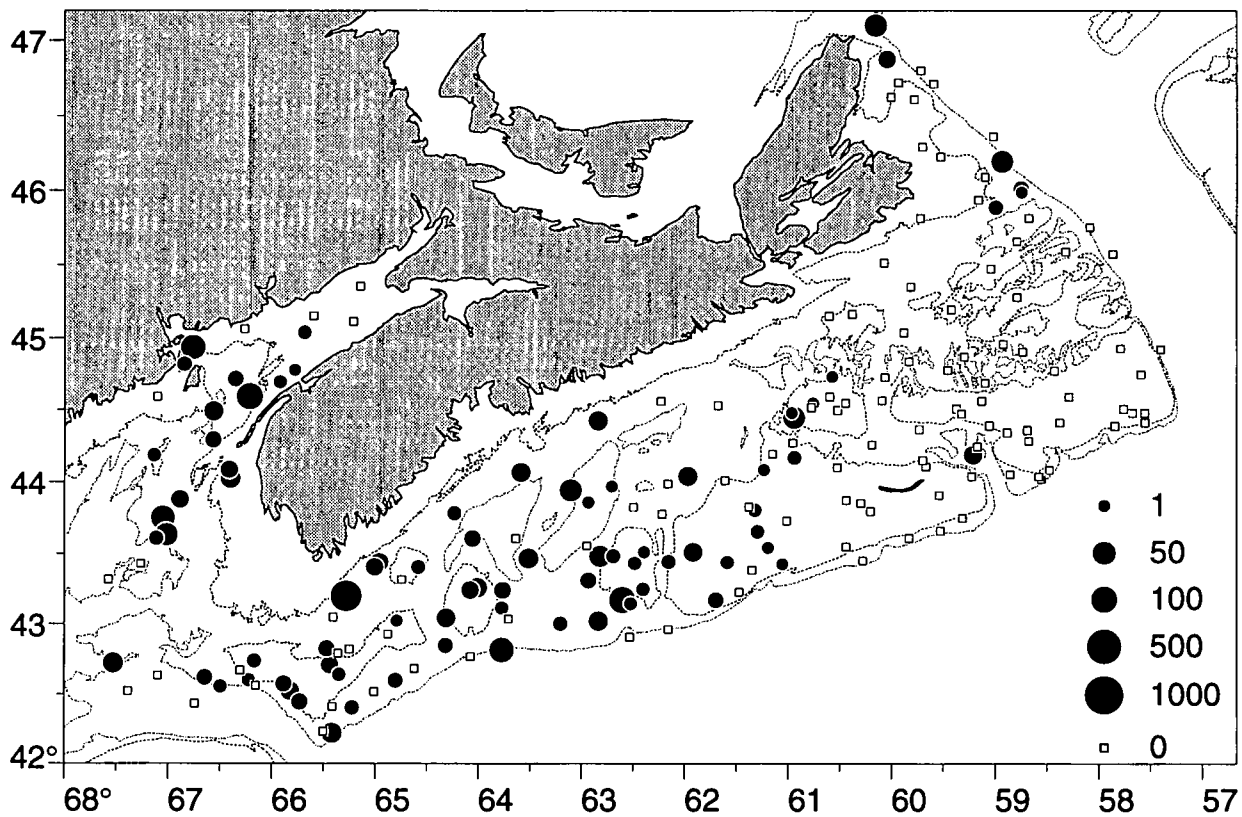
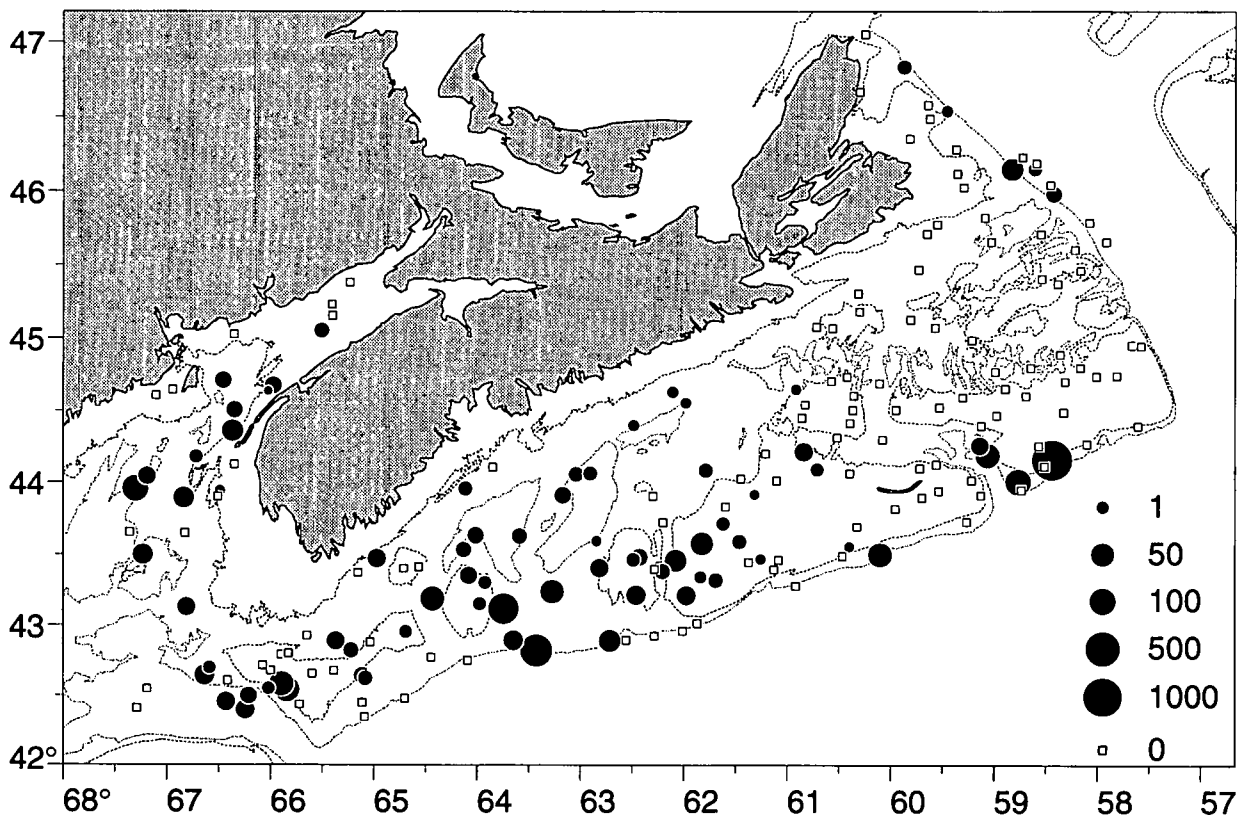


Fig. 17. Summer Groundfish Survey 4VWX Pollock Biomass (kg/tow) July 1993



Summer Groundfish Survey 4VWX Pollock Biomass (kg/tow) July 1994



Summer Groundfish Survey 4VWX Pollock Biomass (kg/tow) July 1995

Unit 3 Redfish (R. Branton, BIO)

1. Abundance

In 1995, the average weight of redfish per tow in Unit 3 was 17 kg and the number of fish was 61. The average weight and number per tow for the period 1990 to 1994 was 24 kg and 78 fish (Fig. 18).

2. Recruitment and Size Composition

The redfish population size composition for 1995 ranged from 6 to 44 cm, had a main mode at 25 cm and several secondary modes of both small and large fish (Fig. 19). The average size composition for the period 1990 to 1994 ranged from 3 to 45 cm, had a main mode at 25 cm and a secondary mode of small fish at 12 cm. In 1995 there were more fish in the 18 to 23 cm range than in the average of the previous 5 years.

Surveys continue to show moderate indications of small fish recruiting to the fishable population.

3. Distribution

The population continues to be widely distributed in all deepwater areas of the management unit (Fig. 20).

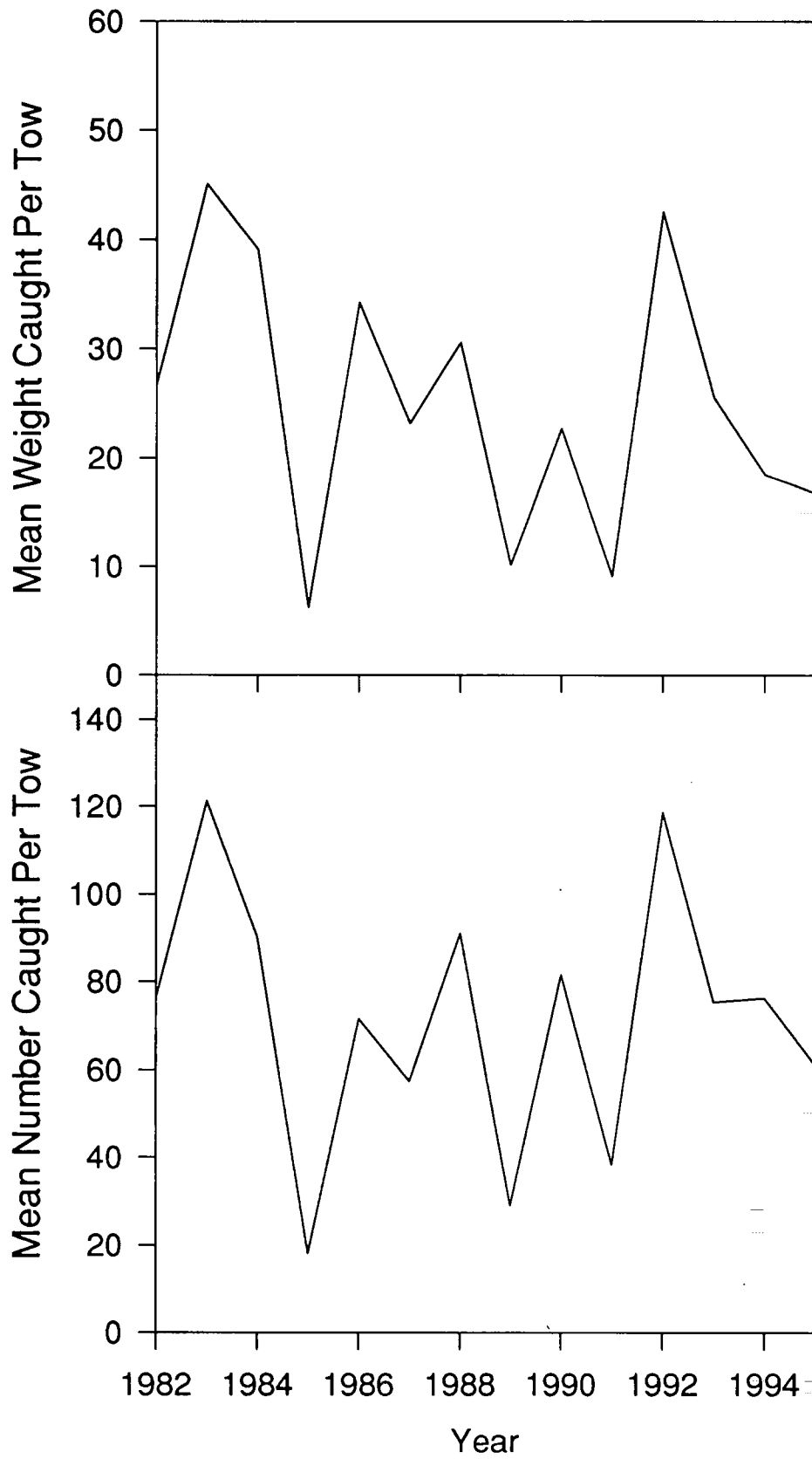


Fig.18 Unit 3 Redfish. Stratified mean weight and number caught per tow from summer surveys, 1982 -1995.

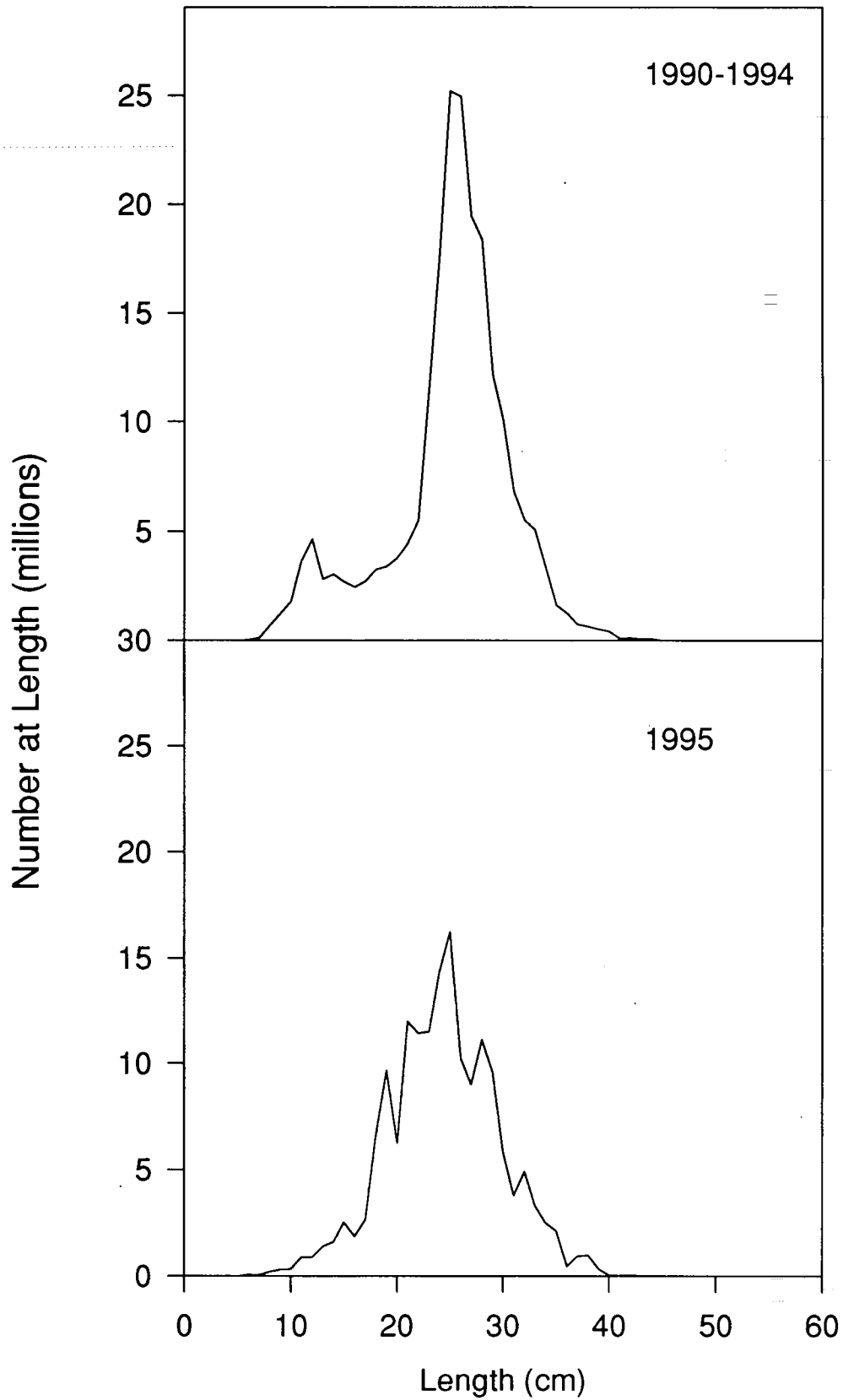
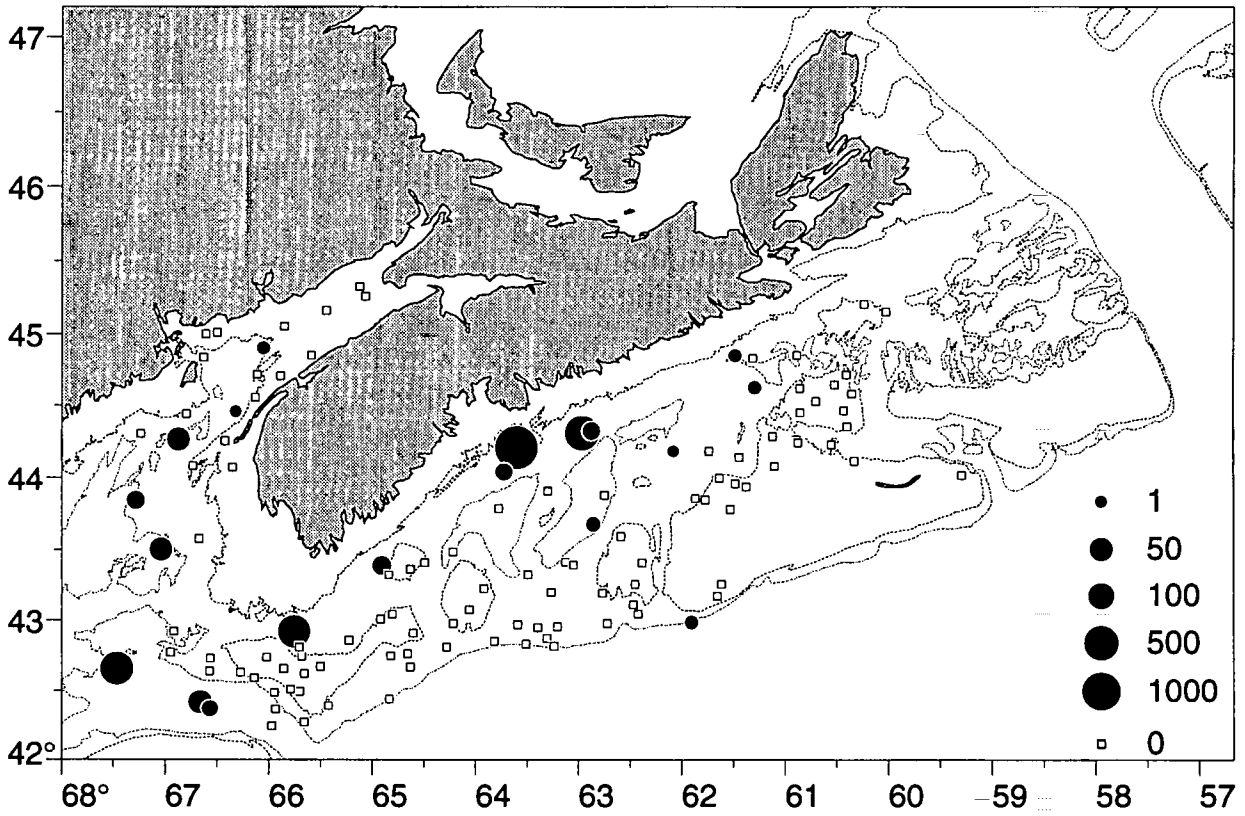


Fig.19. Unit 3 Redfish. Length-frequency distribution from the summer 1995 survey (bottom panel), compared with average from surveys conducted from 1990-1994.



Summer Groundfish Survey Unit 3 Redfish Biomass (kg/tow) July 1992

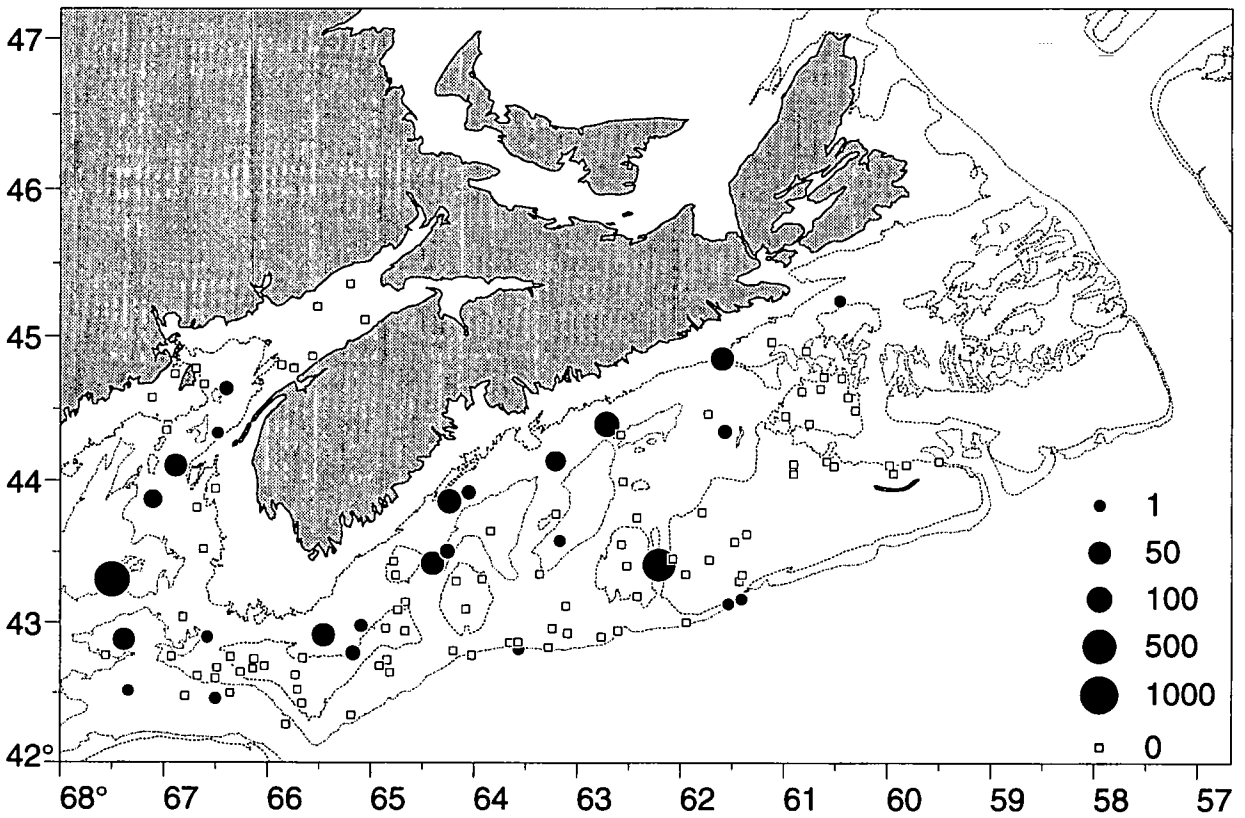
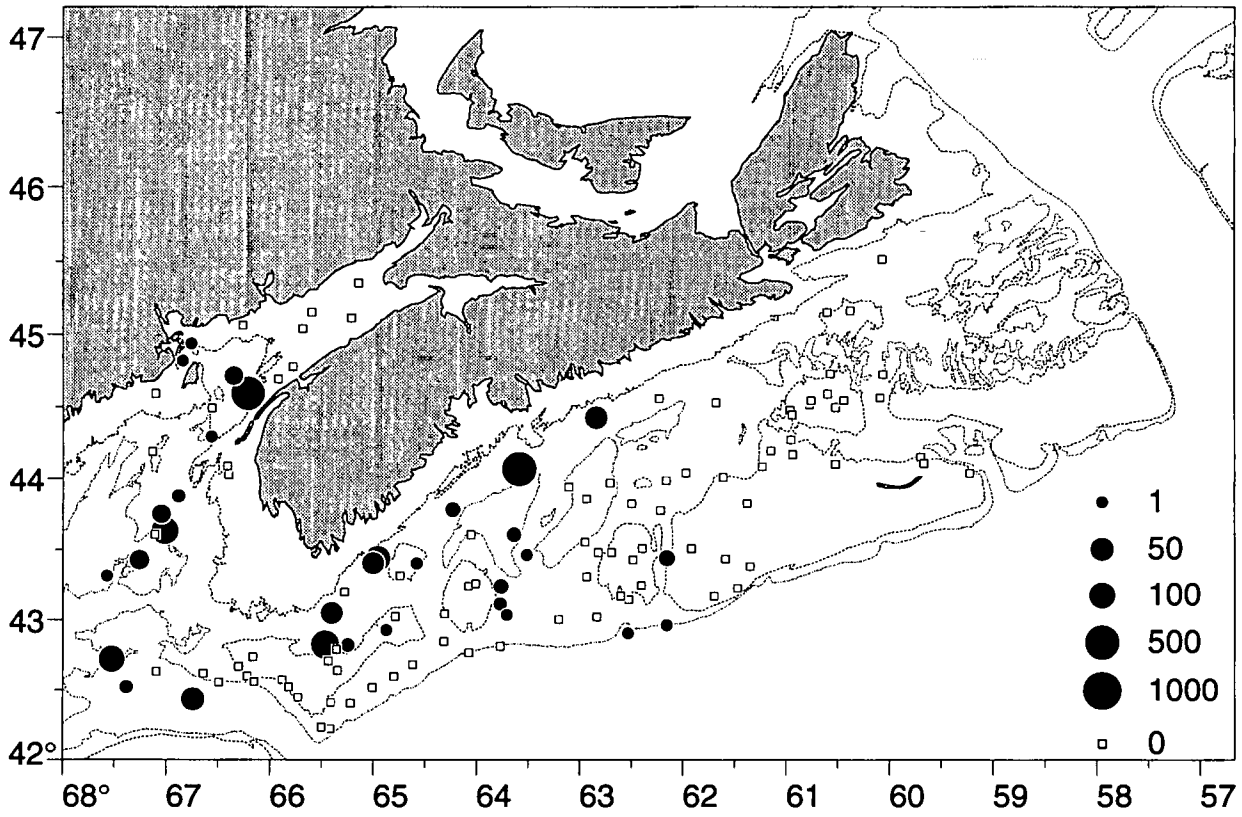
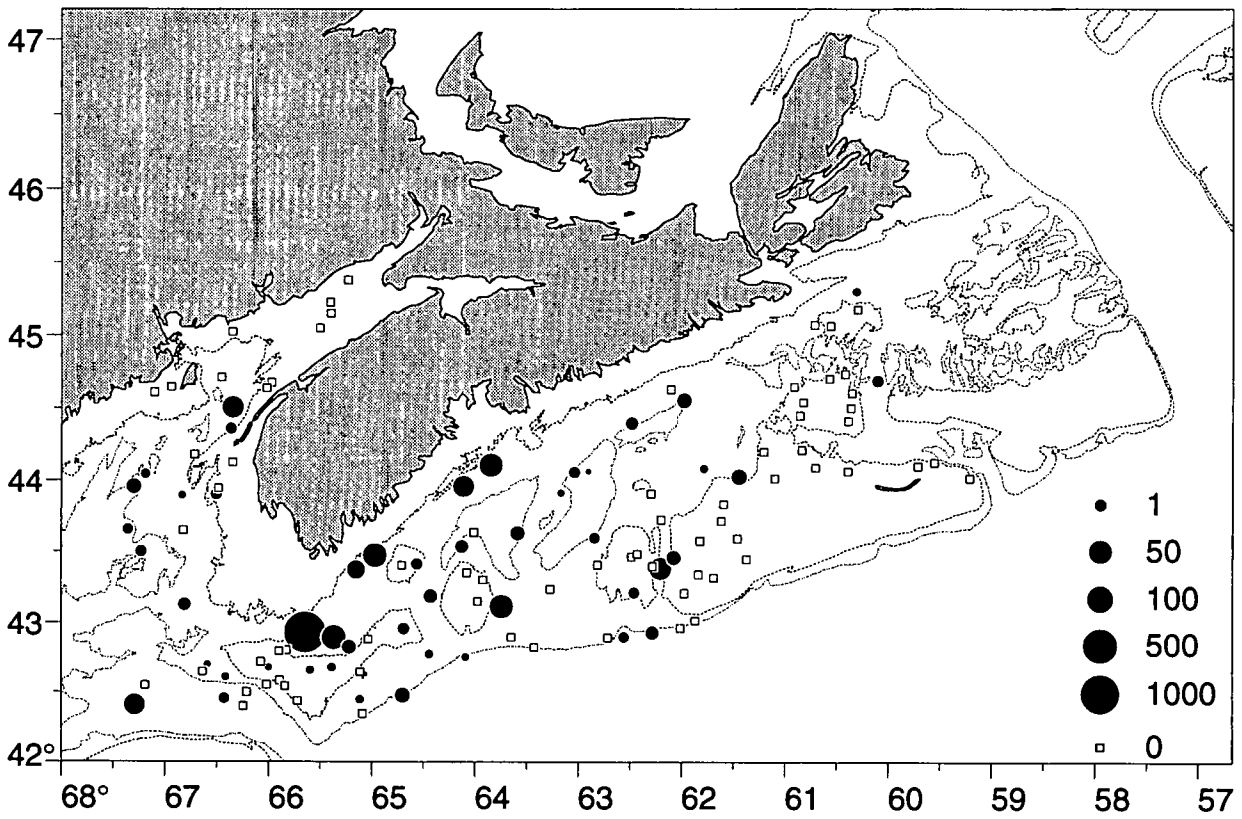


Fig. 20. Summer Groundfish Survey Unit 3 Redfish Biomass (kg/tow) July 1993



Summer Groundfish Survey Unit 3 Redfish Biomass (kg/tow) July 1994



Summer Groundfish Survey Unit 3 Redfish Biomass (kg/tow) July 1995

4VW Flatfish (C. Annand, BIO)

1. Abundance

American plaice: Mean numbers increased from 28.2 fish per tow in 1994 to 43.7 fish per tow in 1995 (Fig. 21). Numbers in 1995 are slightly below the longterm (1970-1994) average.

Yellowtail flounder: Mean numbers increased from 16.8 fish per tow in 1994 to 19.0 fish per tow in 1995, still well below the longterm (1970-1994) average (Fig. 22).

Witch flounder: Mean numbers increased from 4.6 fish per tow to 6.2 fish per tow, somewhat above the longterm (1970-1994) average (Fig. 23).

Winter flounder: Mean numbers declined from 1.9 fish per tow to 1.2 fish per tow (Fig. 24). Numbers per tow are somewhat below the longterm (1970-1994) average.

2. Recruitment and Size Composition

American plaice: Survey length distributions indicated more small fish in 1995 compared to the recent (1990-1994) average size composition (Fig. 25). The 1995 survey caught fewer large American plaice (> 30 cm) but more in the 5-20 cm range which may be an indication of good incoming recruitment.

Yellowtail flounder: Survey length distributions indicated more small fish in 1995 compared to the recent (1990-1994) average size composition (Fig. 26). The 1995 survey caught more yellowtail in the 10-22 cm range which may be an indication of good incoming recruitment.

Witch flounder: Survey length distributions indicated more small fish in 1995 compared to the recent (1990-1994) average size composition (Fig. 27). The 1995 survey caught high numbers of witch flounder in the 5-20 cm range which may be an indication of good incoming recruitment.

Winter flounder: Survey length distributions in 1995 did not show any significant difference in size composition when compared to the recent (1990-1994) average (Fig. 28). There is very little commercial fishery for winter flounder in 4VW.

3. Distribution

American Plaice: Survey catches in 1995 show a similar distribution to 1994 with major concentrations observed in 4V (Fig. 29). Catches in the Banquereau bank (4VSc) were higher in 1995 than in 1994.

Yellowtail flounder: Survey catches in 1995 continue to show major concentrations of yellowtail west of the Sable Island Gully in 4W (Fig. 30). More yellowtail were caught in the Banquereau Bank area (4VSc) in the 1995 survey compared to the 1994 survey catch rates. The commercial fishery for yellowtail flounder takes place almost entirely in 4VSc.

Witch flounder: Survey catch rates in 1995 show a similar distributions to 1994 and indicate that witch flounder are widely distributed in 4VW, but at low concentrations (Fig. 31). Localized areas of abundance occur in the Gully and in deep holes north of Banquereau and in 4Vn. These very localized areas may account for the variability in the survey estimates.

Winter flounder: As in 1994 the 1995 survey catch rates continue to show concentrations of winter flounder only to the west of Sable Island, and Middle and Western Banks (Fig. 32). A large proportion of the survey abundance is contained within the 4W closed area.

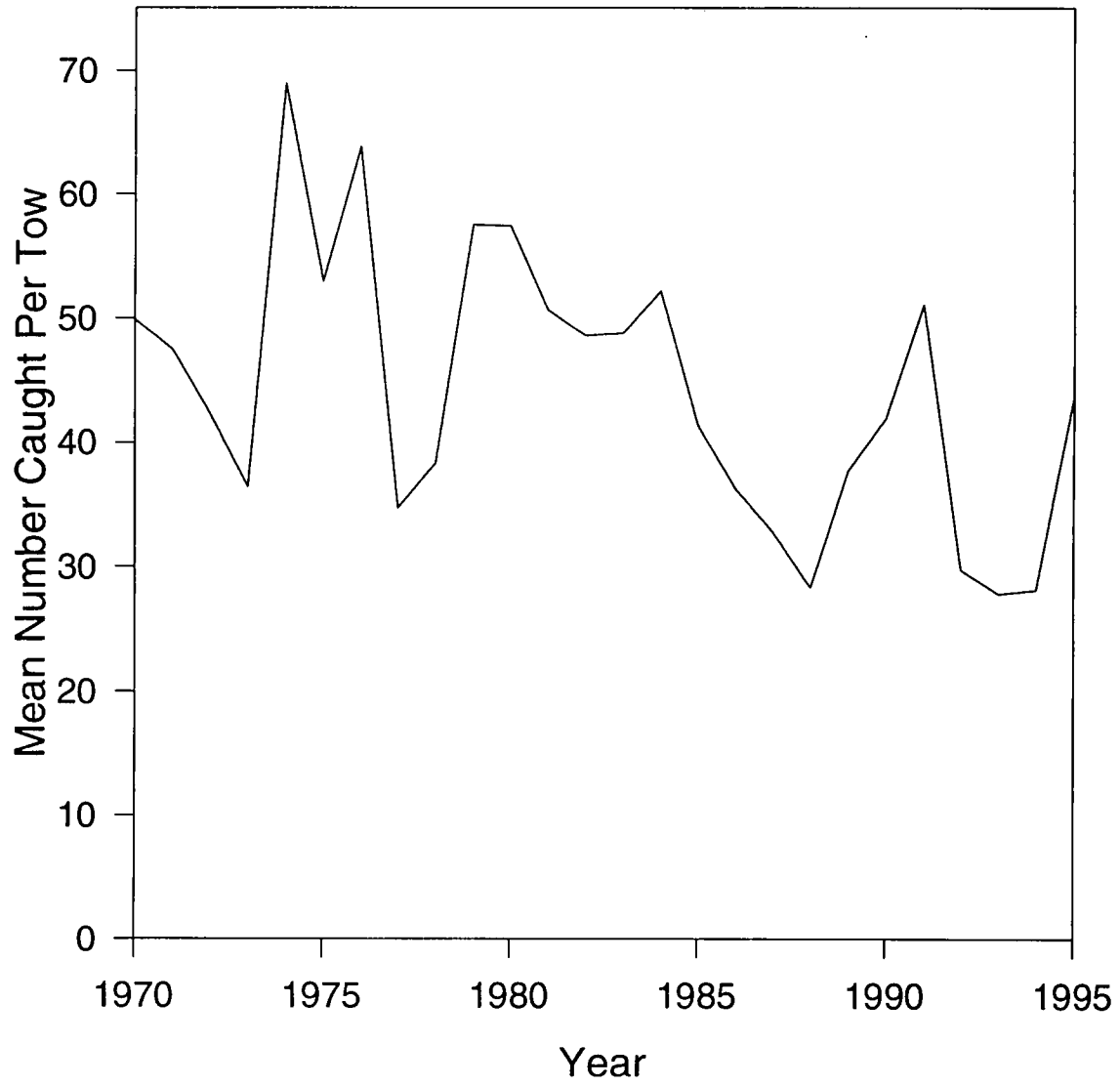


Fig. 214 VW Plaice. Stratified Mean number per tow from summer surveys, 1970-1995.

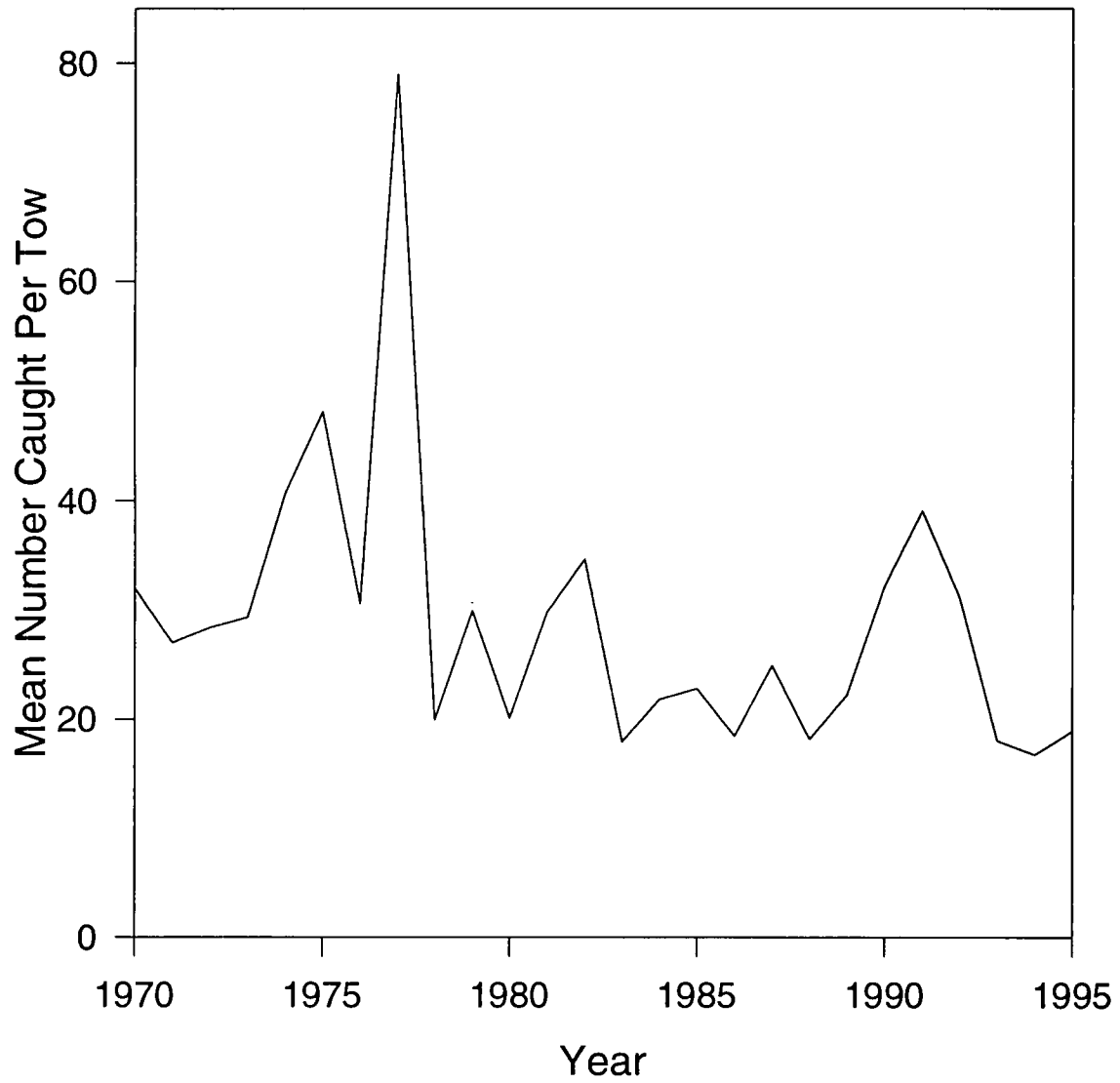


Fig. ²² 4VW Yellowtail. Stratified Mean number per tow from summer surveys, 1970-1995.

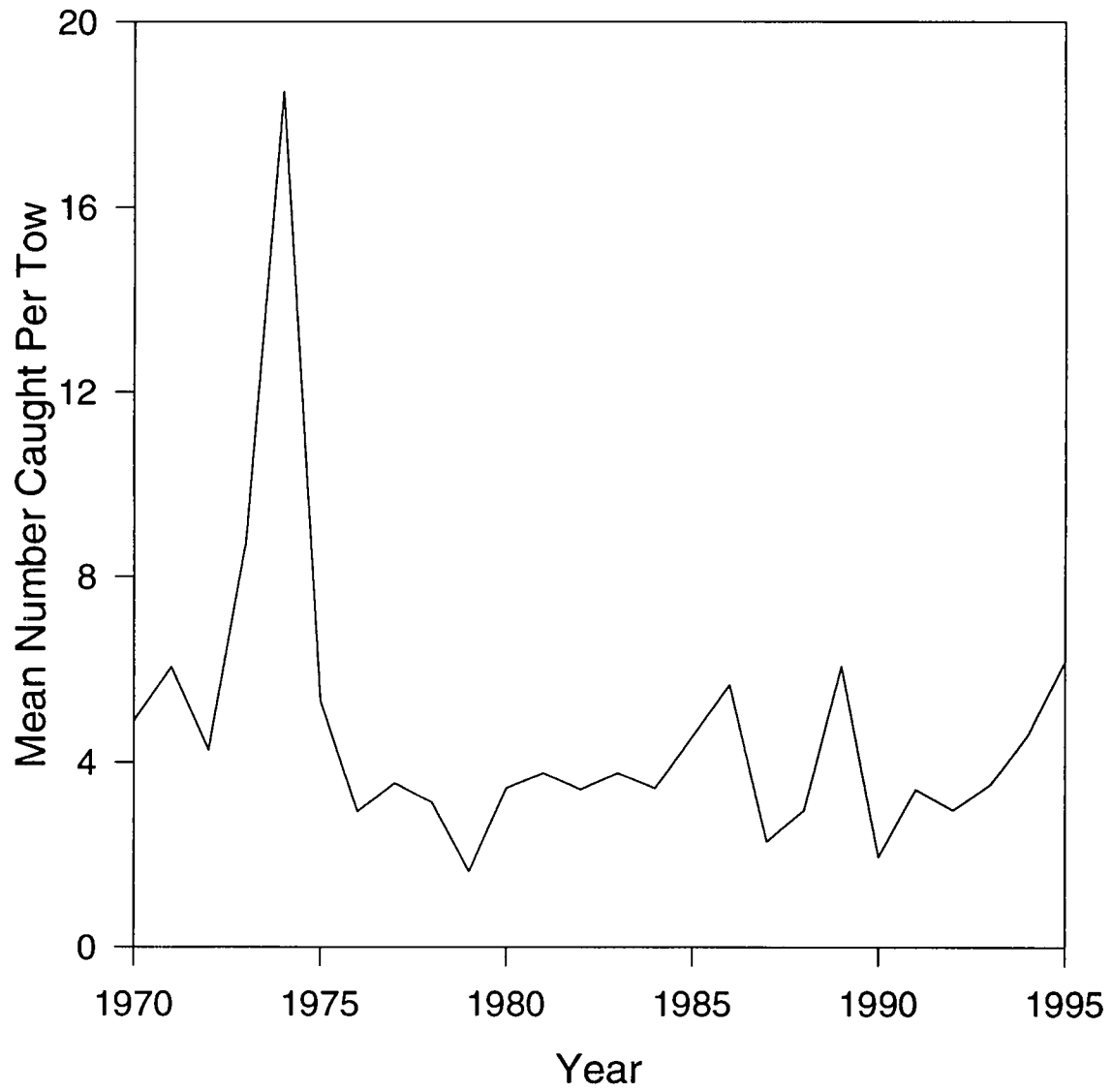


Fig. ²³4VW Witch Flounder. Stratified Mean number per tow from summer surveys, 1970-1995.

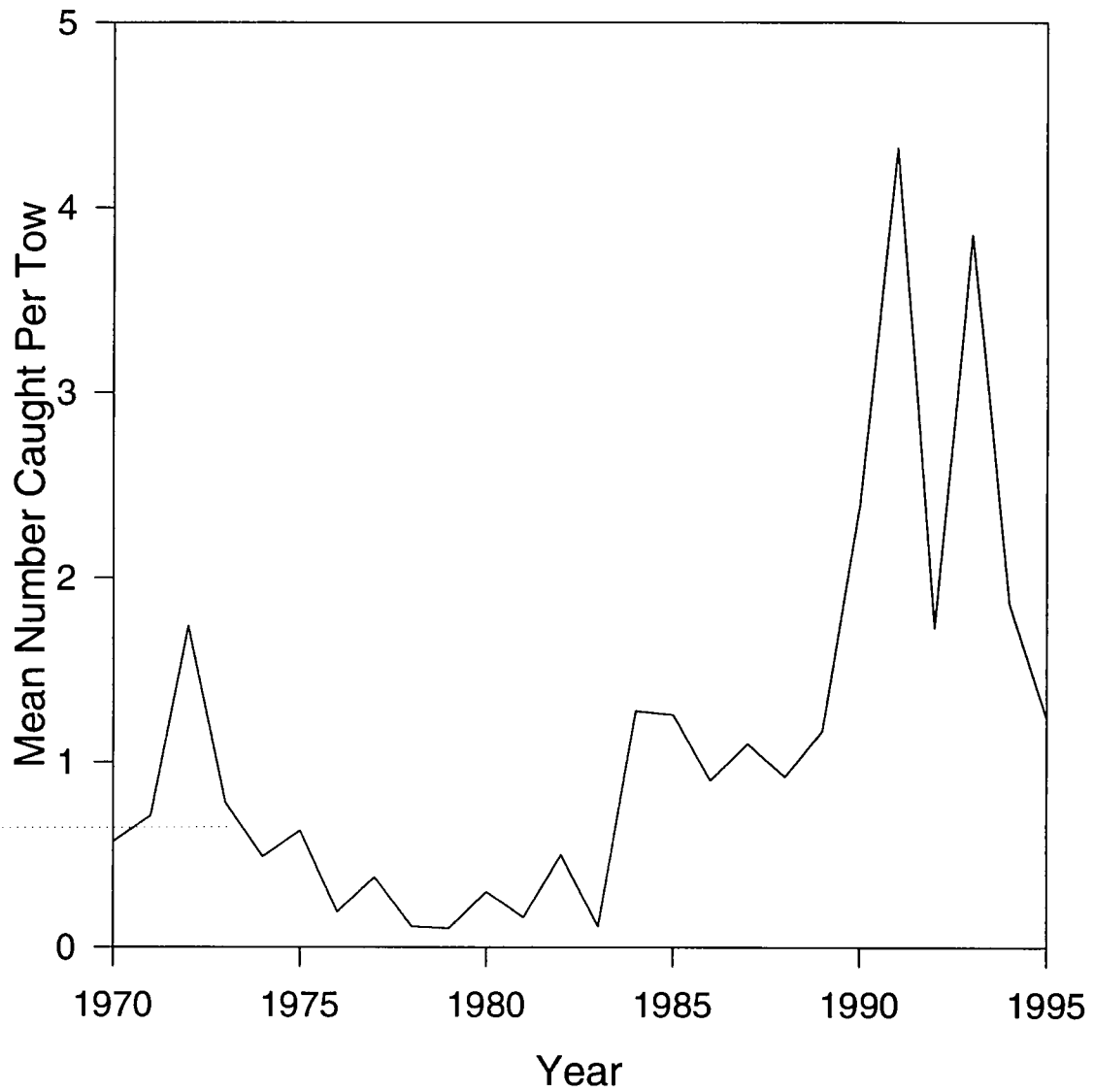


Fig. ²⁴ 4VW Winter Flounder. Stratified Mean number per tow from summer surveys, 1970-1995.

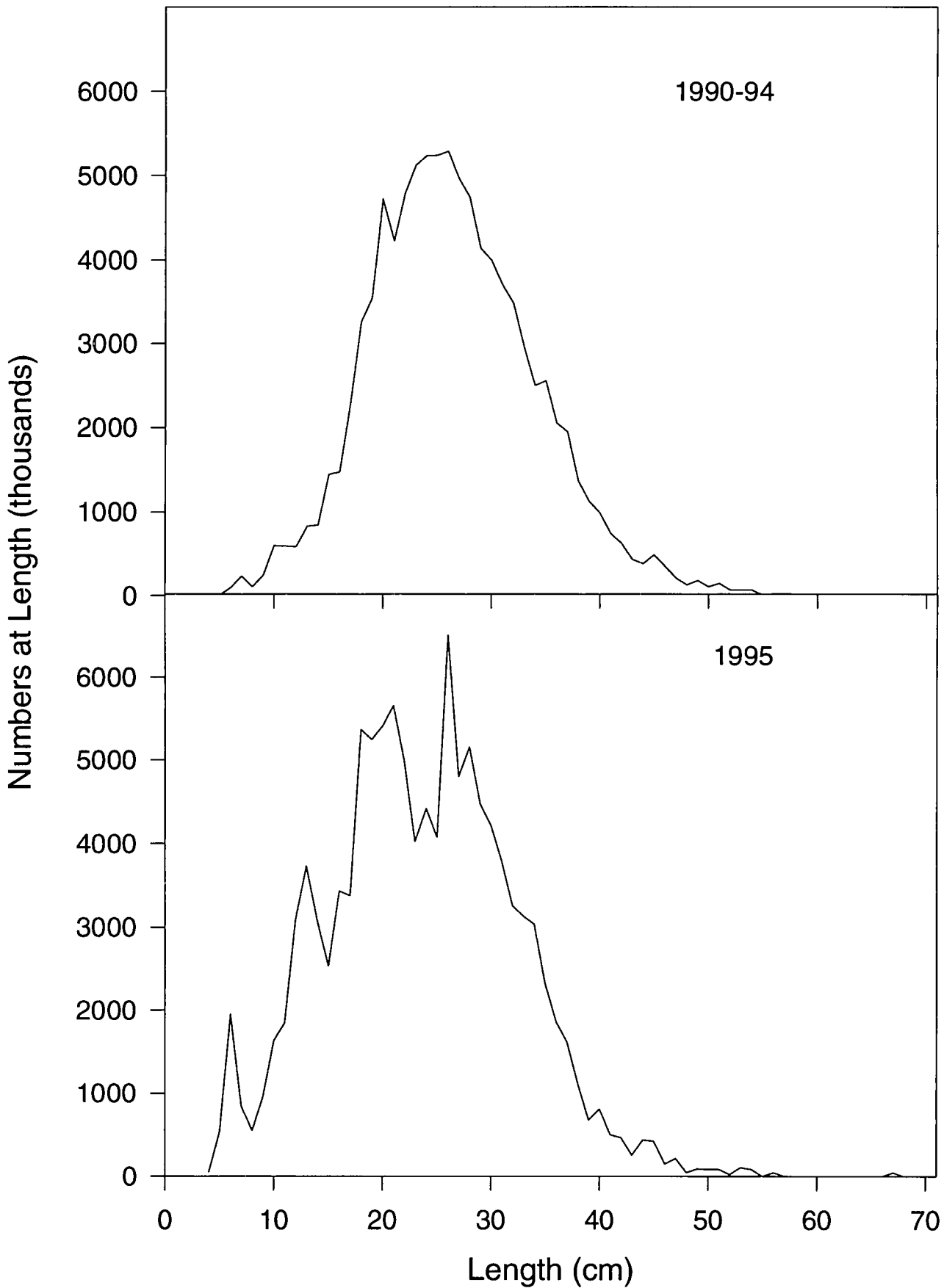


Fig. ²⁵ 4VW Plaice. Length frequency distribution from the summer 1995 survey (bottom panel), compared with average from surveys conducted from 1990 - 1994.

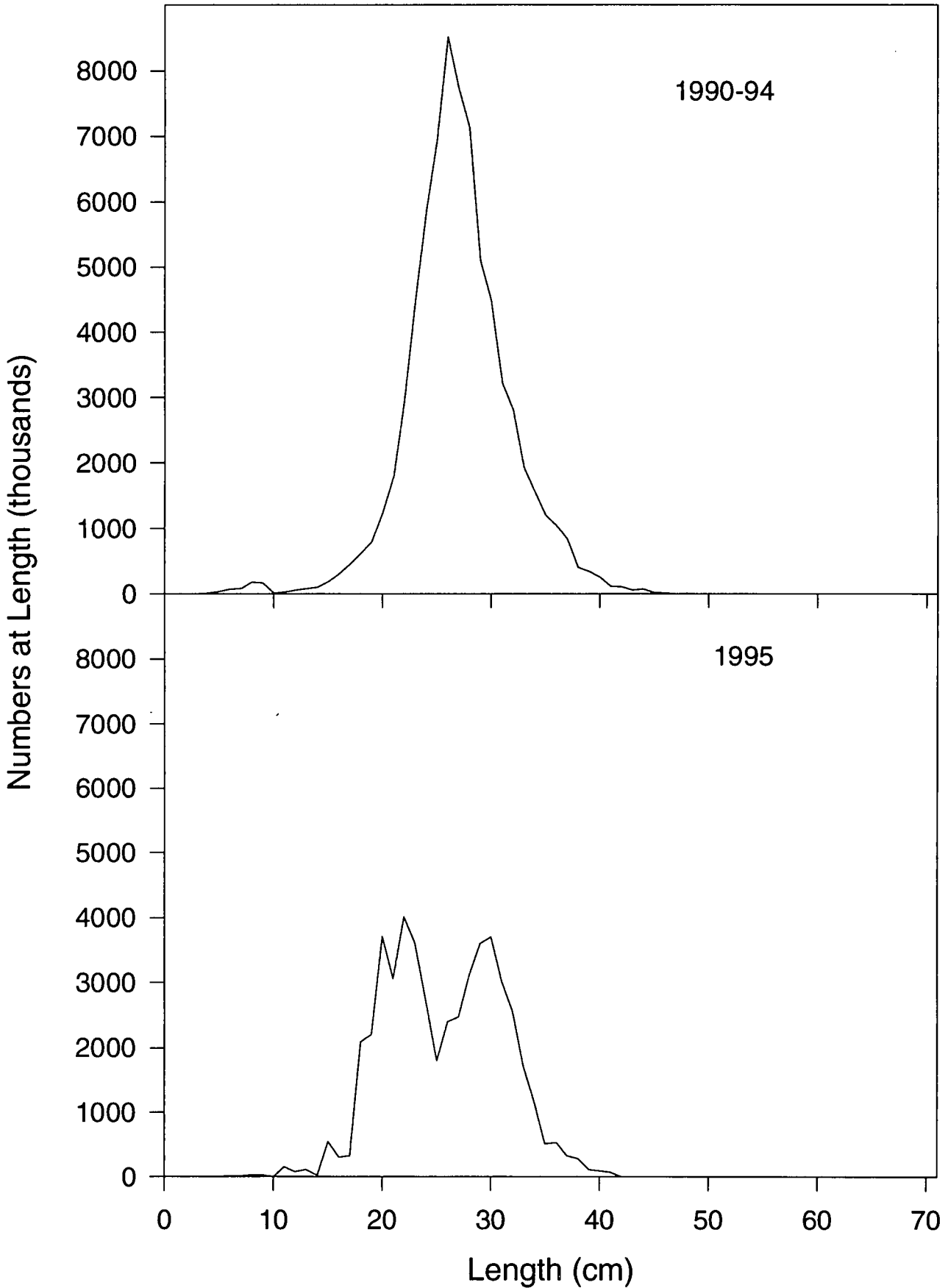


Fig. 26 4VW Yellowtail. Length frequency distribution from the summer 1995 survey (bottom panel), compared with average from surveys conducted from 1990 - 1994.

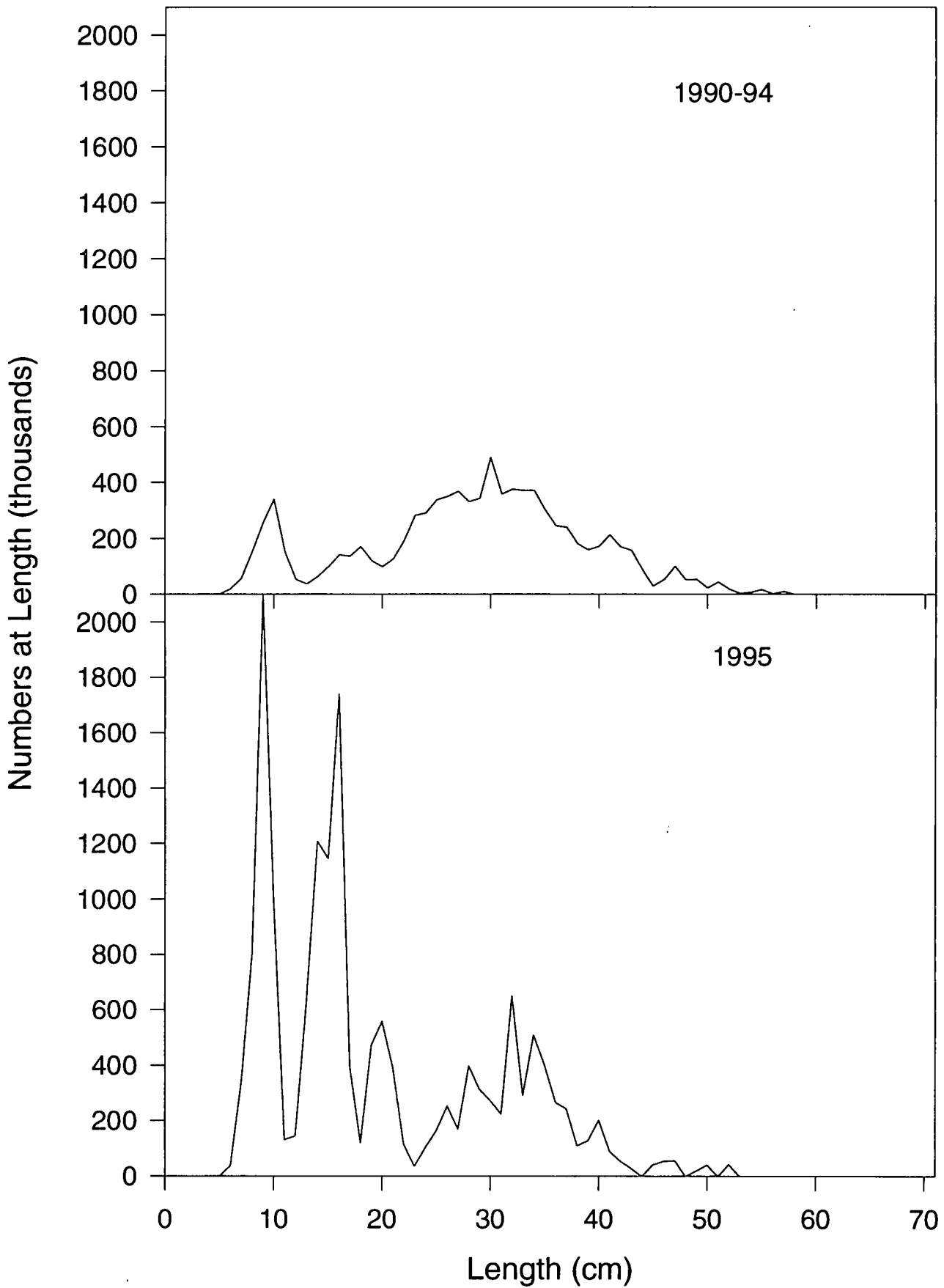


Fig. 27 4VW Witch Flounder. Length frequency distribution from the summer 1995 survey (bottom panel), compared with average from surveys conducted from 1990 - 1994.

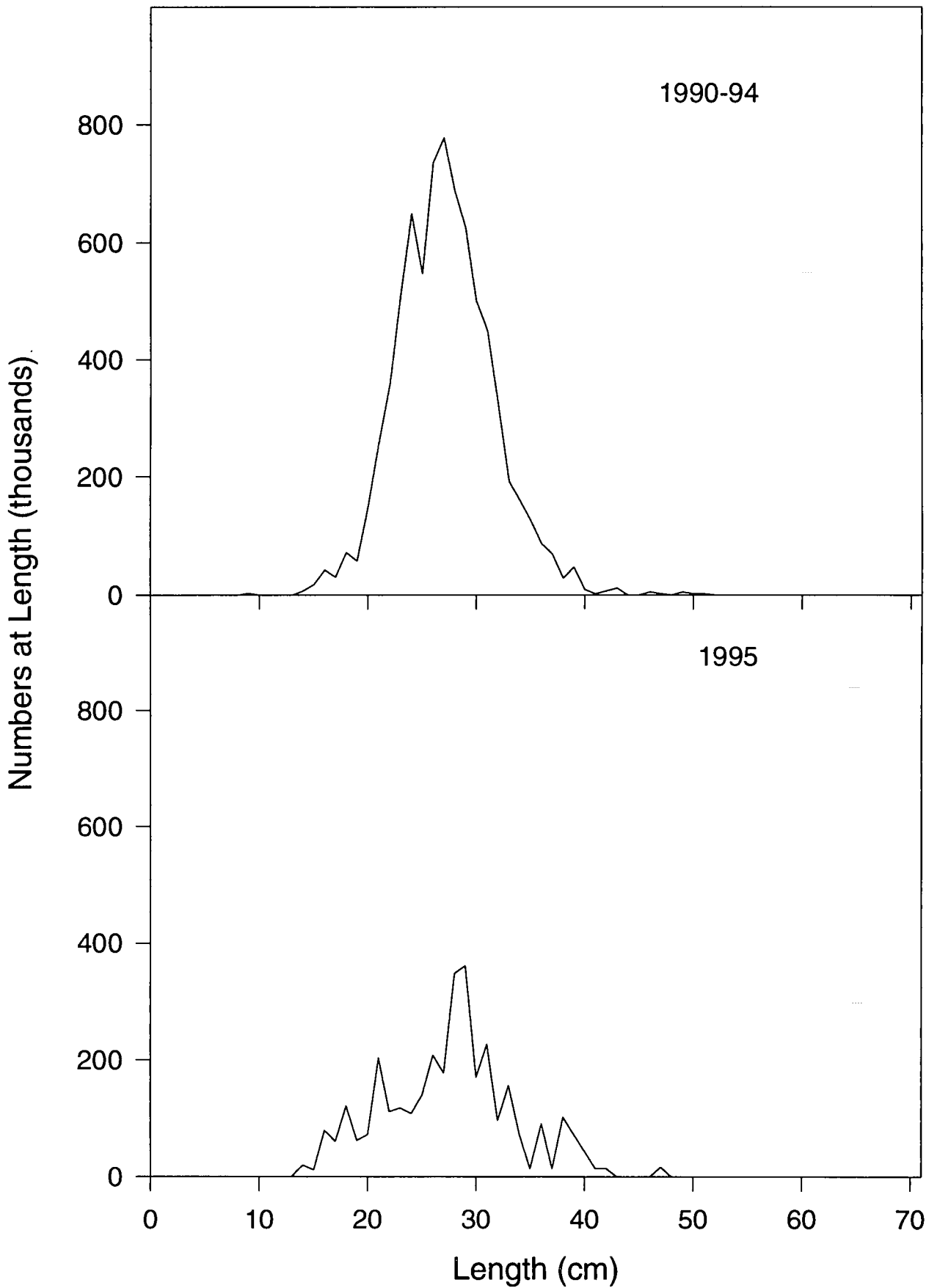
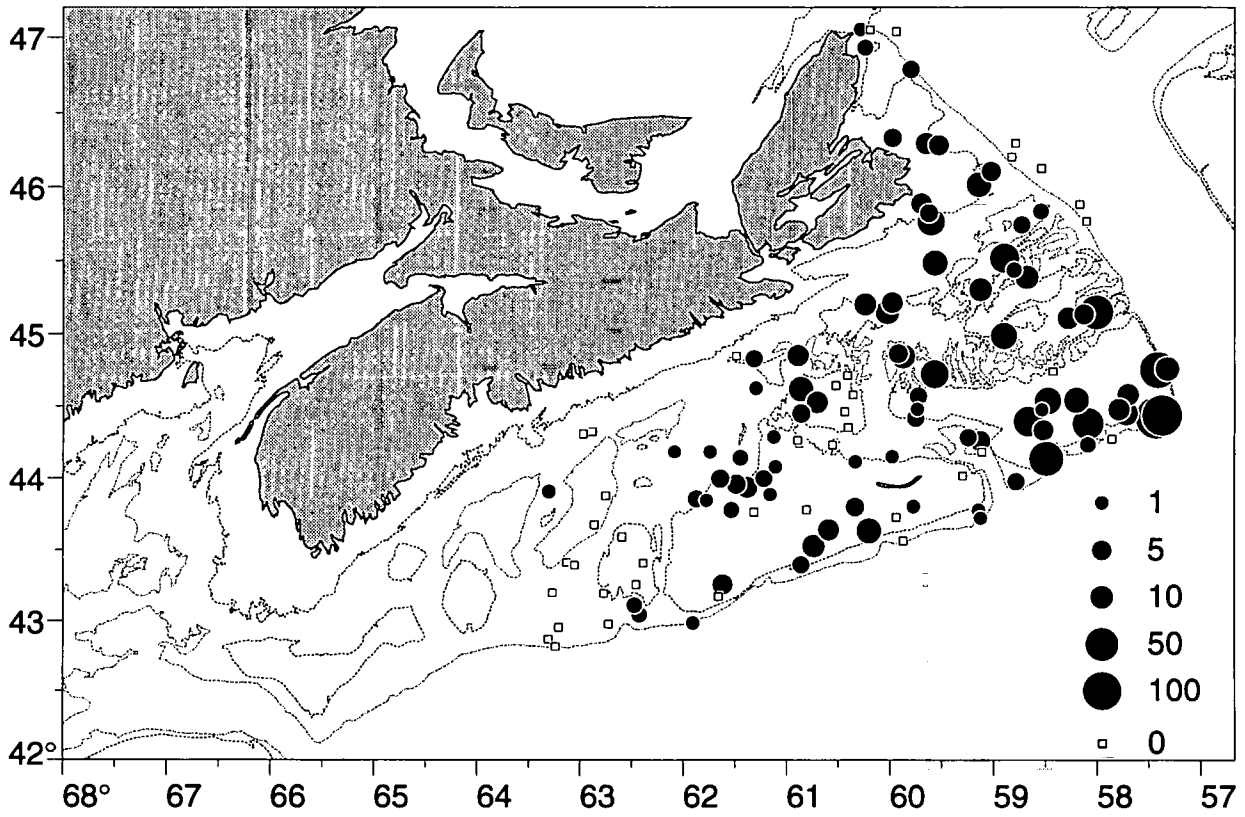


Fig. 28 4VW Winter Flounder. Length frequency distribution from the summer 1995 survey (bottom pane compared with average from surveys conducted from 1990 - 1994).



Summer Groundfish Survey 4VW Plaiice Biomass (kg/tow) July 1992

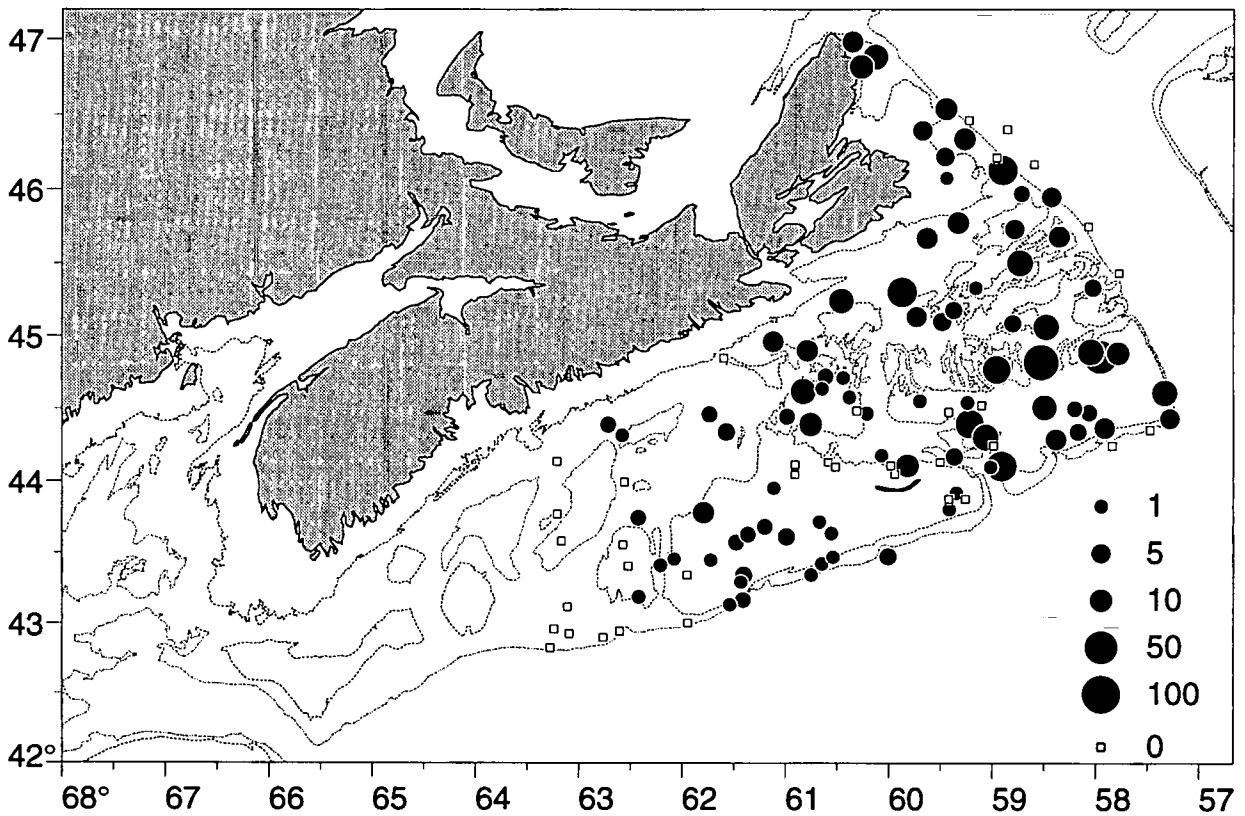
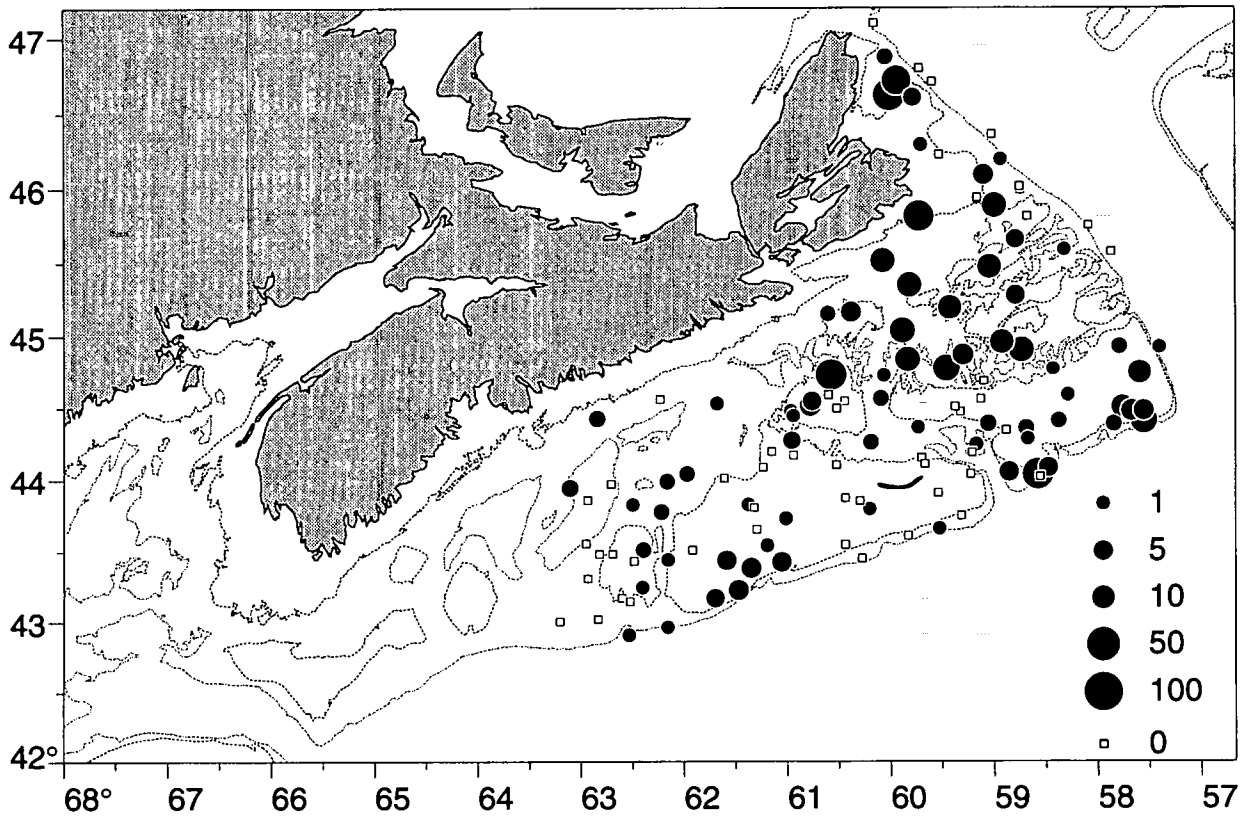
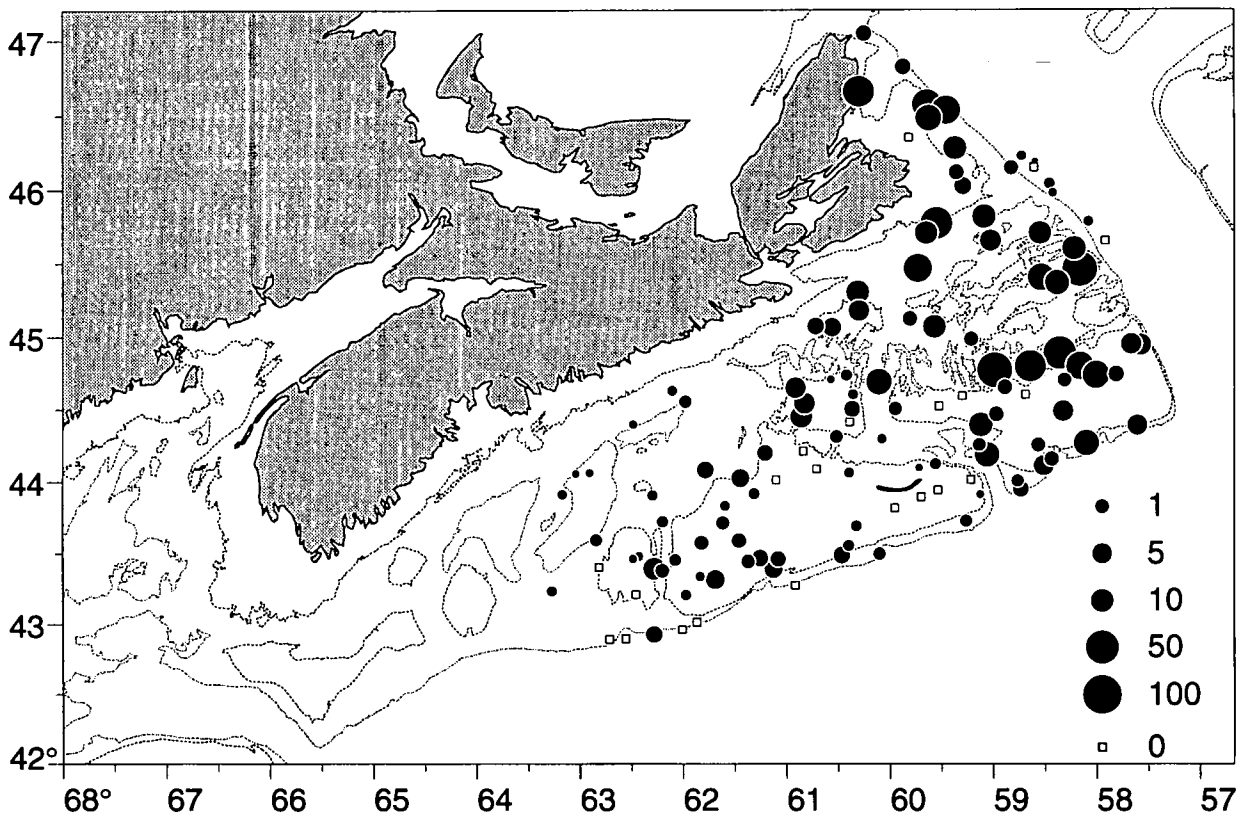


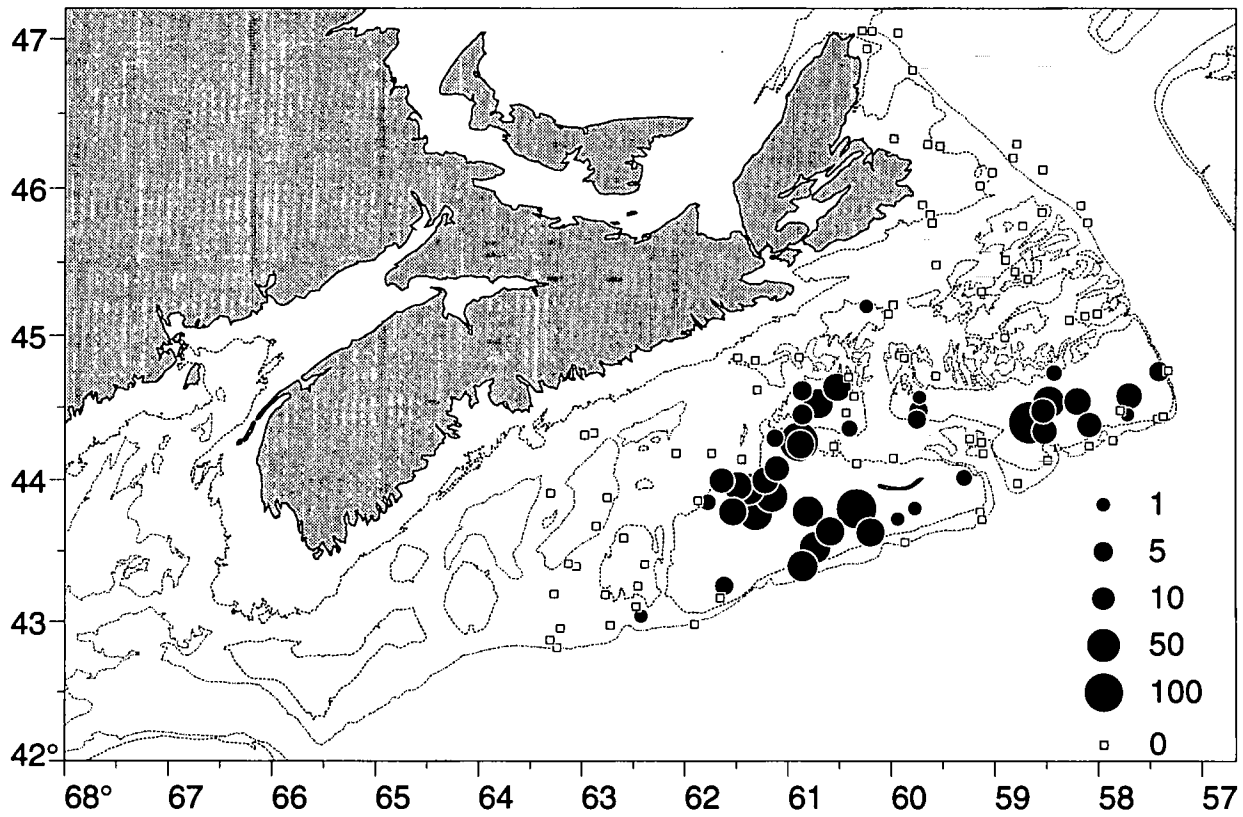
Fig. 29. Summer Groundfish Survey 4VW Plaiice Biomass (kg/tow) July 1993



Summer Groundfish Survey 4VW Plaiice Biomass (kg/tow) July 1994



Summer Groundfish Survey 4VW Plaiice Biomass (kg/tow) July 1995



Summer Groundfish Survey 4VW Yellowtail Biomass (kg/tow) July 1992

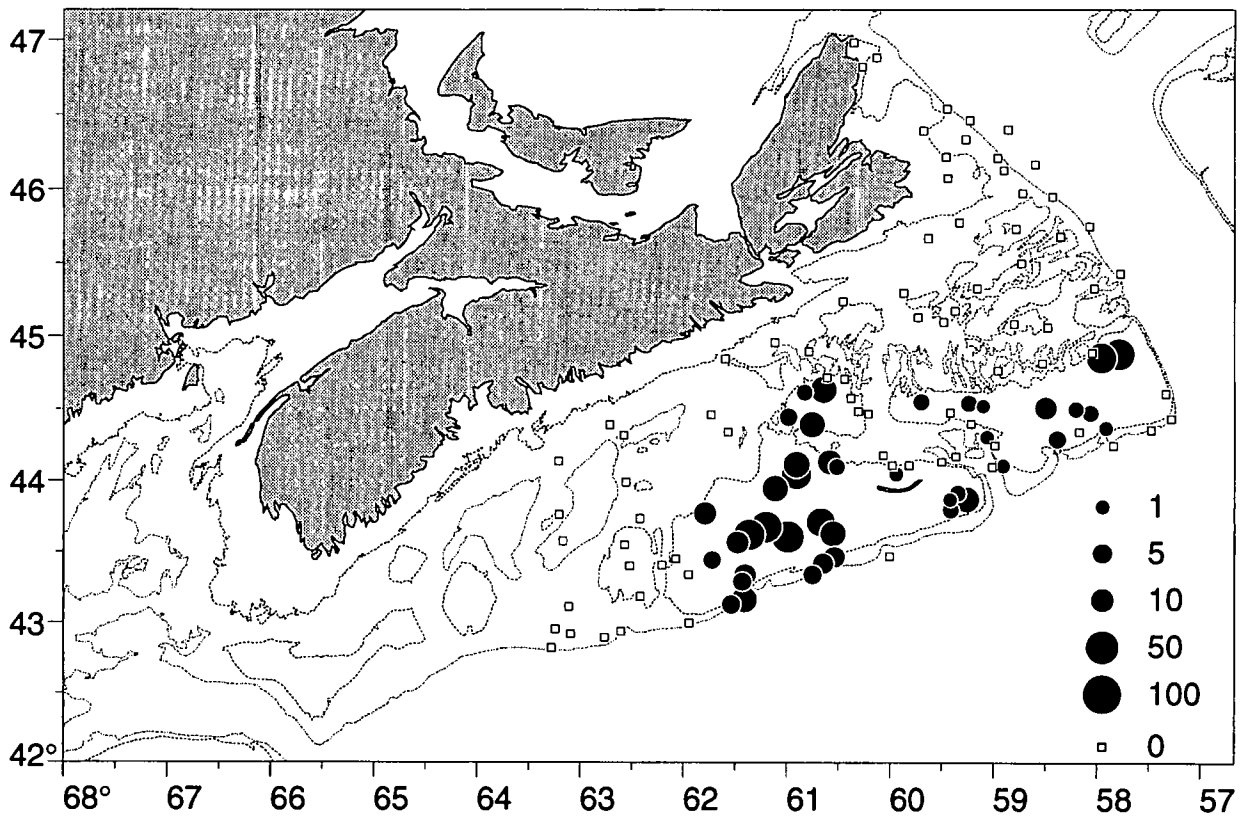
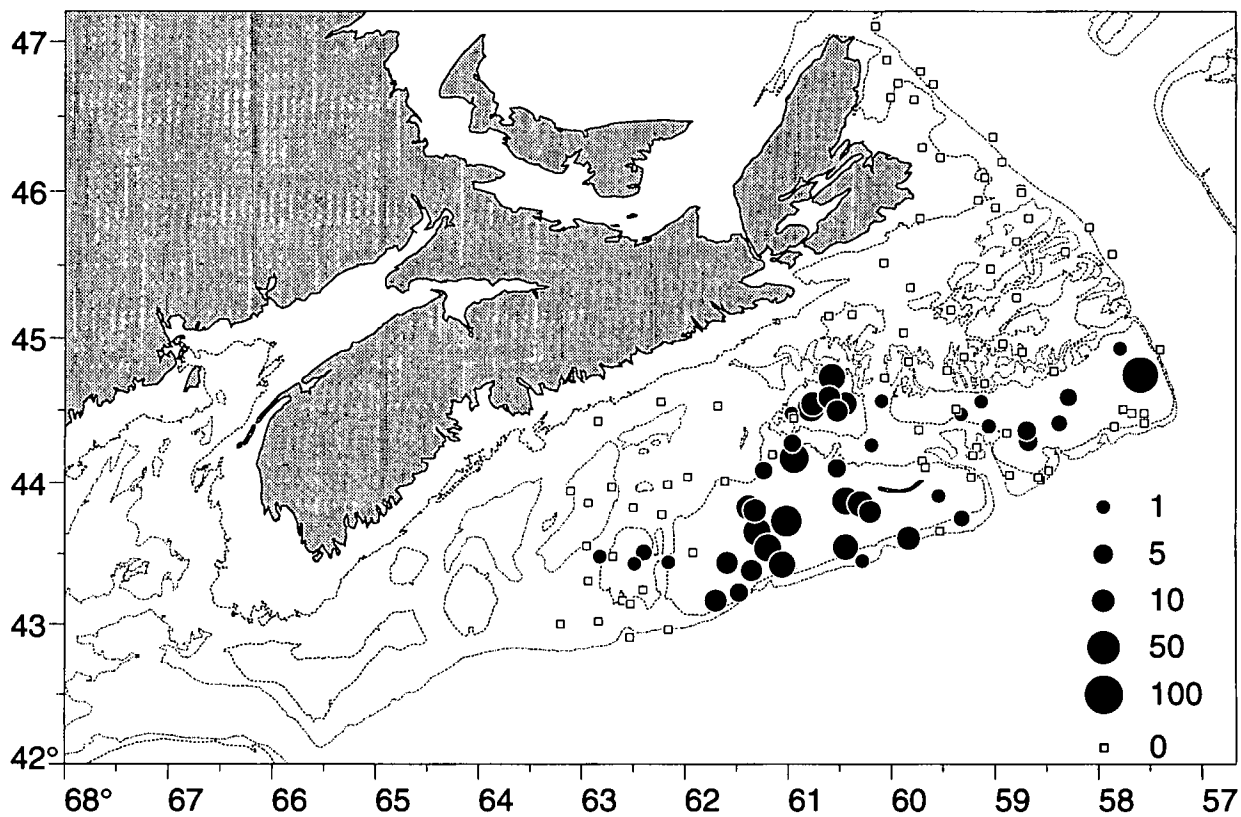
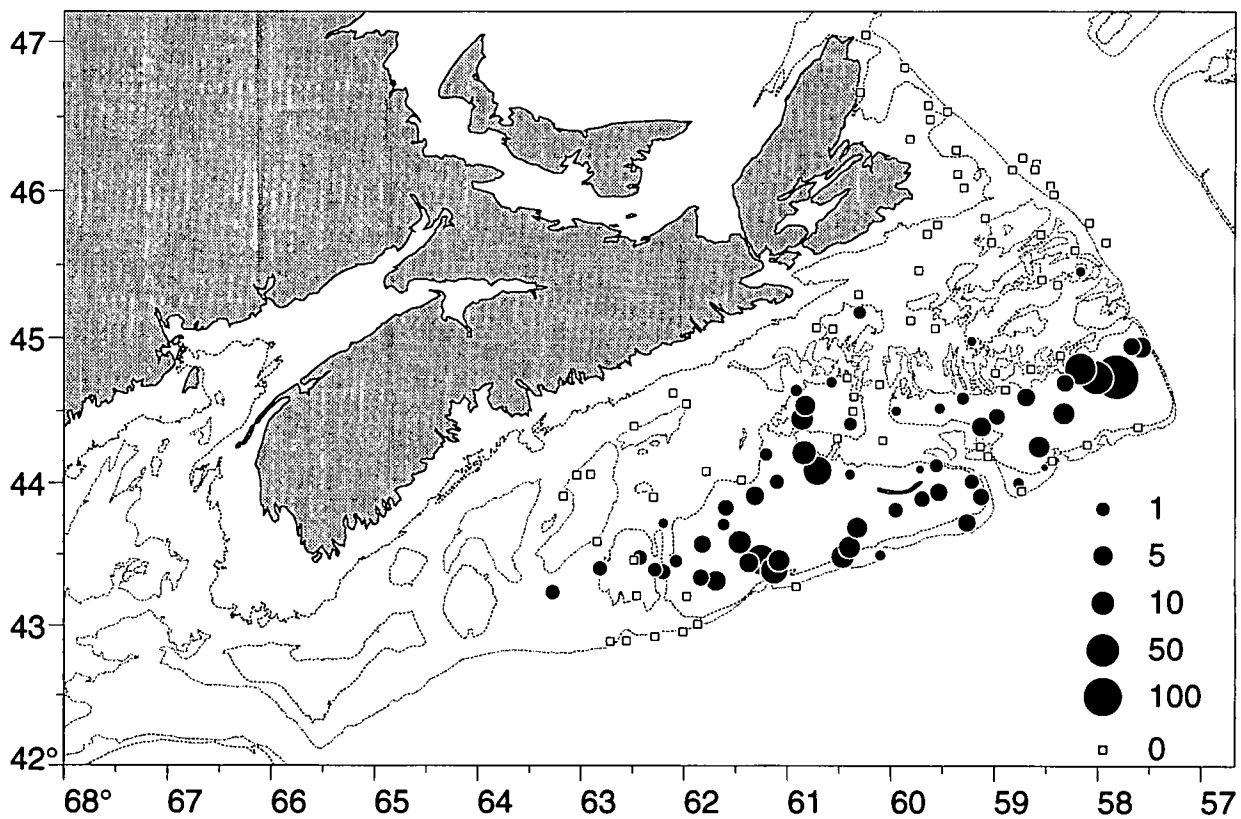


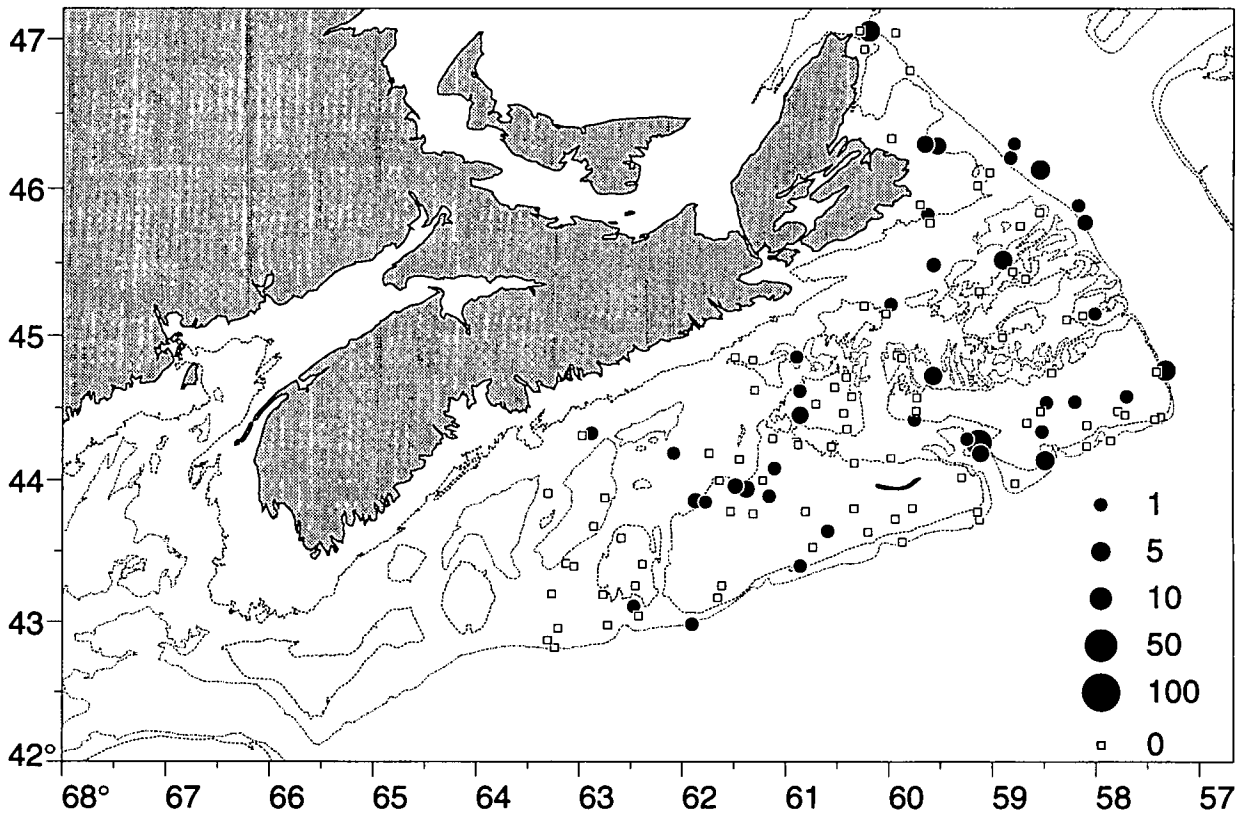
Fig. 30. Summer Groundfish Survey 4VW Yellowtail Biomass (kg/tow) July 1993



Summer Groundfish Survey 4VW Yellowtail Biomass (kg/tow) July 1994



Summer Groundfish Survey 4VW Yellowtail Biomass (kg/tow) July 1995



Summer Groundfish Survey 4VW Witch Biomass (kg/tow) July 1992

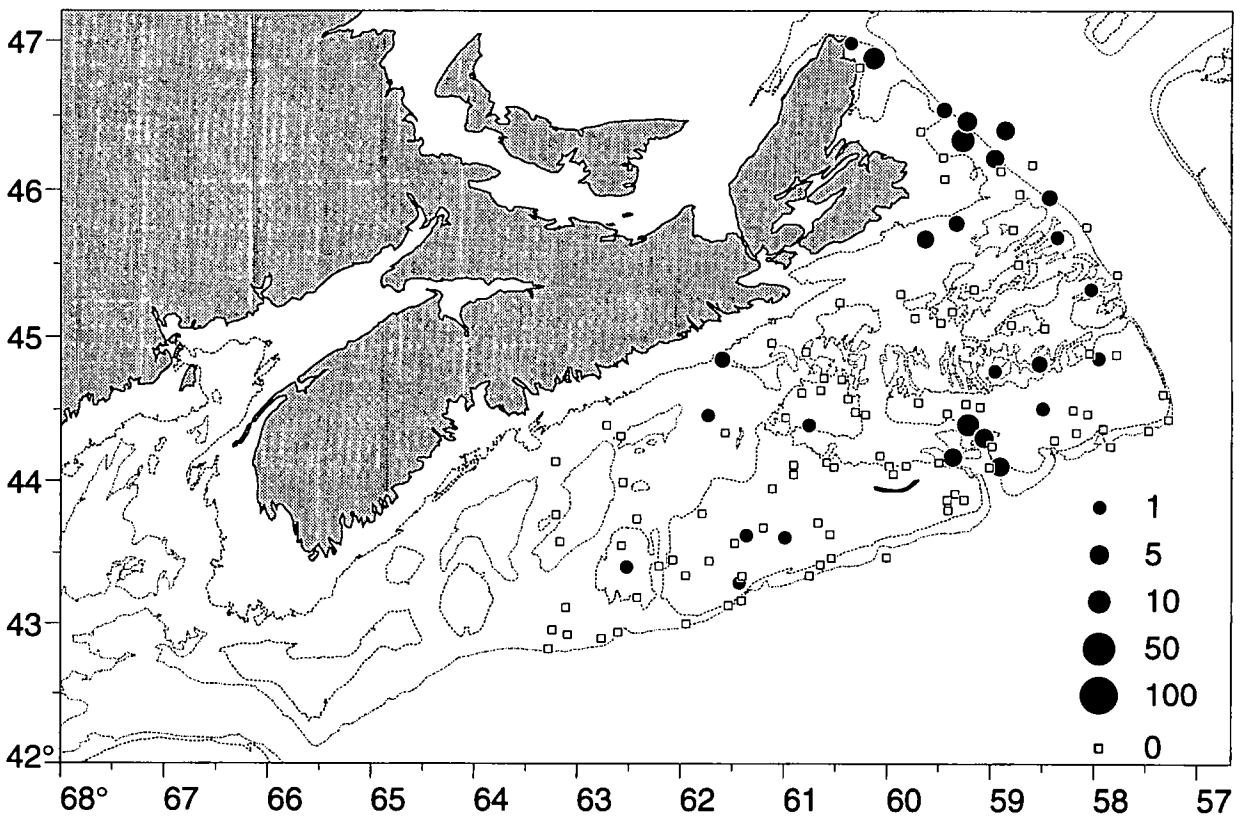
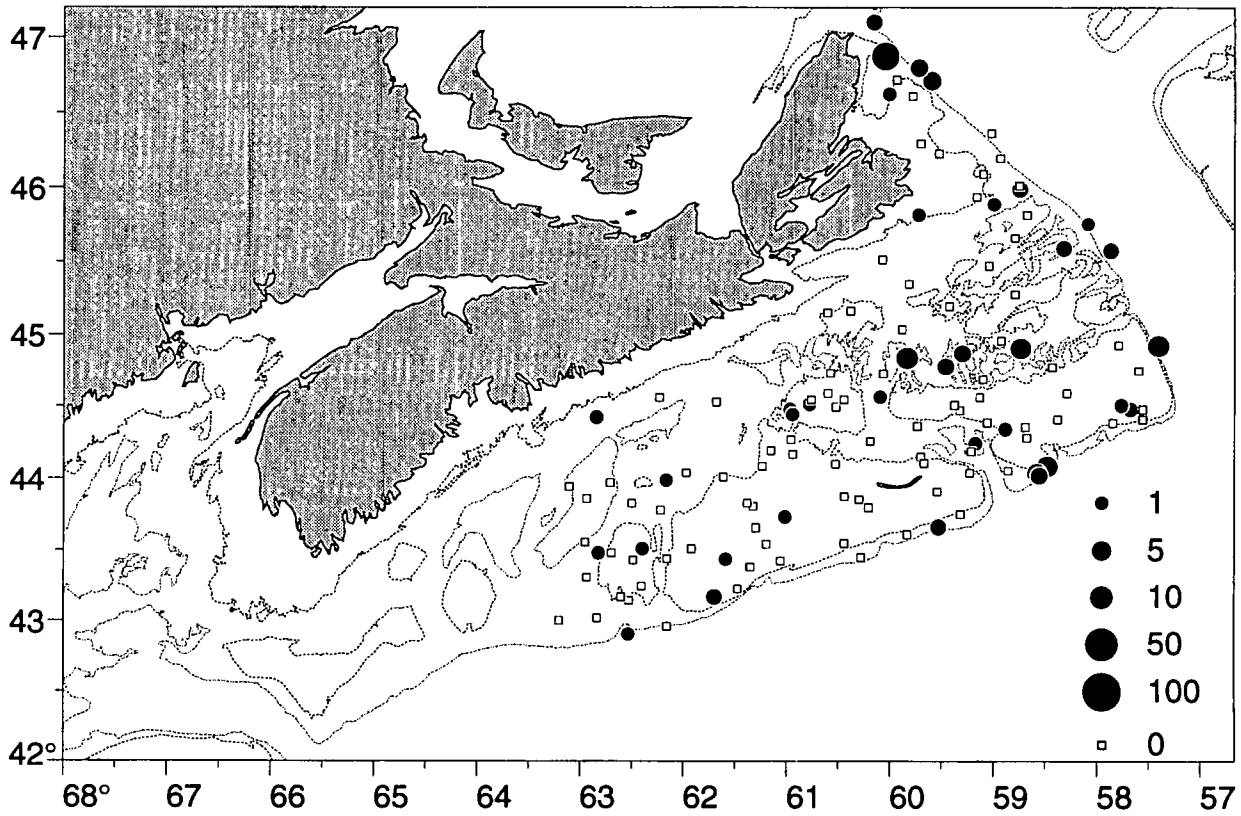
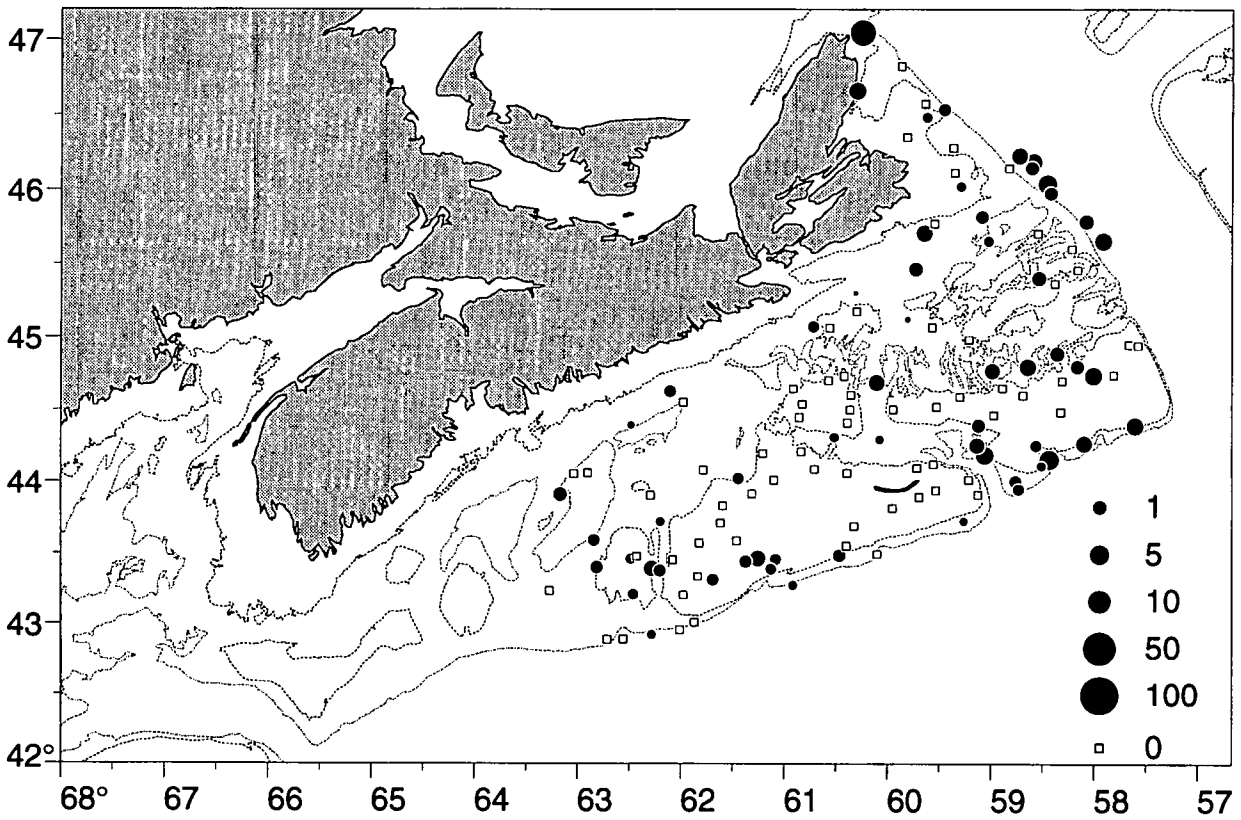


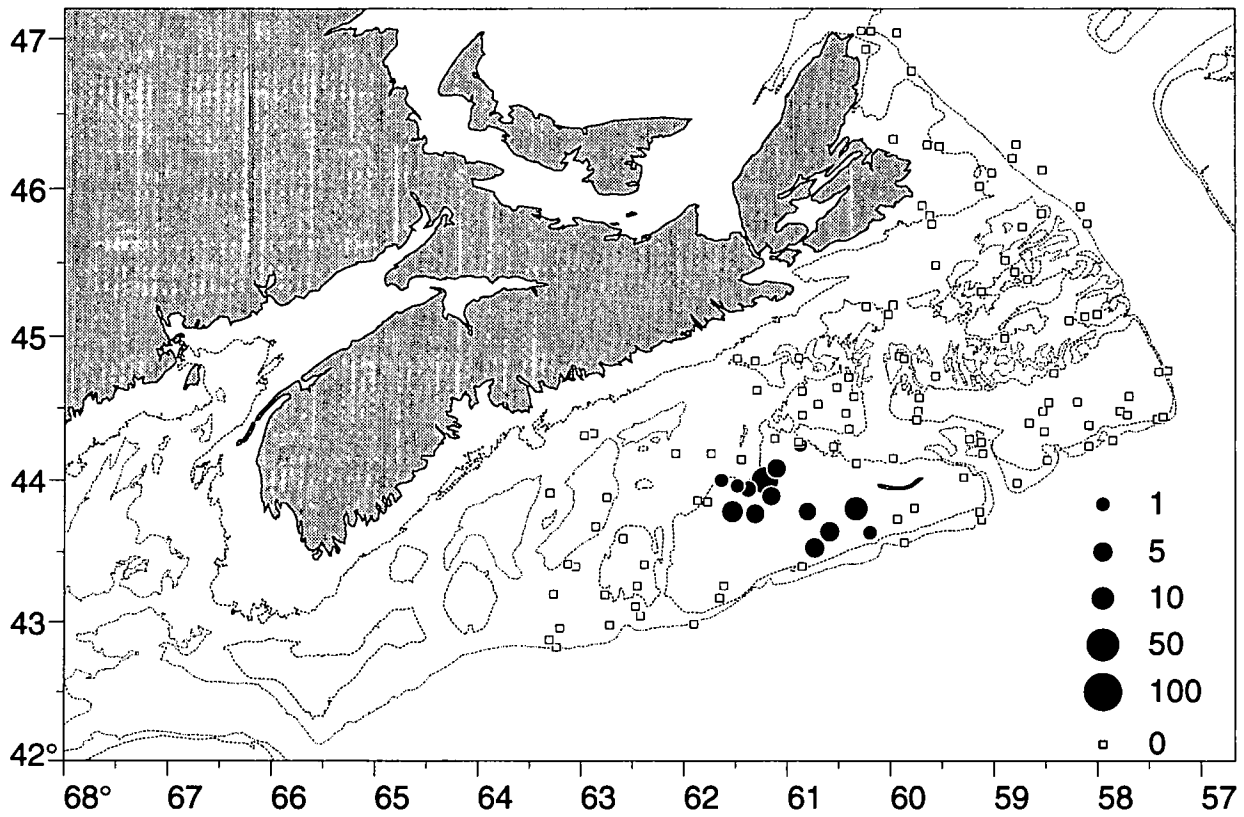
Fig. 31. Summer Groundfish Survey 4VW Witch Biomass (kg/tow) July 1993



Summer Groundfish Survey 4VW Witch Biomass (kg/tow) July 1994



Summer Groundfish Survey 4VW Witch Biomass (kg/tow) July 1995



Summer Groundfish Survey 4VW Winter Biomass (kg/tow) July 1992

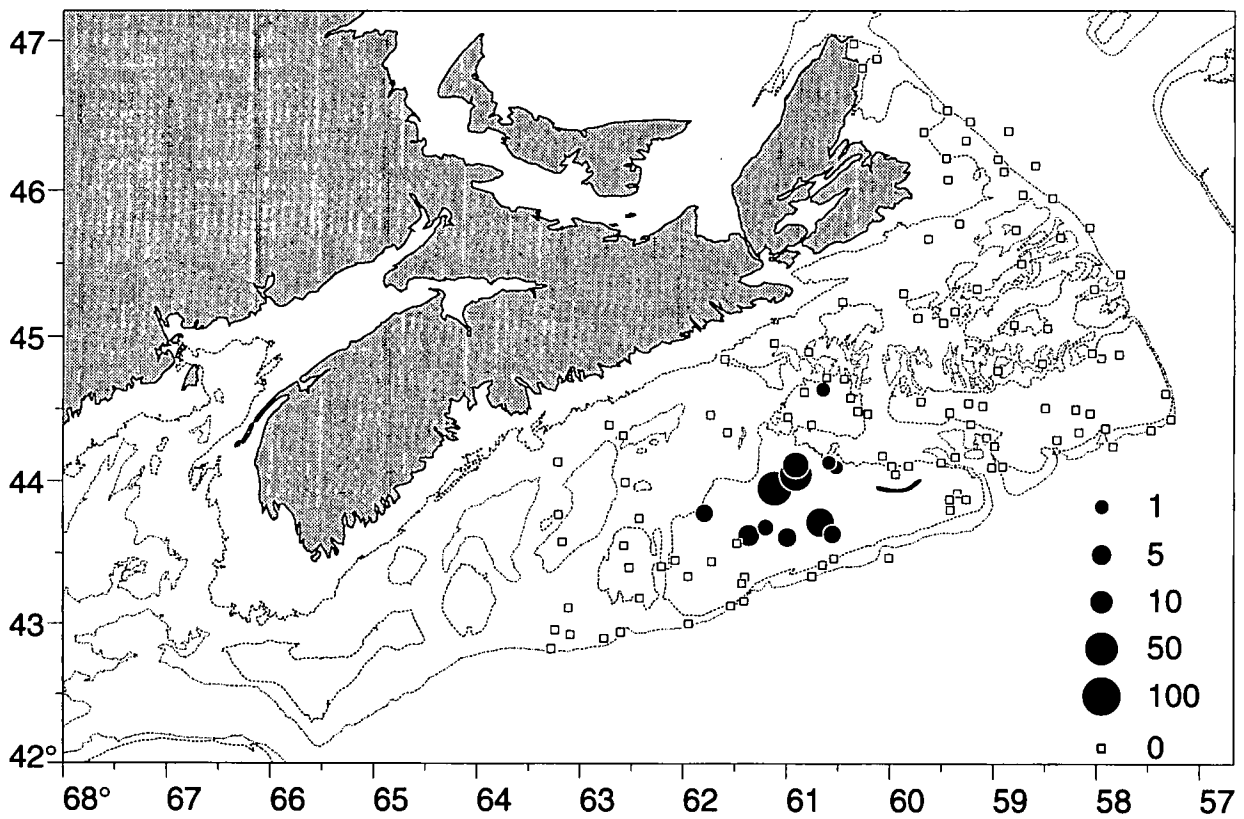
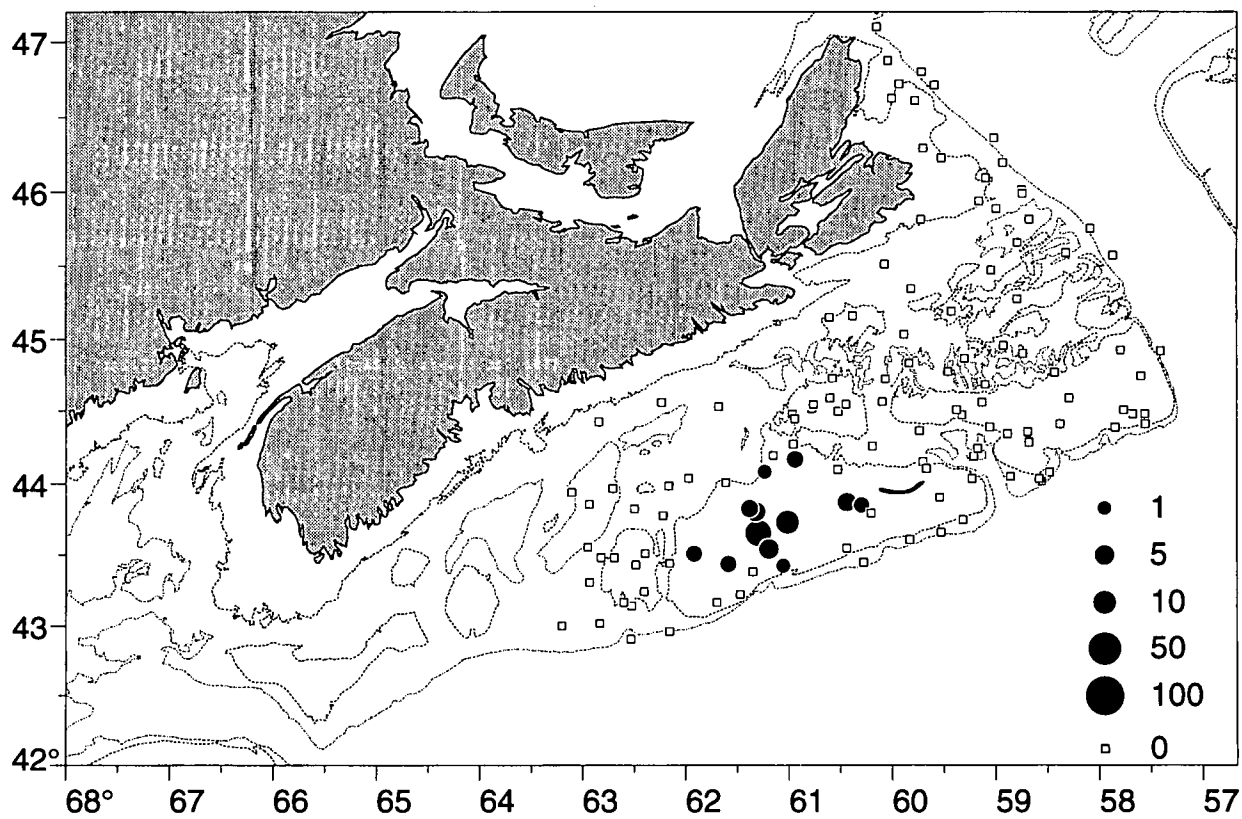
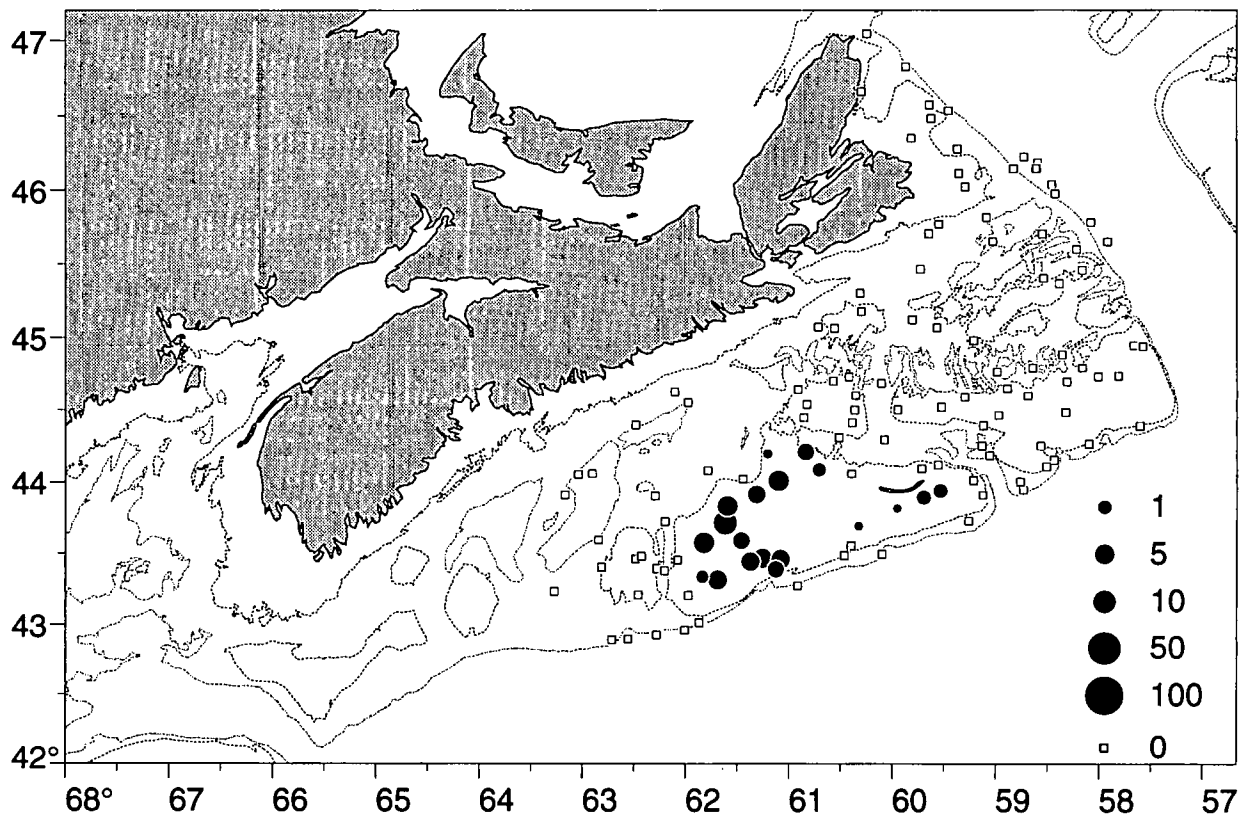


Fig. 32. Summer Groundfish Survey 4VW Winter Biomass (kg/tow) July 1993



Summer Groundfish Survey 4VW Winter Biomass (kg/tow) July 1994



Summer Groundfish Survey 4VW Winter Biomass (kg/tow) July 1995

4X Flatfish (C. Annand, BIO)

1. Abundance

Winter flounder: Mean numbers increased from 5.4 fish per tow in 1994 to 6.4 fish per tow in 1995 (Fig. 33). Mean numbers have been relatively stable since 1992 and above the longterm (1970-1994) average. It should be noted that the survey does not cover the inshore portion of 4X which is thought to contain a large portion of the winter flounder abundance.

Witch flounder: Mean numbers declined from 2.1 fish per tow in 1994 to 1.6 fish per tow in 1995 (Fig. 34). Numbers per tow have been relatively stable in recent years but below the longterm (1970-1994) average.

American plaice: Mean numbers declined from a high of 14.4 fish per tow in 1994 to 10.1 fish per tow in 1995 (Fig. 35). Numbers per tow are currently above the longterm (1970-1994) average.

Yellowtail flounder: Mean numbers declined from a series high of 4.7 fish per tow in 1994 to 2.0 fish per tow in 1995 (Fig. 36). Numbers per tow are currently above the longterm (1970-1994) average.

2. Recruitment and Size Composition

Winter flounder: Survey length distributions in 1995 did not indicate any significant changes compared to the recent (1990-1994) average size composition (Fig. 37).

Witch flounder: Survey length distributions in 1995 did not indicate any significant changes compared to the recent (1990-1994) average size composition (Fig. 38). However more witch flounder (< 30) cm were caught in the 1995 survey, which may be an indication of good incoming recruitment.

American plaice: Survey length distributions in 1995 did not indicate any significant changes compared to the recent (1990-1994) average size composition (Fig. 39).

Yellowtail flounder: Survey length distributions in 1995 did not indicate any significant changes compared to the recent (1990-1994) average size composition (Fig. 40).

3. Distribution

Winter flounder: As in 1994, the 1995 survey distribution of winter flounder appears to be restricted to Browns Bank and the Bay of Fundy (Fig. 41). Catch rates on Browns Bank were higher than in the 1994 survey.

Witch flounder: As in 1994, the 1995 survey catch rates indicate that witch flounder are widely distributed in 4X but at low concentrations (Fig. 42). Fewer witch flounder were caught in the

Browns Bank area in the 1995 survey than in 1994.

American plaice: Survey distributions in 1995 were similar to those in 1994 with the highest catch rates observed between Roseway and Browns Bank (Fig. 43). More American plaice were caught around the mouth of the Bay of Fundy in 1995 than in the 1994 survey.

Yellowtail flounder: Survey catch rates in both 1994 and 1995 indicate that yellowtail distribution in 4X is limited to the Browns Bank area, with lower catch rates around the mouth of the Bay of Fundy (Fig. 44).

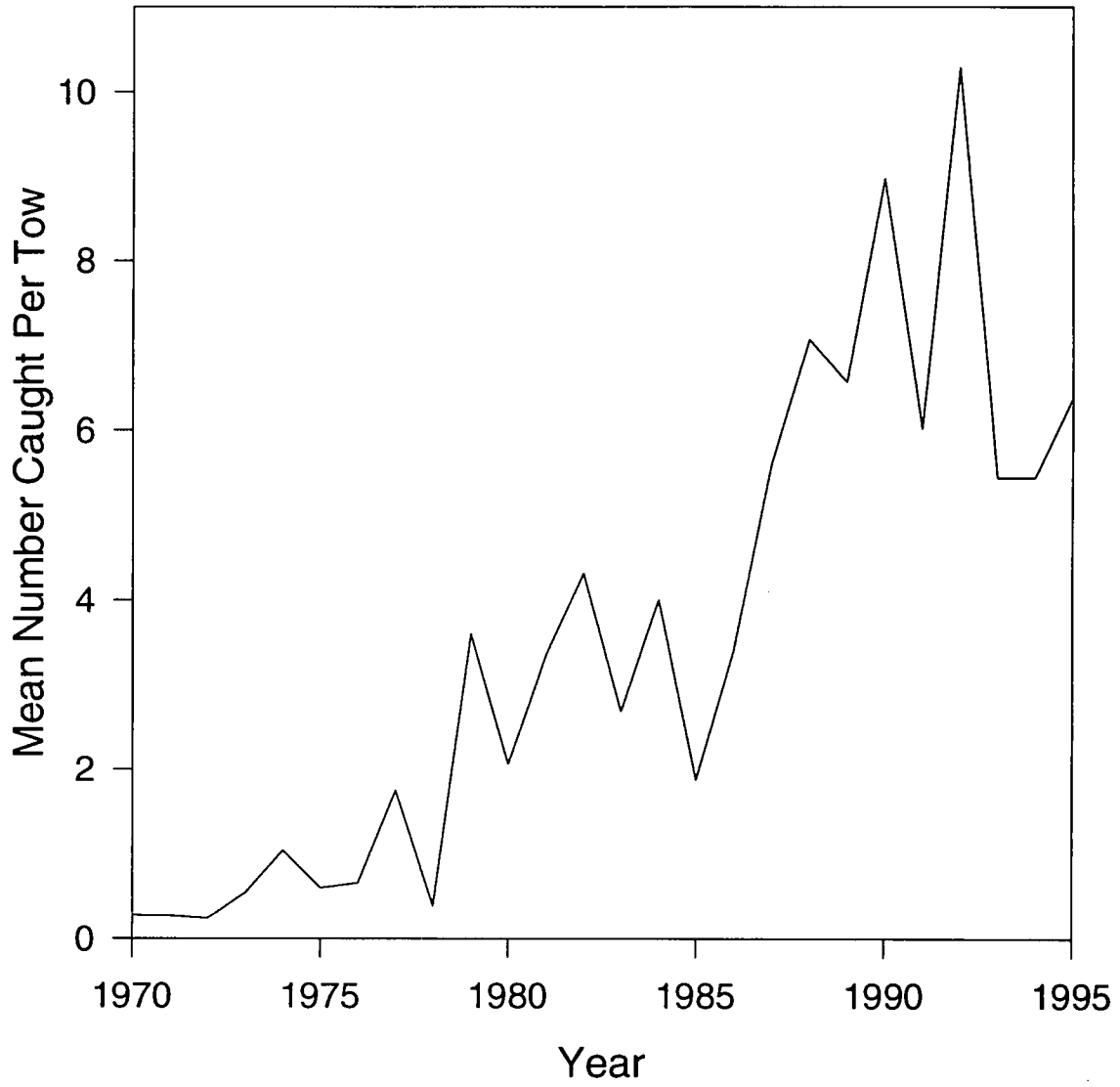


Fig. ³³ 4X Winter Flounder. Stratified Mean number per tow from summer surveys, 1970-1995.

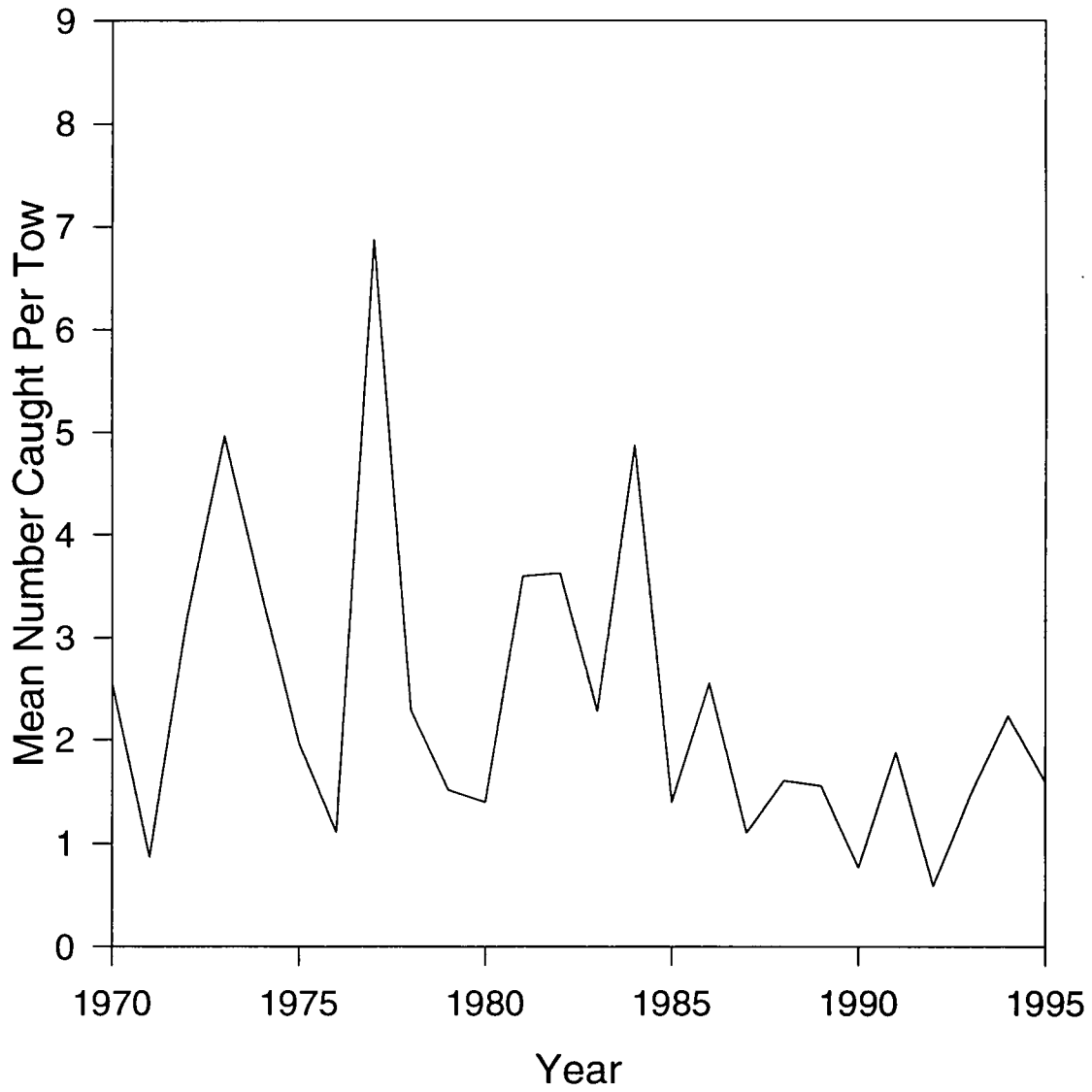
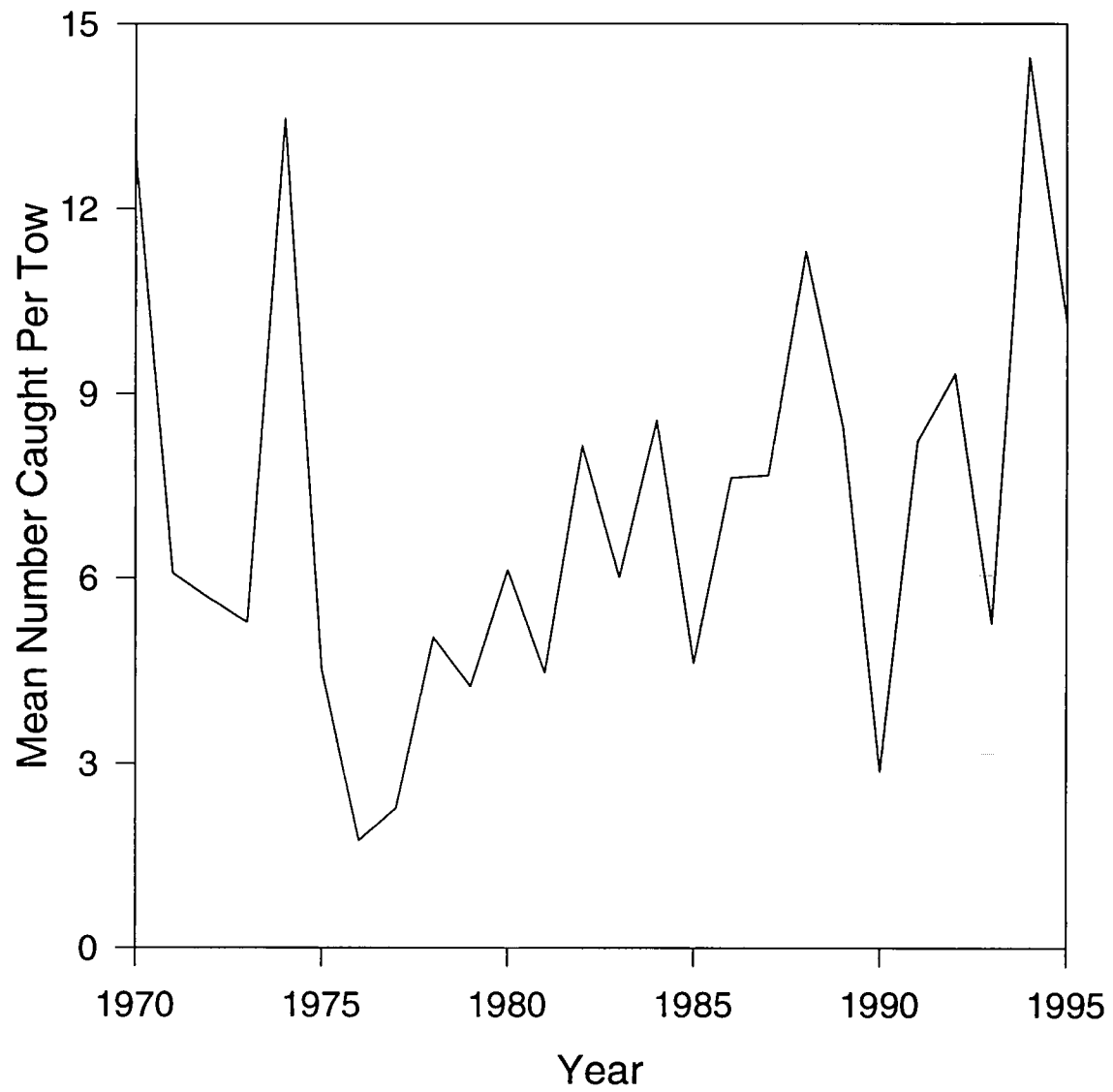


Fig.³⁴ 4X Witch Flounder. Stratified Mean number per tow from summer surveys, 1970-1995.



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Fig. 4X Plaice. Stratified Mean number per tow from summer surveys, 1970-1995.

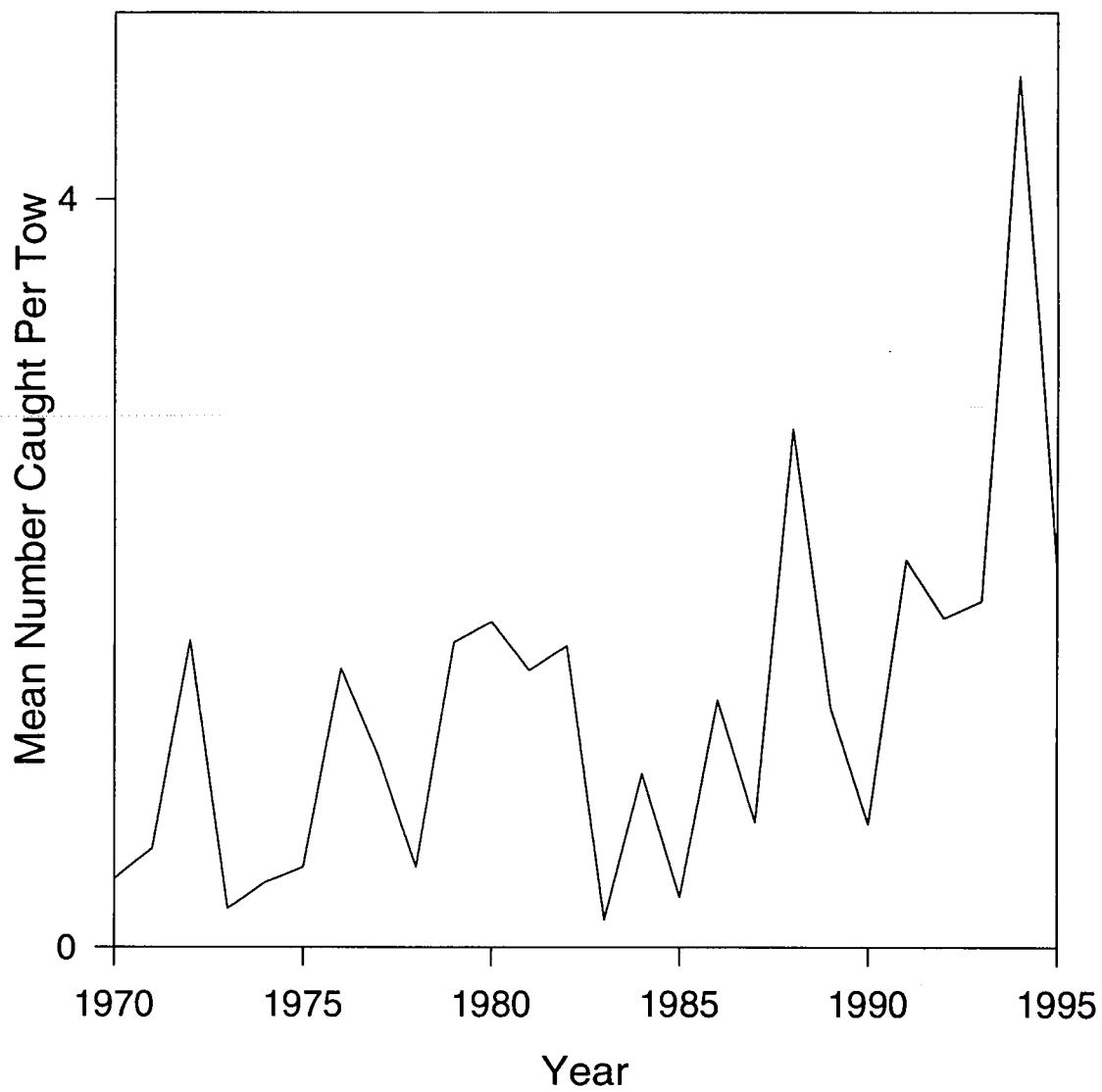


Fig. ³⁶ 4X Yellowtail. Stratified Mean number per tow from summer surveys, 1970-1995.

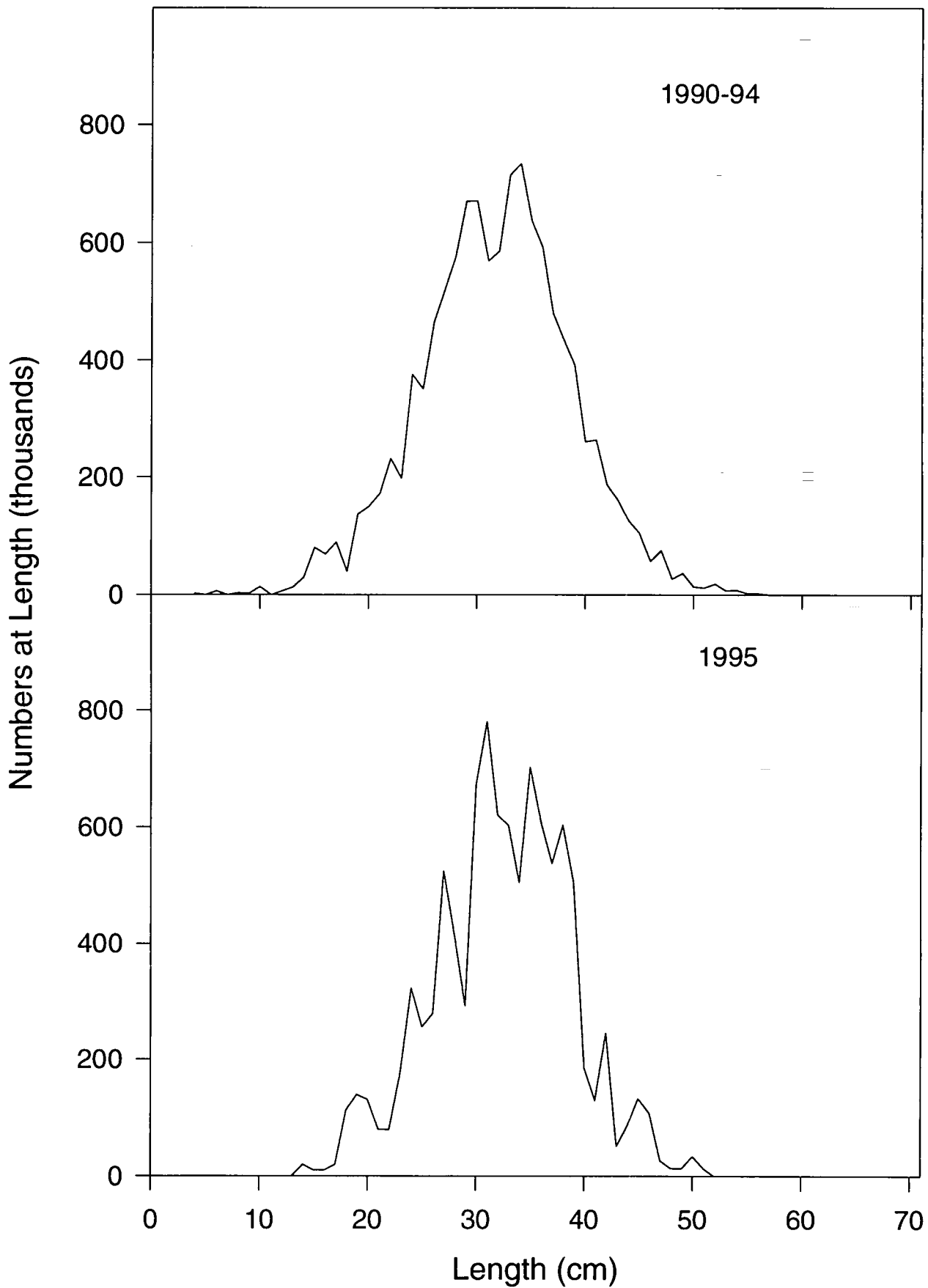


Fig. 37 4X Winter Flounder. Length frequency distribution from the summer 1995 survey (bottom panel), compared with average from surveys conducted from 1990 - 1994.

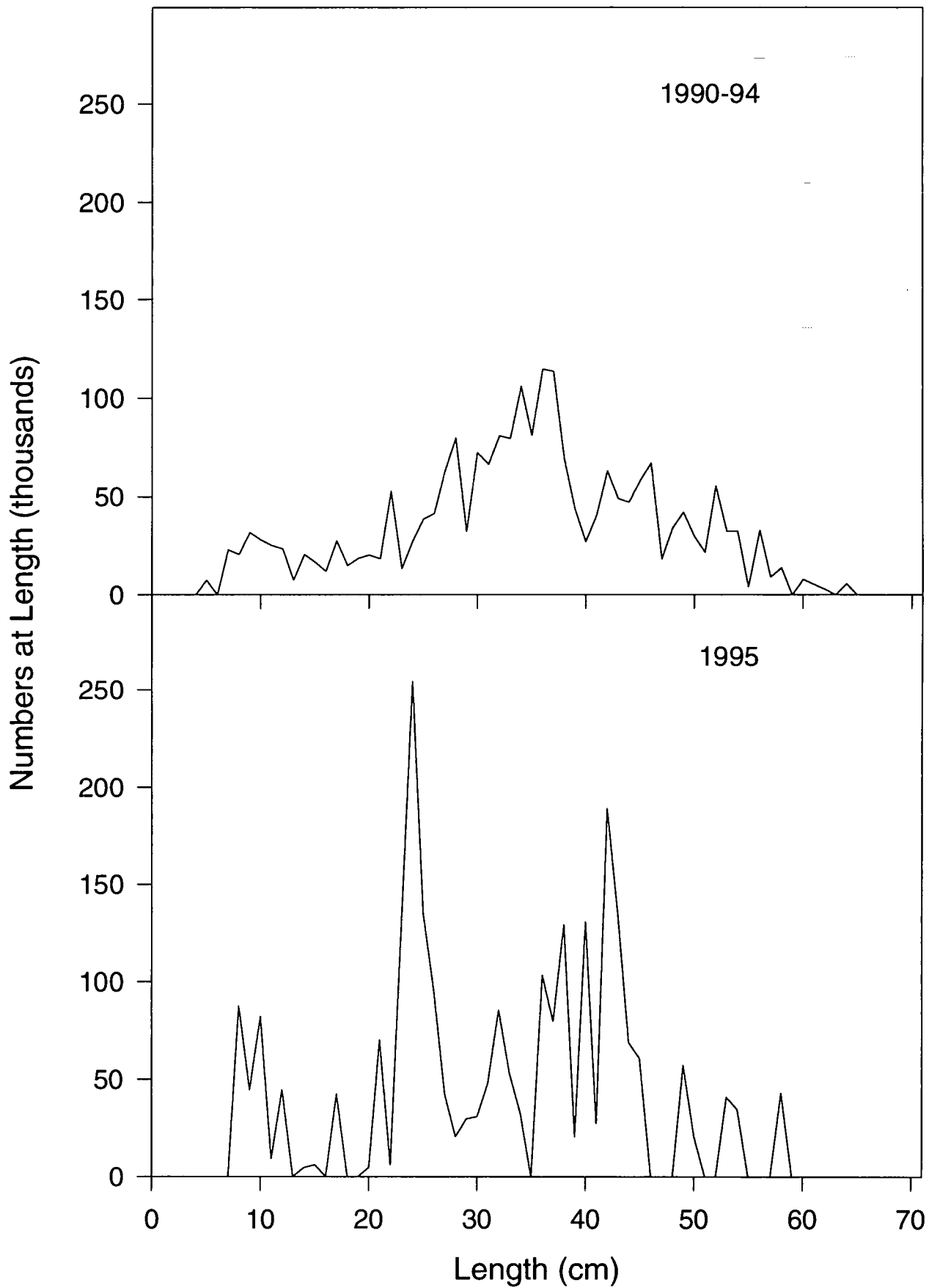


Fig. 38 4X Witch Flounder. Length frequency distribution from the summer 1995 survey (bottom panel), compared with average from surveys conducted from 1990 - 1994.

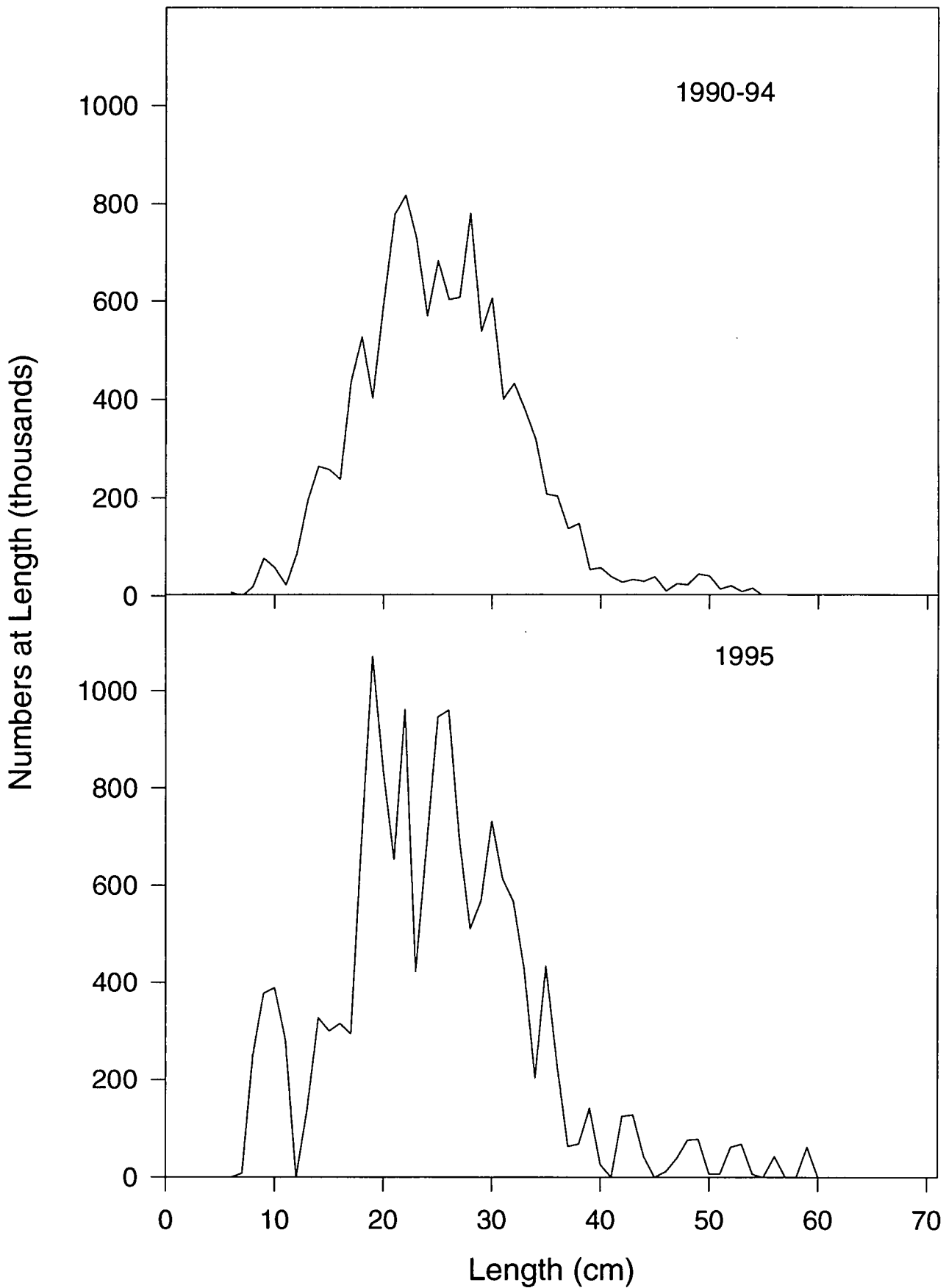


Fig. 39 4X Plaice. Length frequency distribution from the summer 1995 survey (bottom panel), compared with average from surveys conducted from 1990 - 1994.

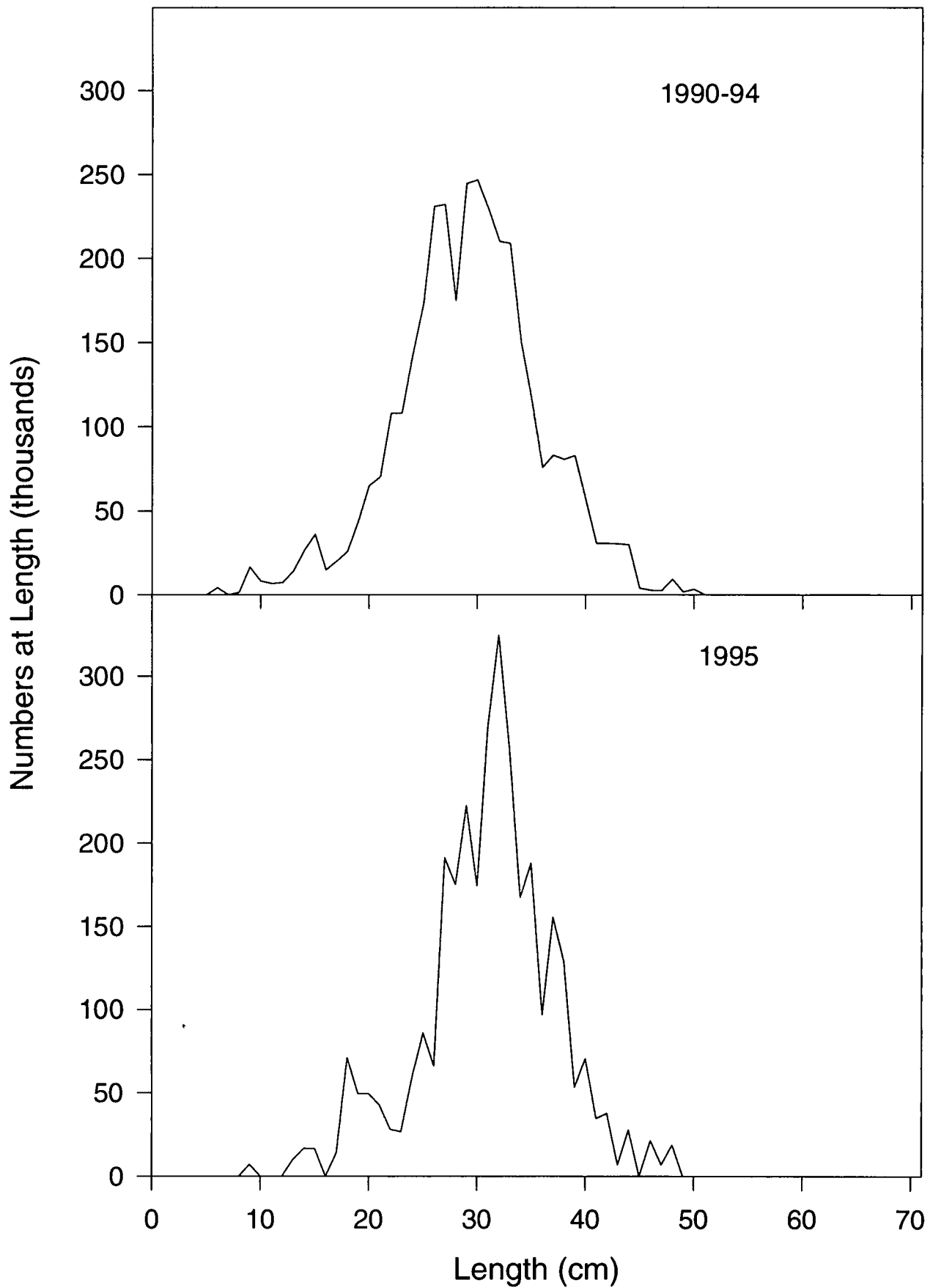
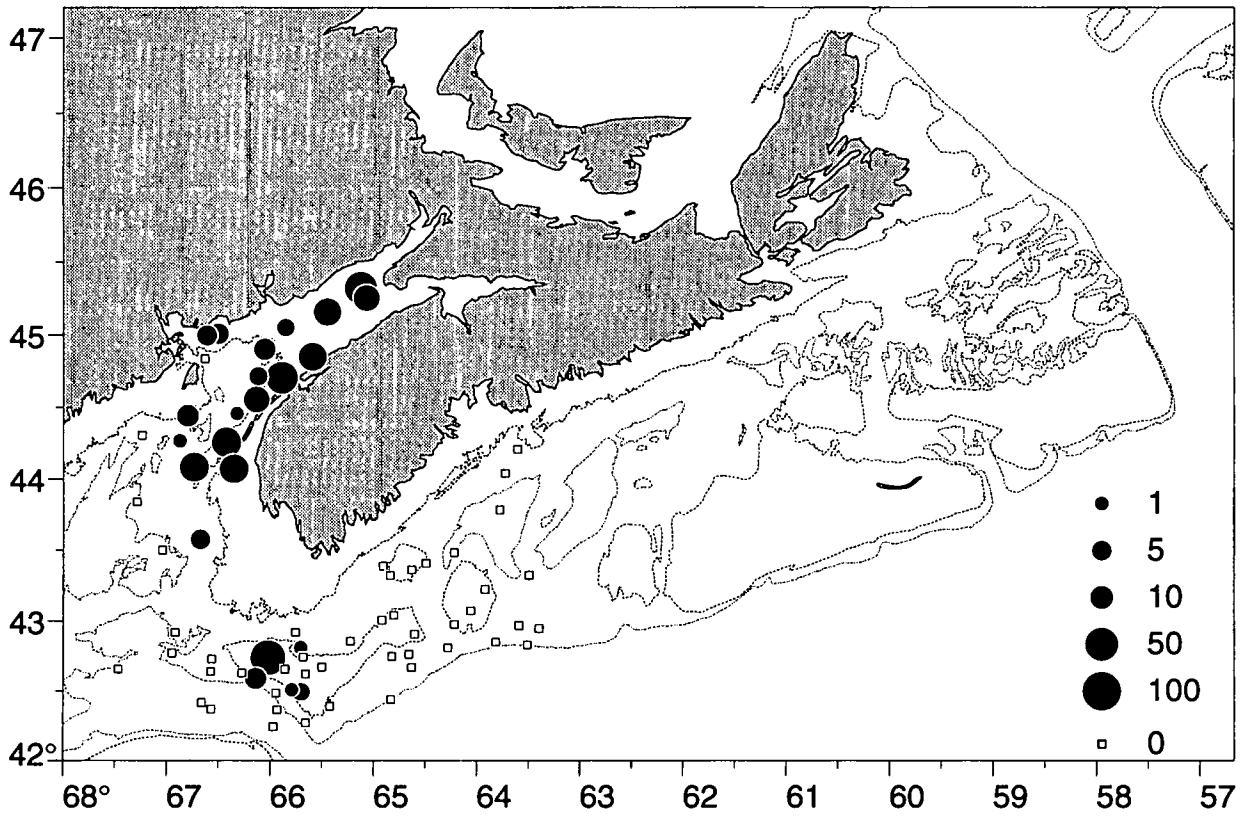


Fig. ⁴⁰ 4X Yellowtail. Length frequency distribution from the summer 1995 survey (bottom panel), compared with average from surveys conducted from 1990 - 1994.



Summer Groundfish Survey 4X Winter Biomass (kg/tow) July 1992

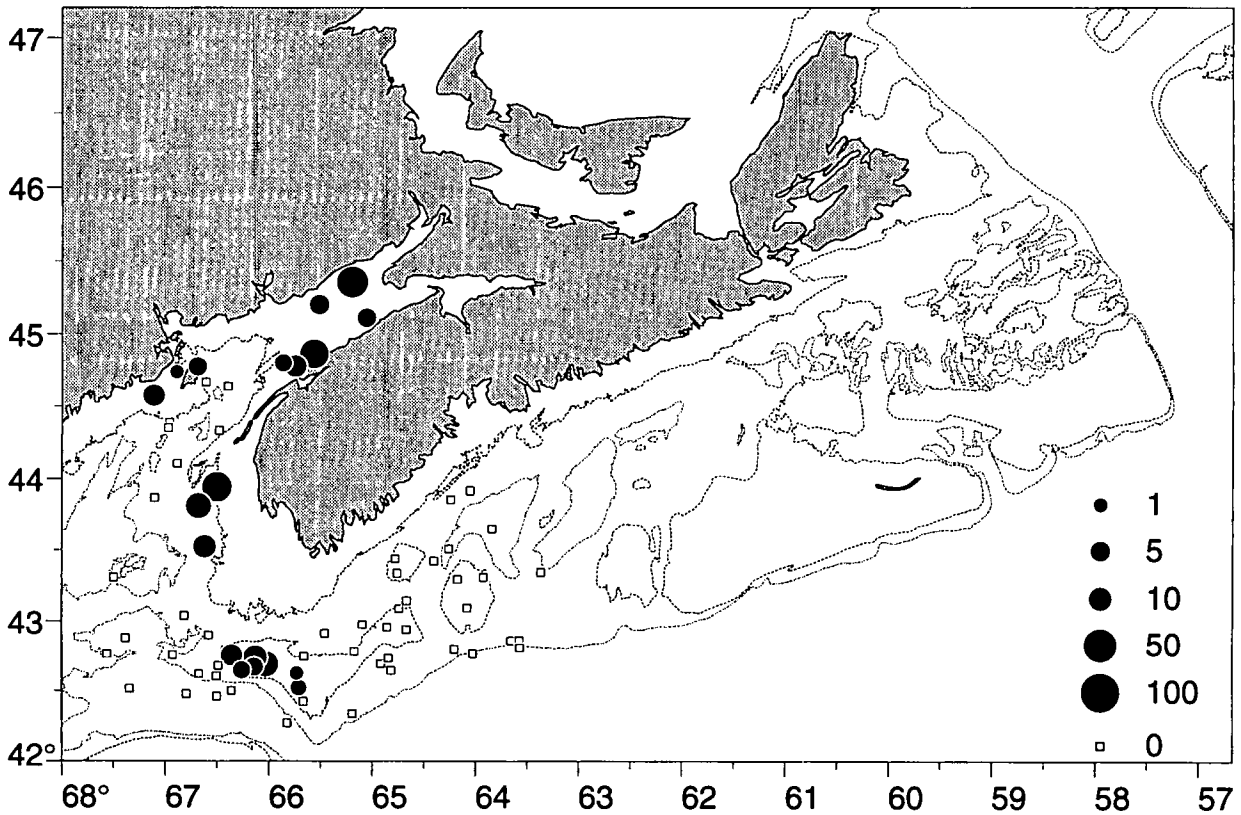
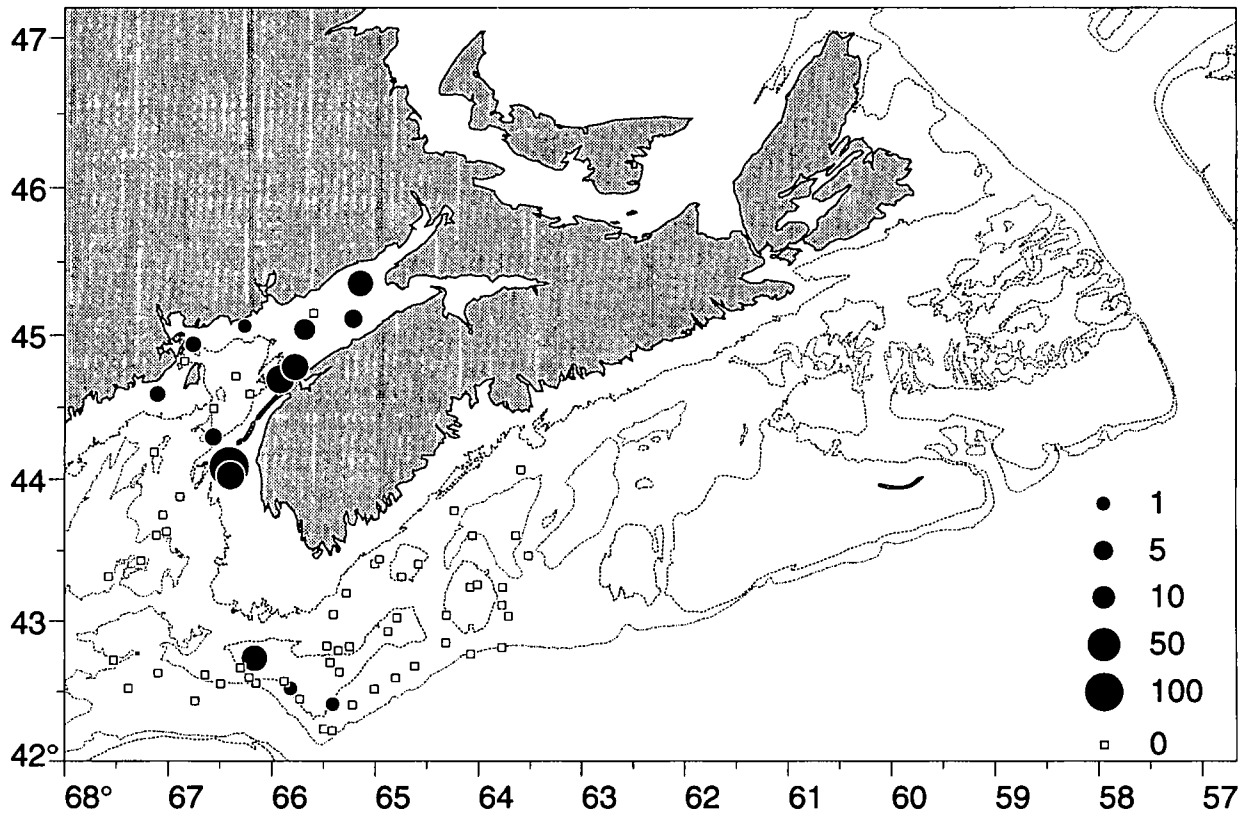
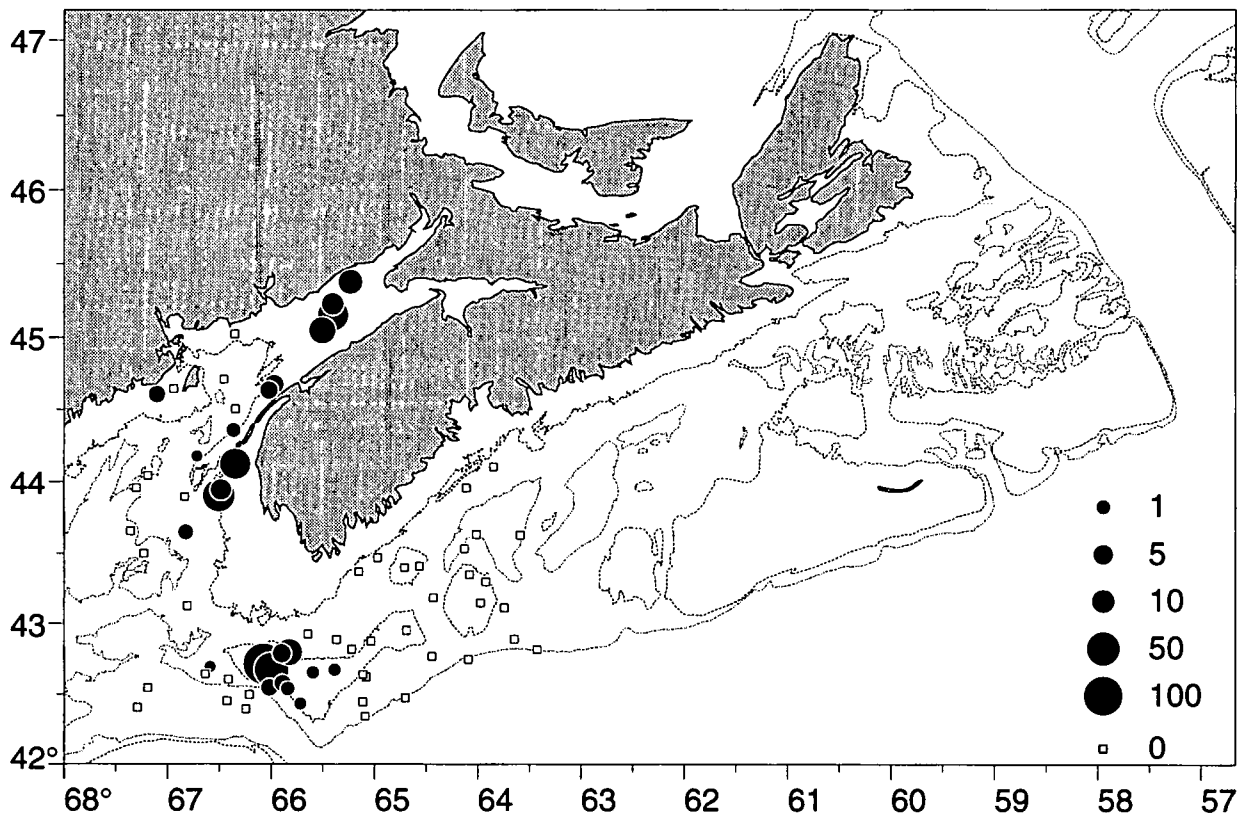


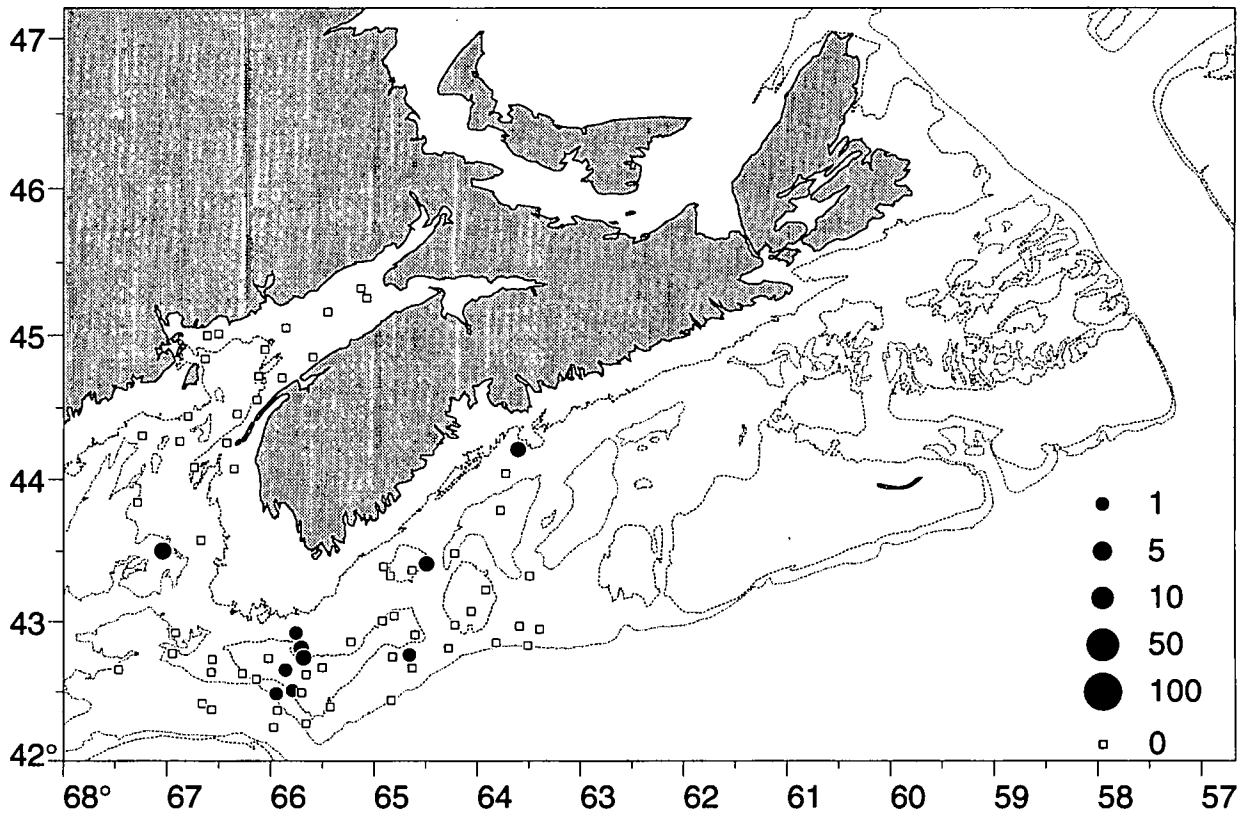
Fig. 41. Summer Groundfish Survey 4X Winter Biomass (kg/tow) July 1993



Summer Groundfish Survey 4X Winter Biomass (kg/tow) July 1994



Summer Groundfish Survey 4X Winter Biomass (kg/tow) July 1995



Summer Groundfish Survey 4X Witch Biomass (kg/tow) July 1992

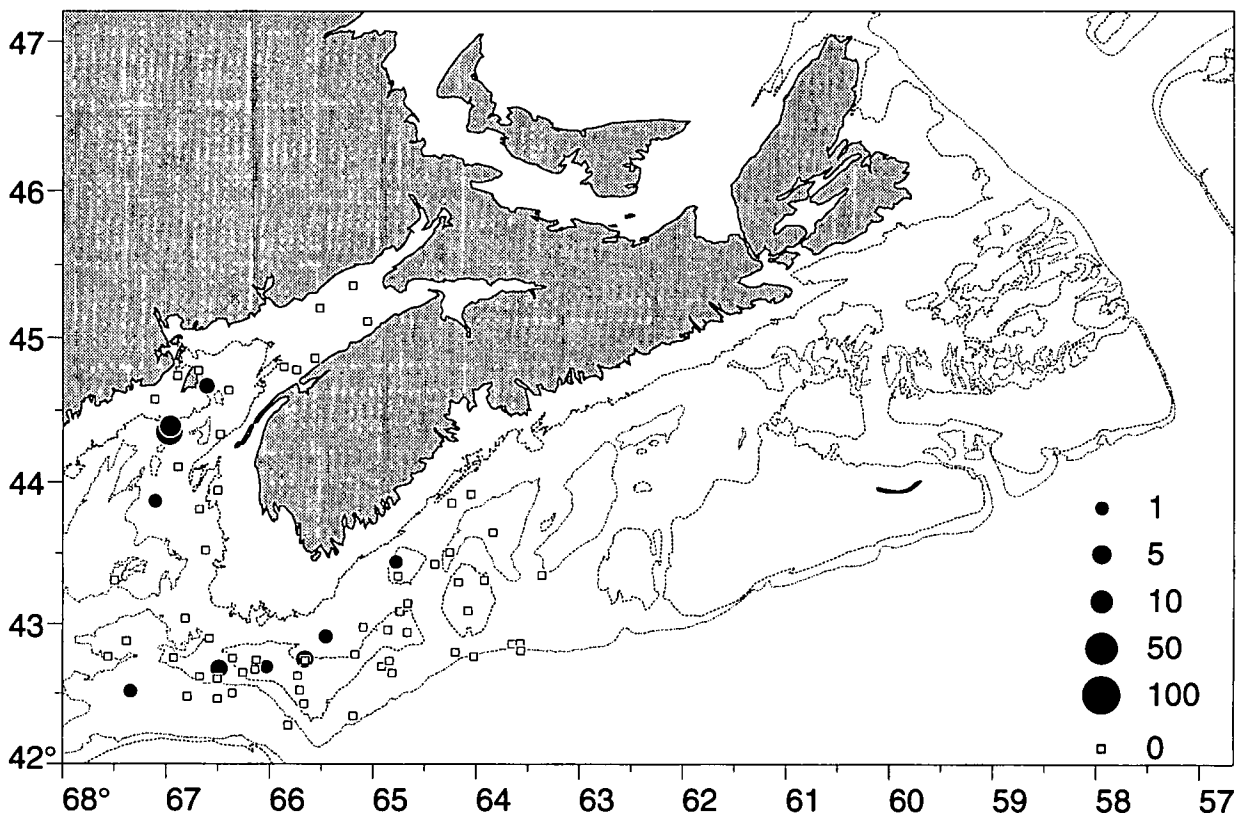
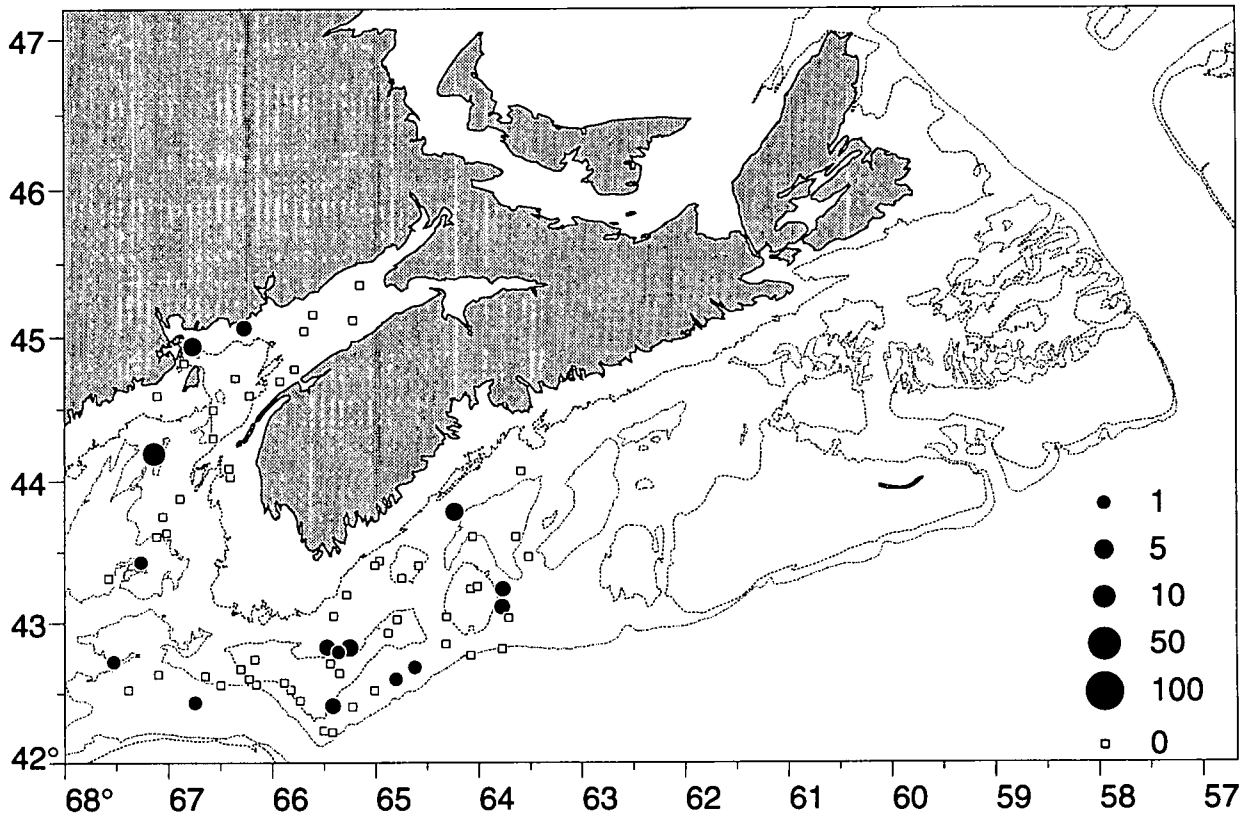
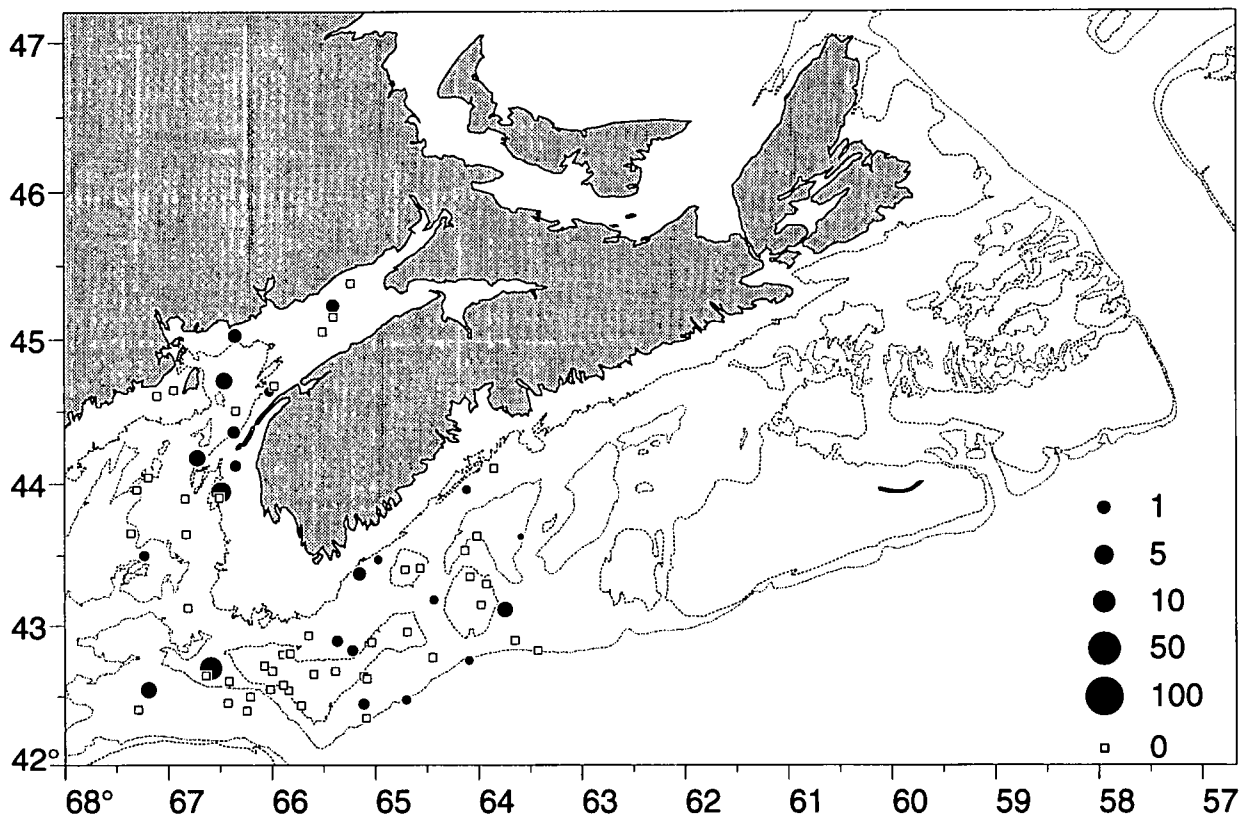


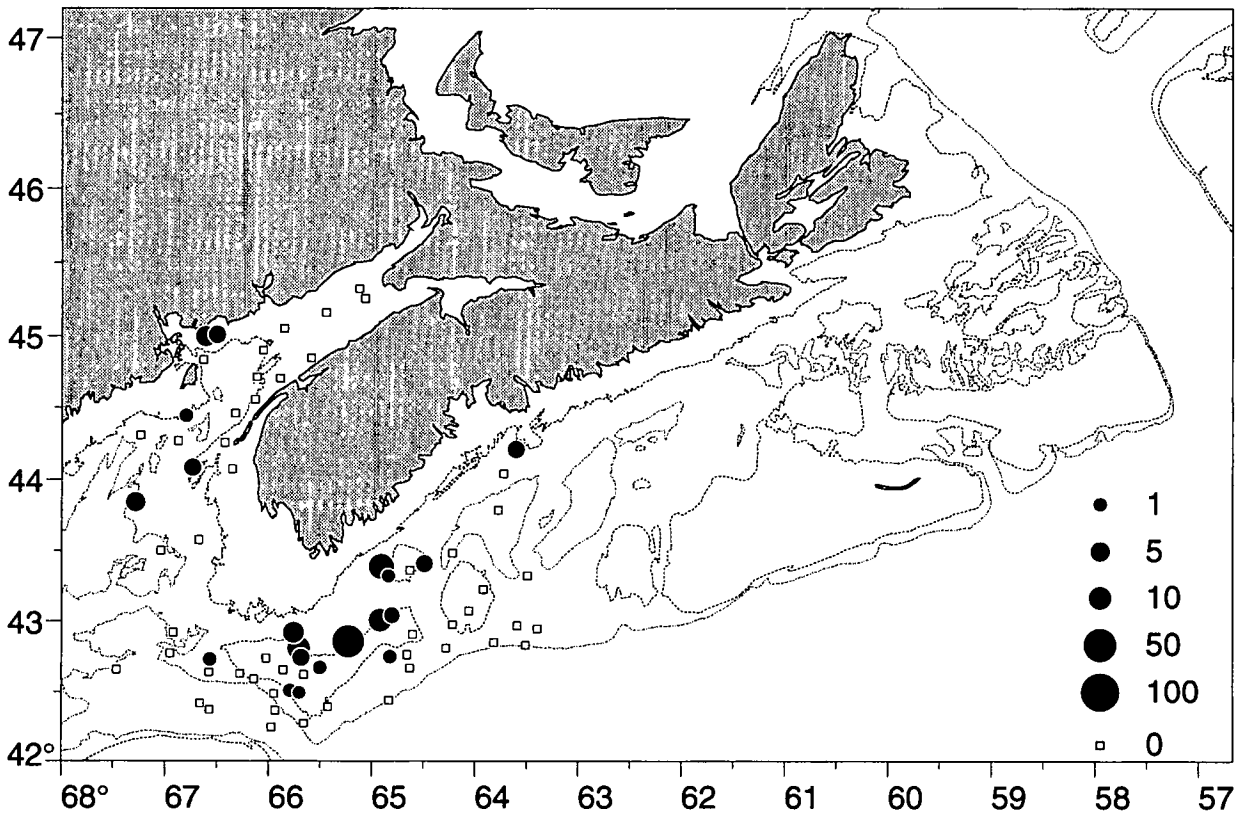
Fig. 42. Summer Groundfish Survey 4X Witch Biomass (kg/tow) July 1993



Summer Groundfish Survey 4X Witch Biomass (kg/tow) July 1994



Summer Groundfish Survey 4X Witch Biomass (kg/tow) July 1995



Summer Groundfish Survey 4X Plaice Biomass (kg/tow) July 1992

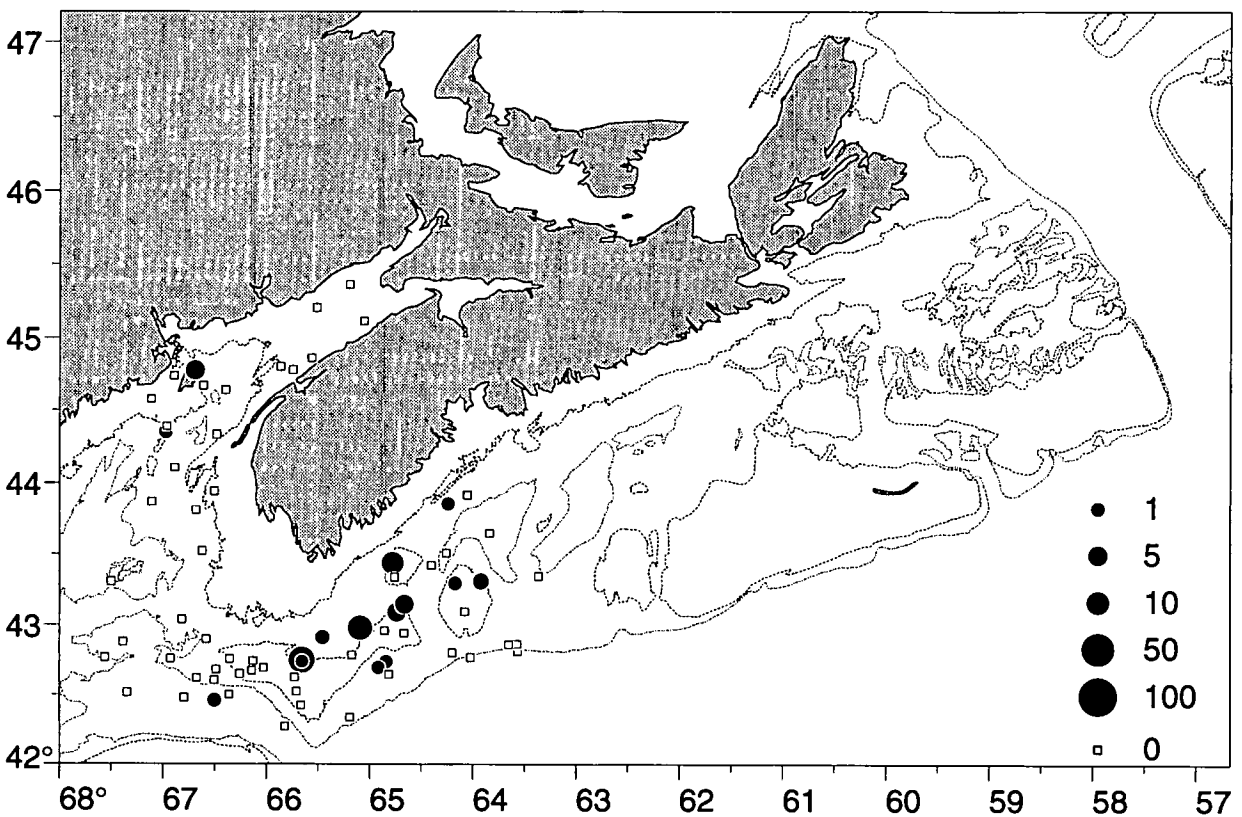
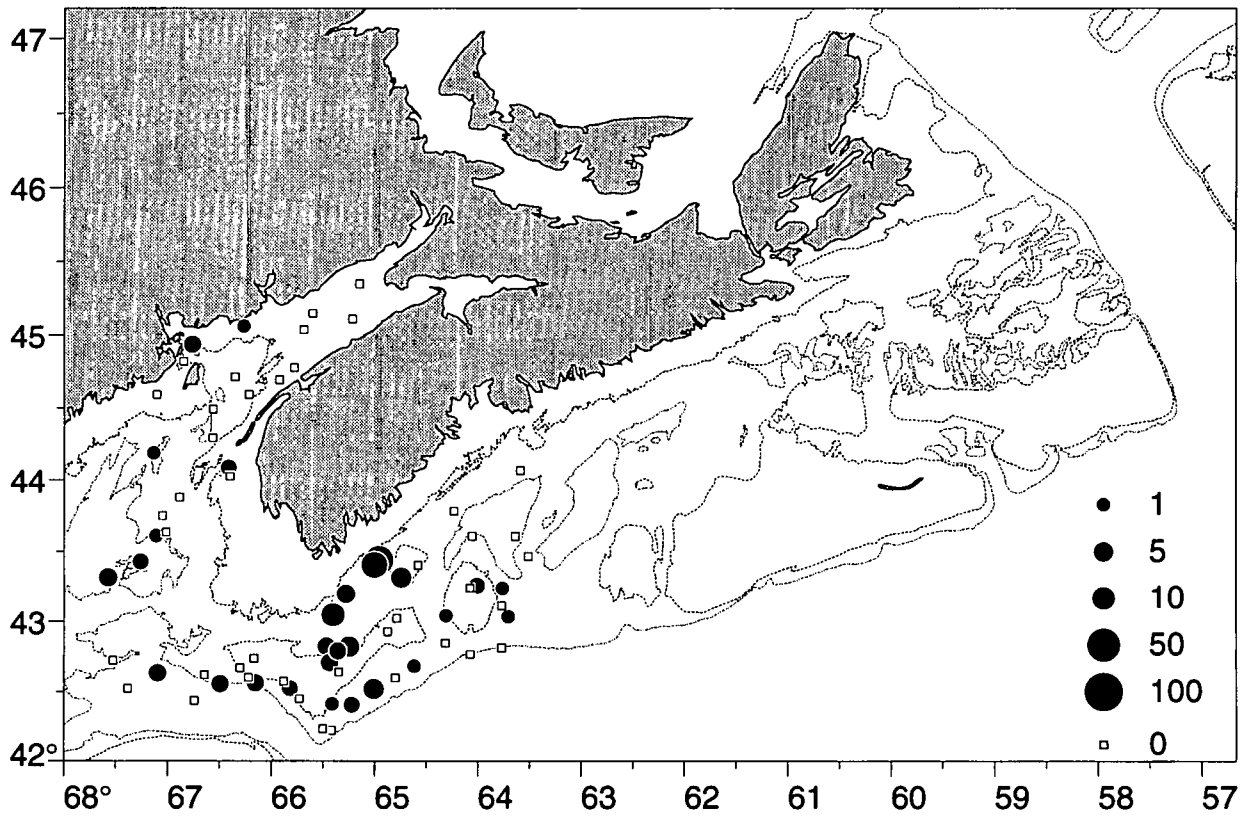
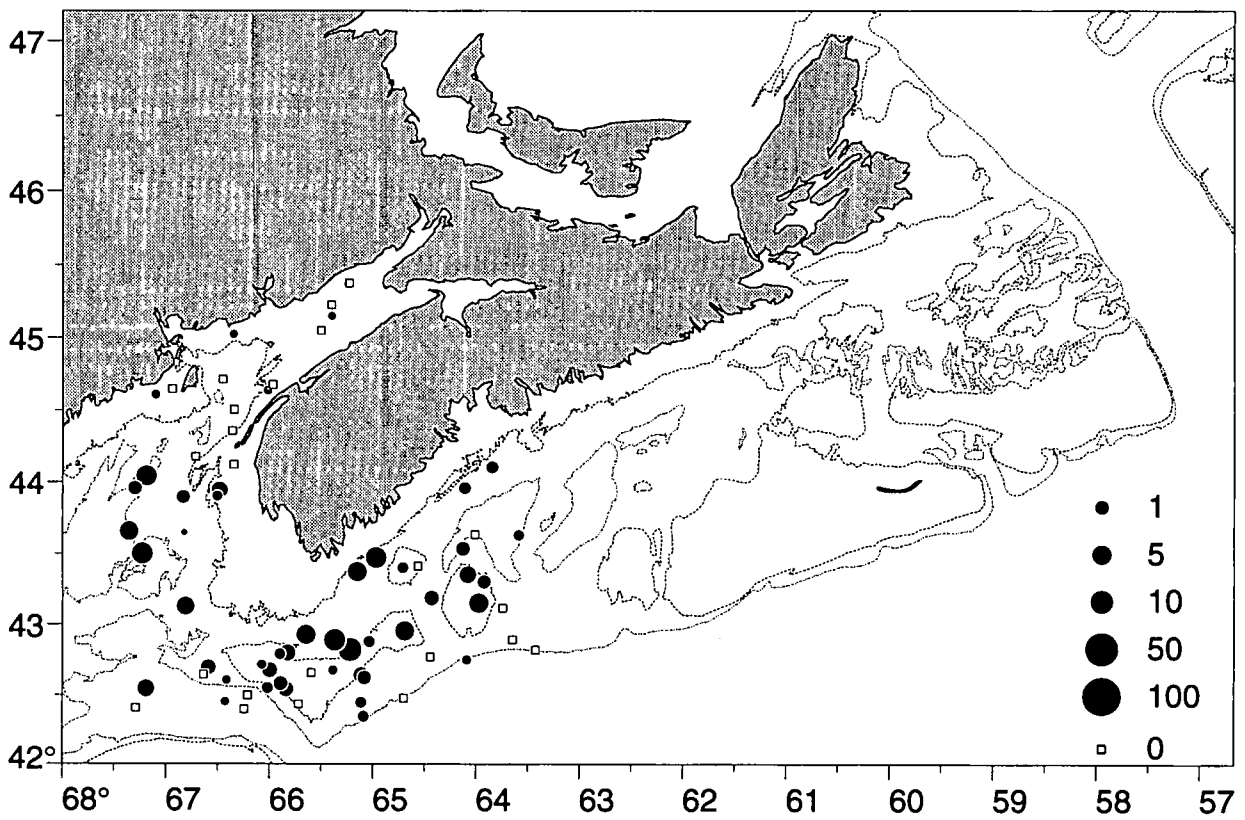


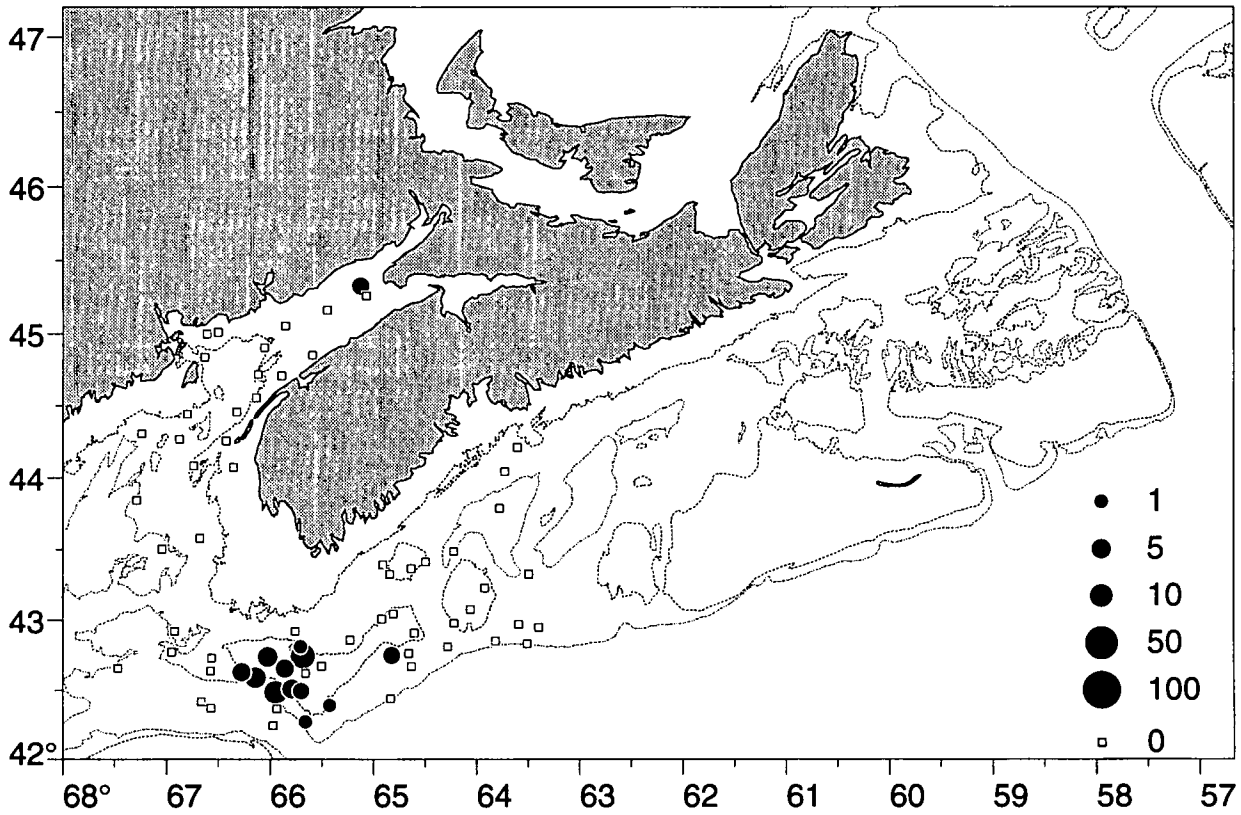
Fig. 43. Summer Groundfish Survey 4X Plaice Biomass (kg/tow) July 1993



Summer Groundfish Survey 4X Plaice Biomass (kg/tow) July 1994



Summer Groundfish Survey 4X Plaice Biomass (kg/tow) July 1995



Summer Groundfish Survey 4X Yellowtail Biomass (kg/tow) July 1992

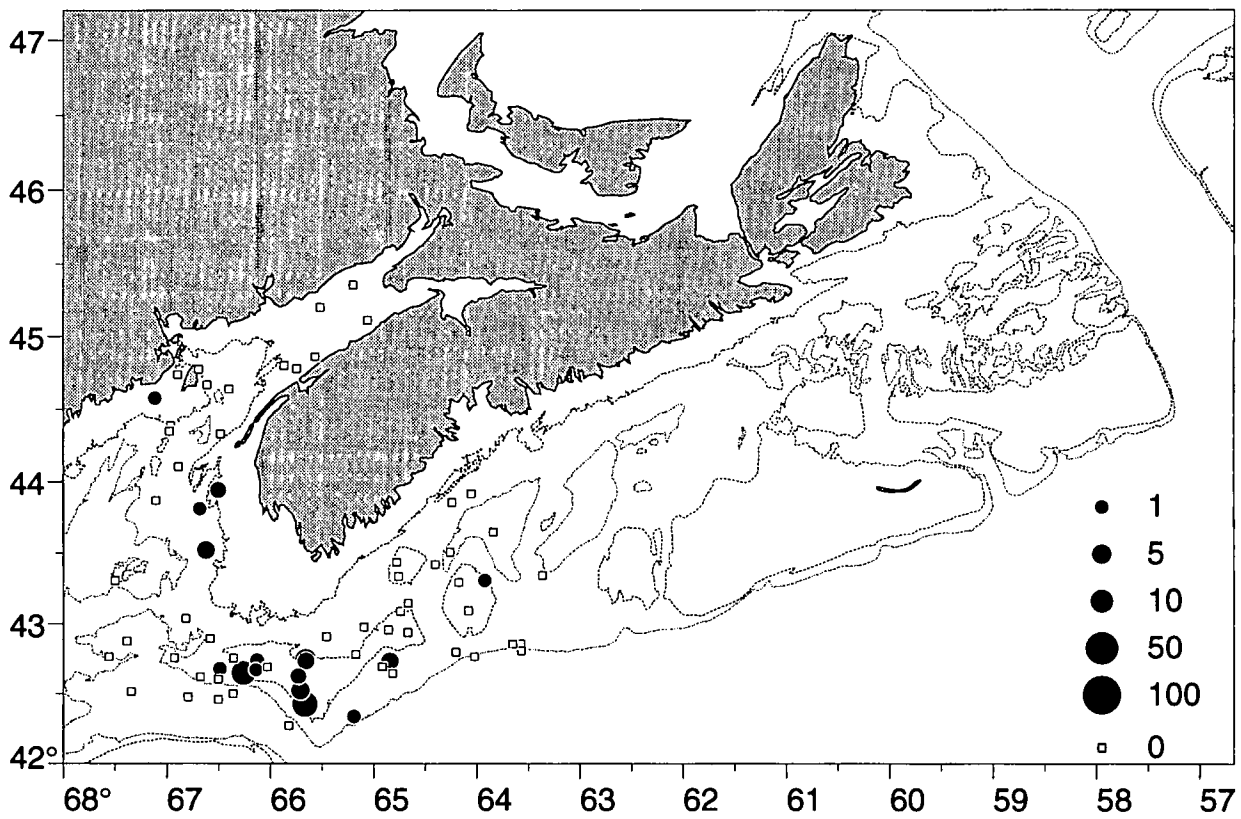
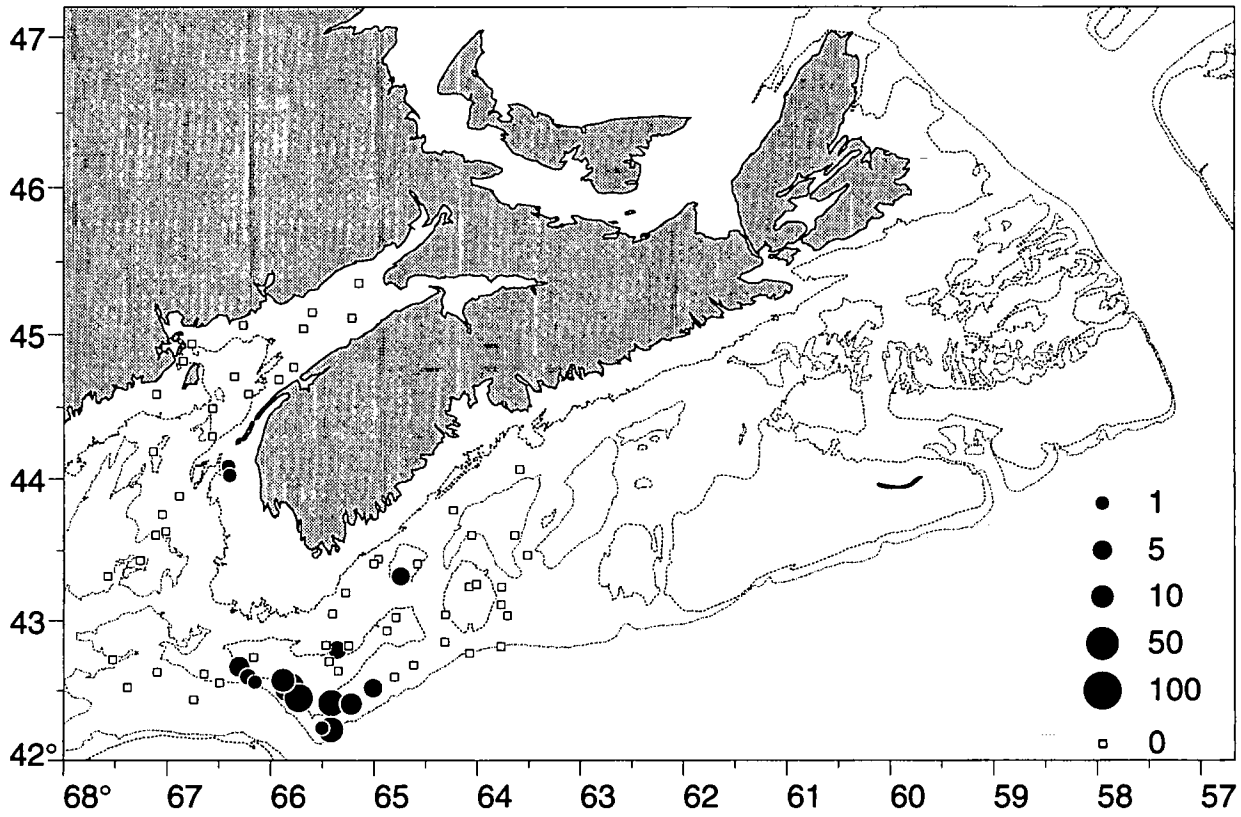
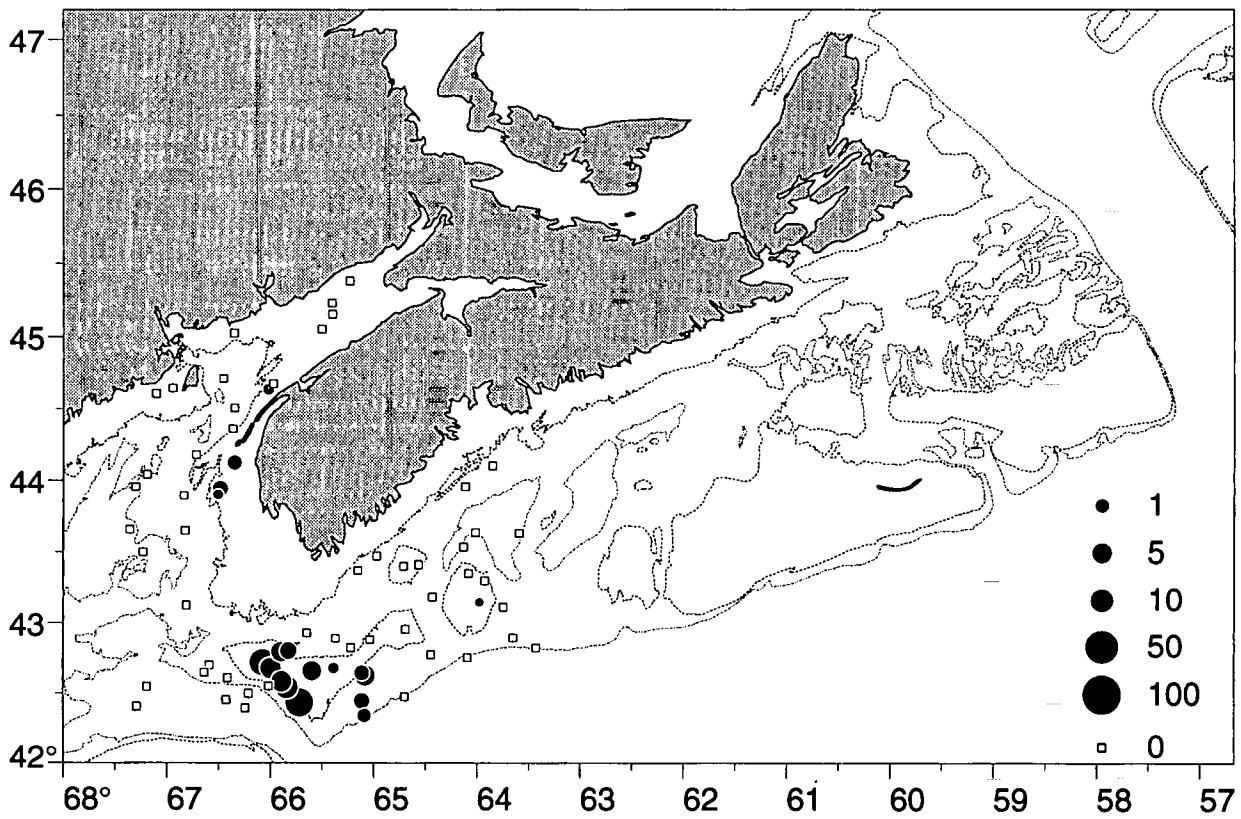


Fig. 44. Summer Groundfish Survey 4X Yellowtail Biomass (kg/tow) July 1993



Summer Groundfish Survey 4X Yellowtail Biomass (kg/tow) July 1994



Summer Groundfish Survey 4X Yellowtail Biomass (kg/tow) July 1995

4VWX5 Halibut (C. Annand, BIO)

1. Abundance

Mean number were relatively stable between 1994 and 1995, declining slightly from 0.15 fish per tow in 1994 to 0.14 fish per tow in 1995 (Fig. 45). The survey gear catches a different size distribution of halibut (generally smaller) than those taken in the longline fishery (>81 cm). The survey catch rates may prove to be a future indicator of recruitment rather than fishable biomass.

2. Recruitment and Size Composition

Survey length distributions in 1995 indicate fewer large halibut in the population compared to the recent (1990- 1994) average size composition (Fig. 46). However, more halibut in the 30-40 cm range were caught in the 1995 survey, which may be an indication of good incoming recruitment. However, the few halibut caught by the survey make valid comparison difficult.

3. Distribution

Halibut summer distributions do not appear to have changed much over time; however as was noted in previous surveys, few halibut were caught east of the Gully along the shelf edge in 4VSc (Fig. 47). In 1995, no halibut were caught on the eastern edge of 4Vs or 4Vn.

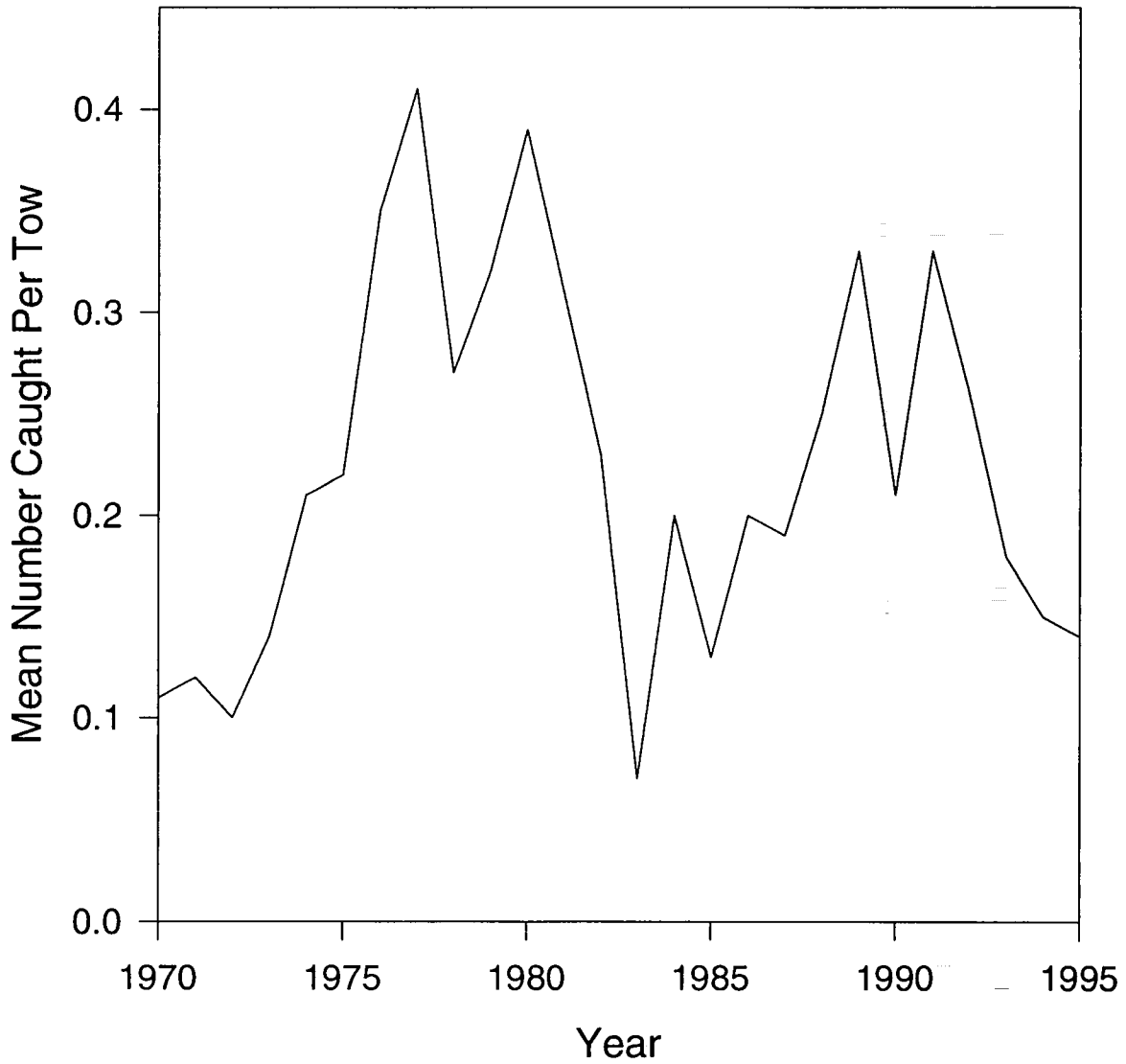


Fig. 45 4VWX Halibut. Stratified Mean number per tow from summer surveys, 1970-1995.

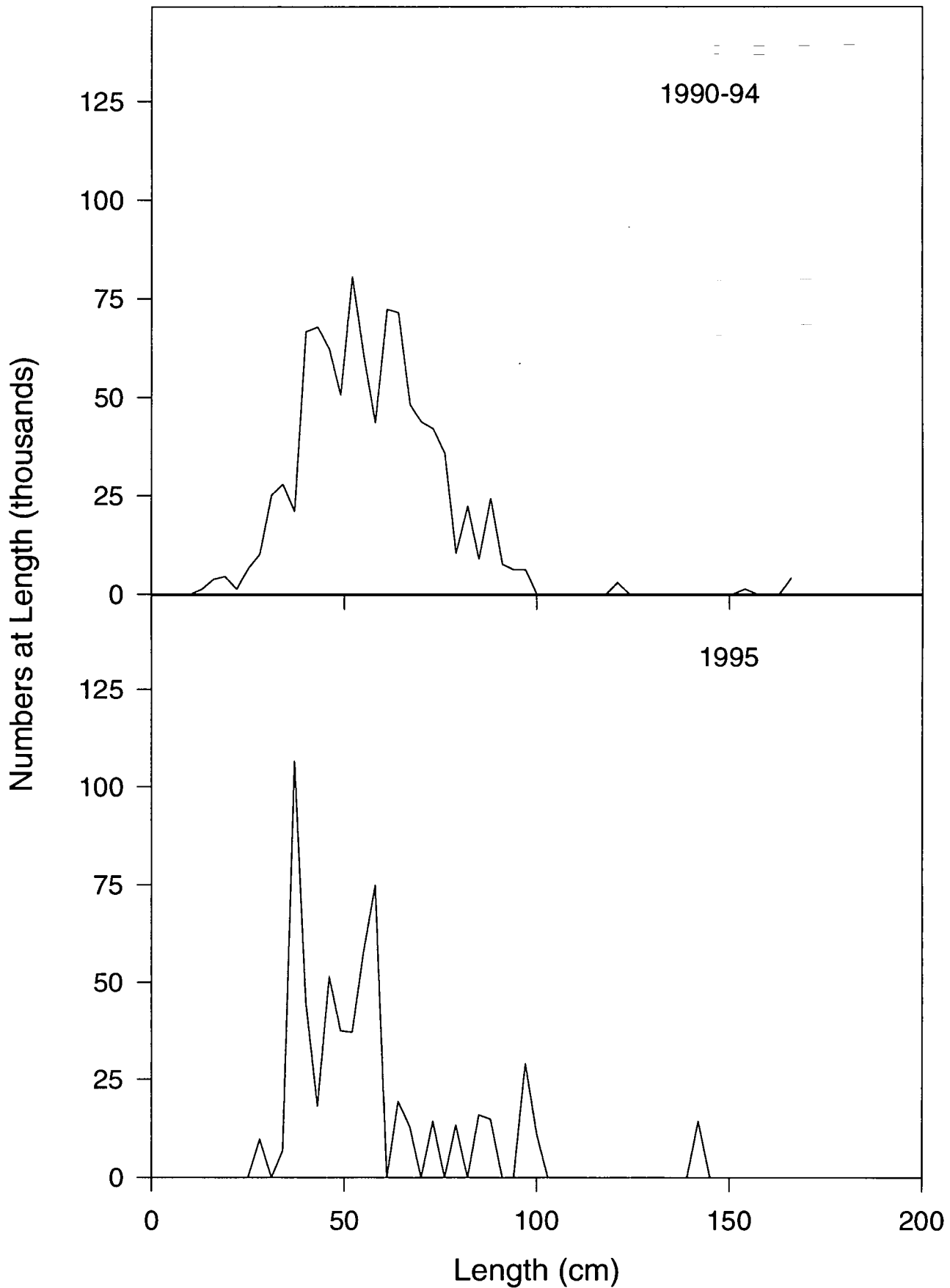
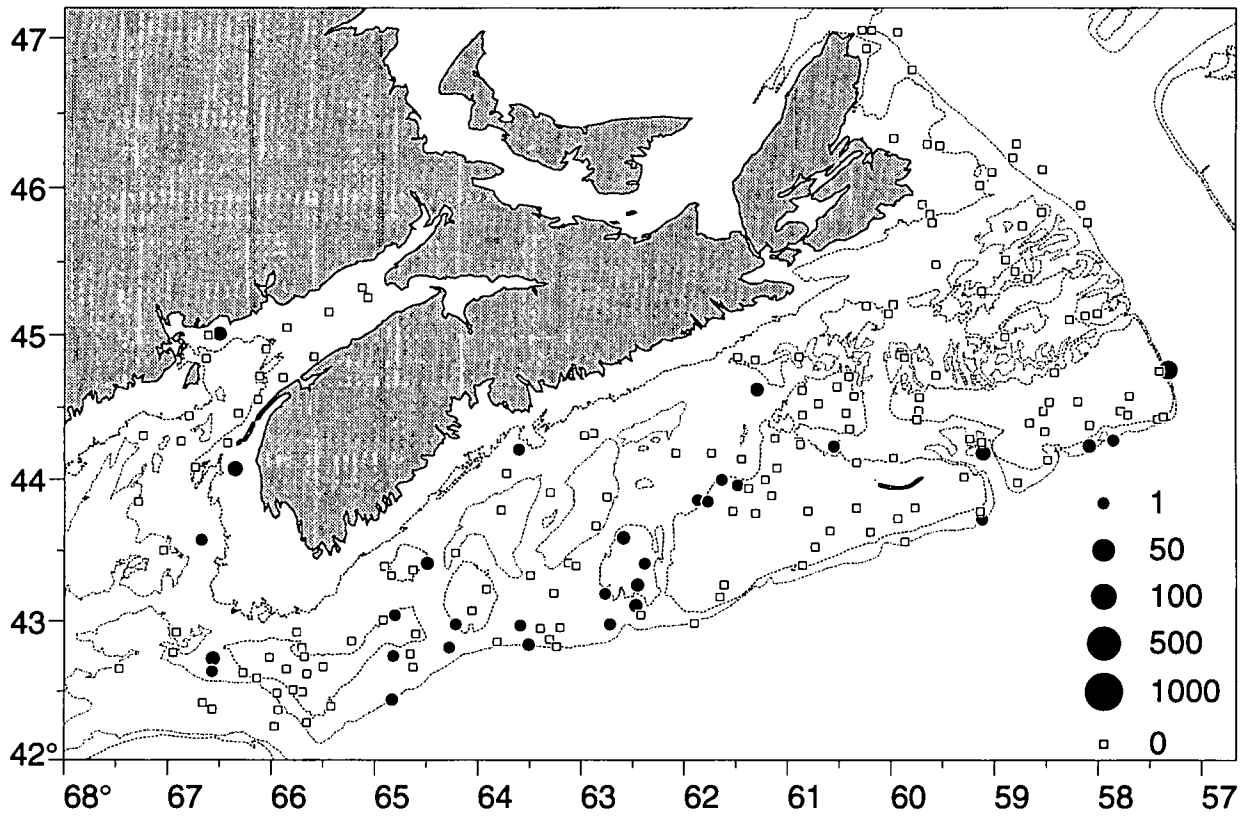


Fig. ⁴⁶ 4VWX Halibut. Length frequency distribution from the summer 1995 survey (bottom panel), compared with average from surveys conducted from 1990 - 1994.



Summer Groundfish Survey 4VWX Halibut Biomass (kg/tow) July 1992

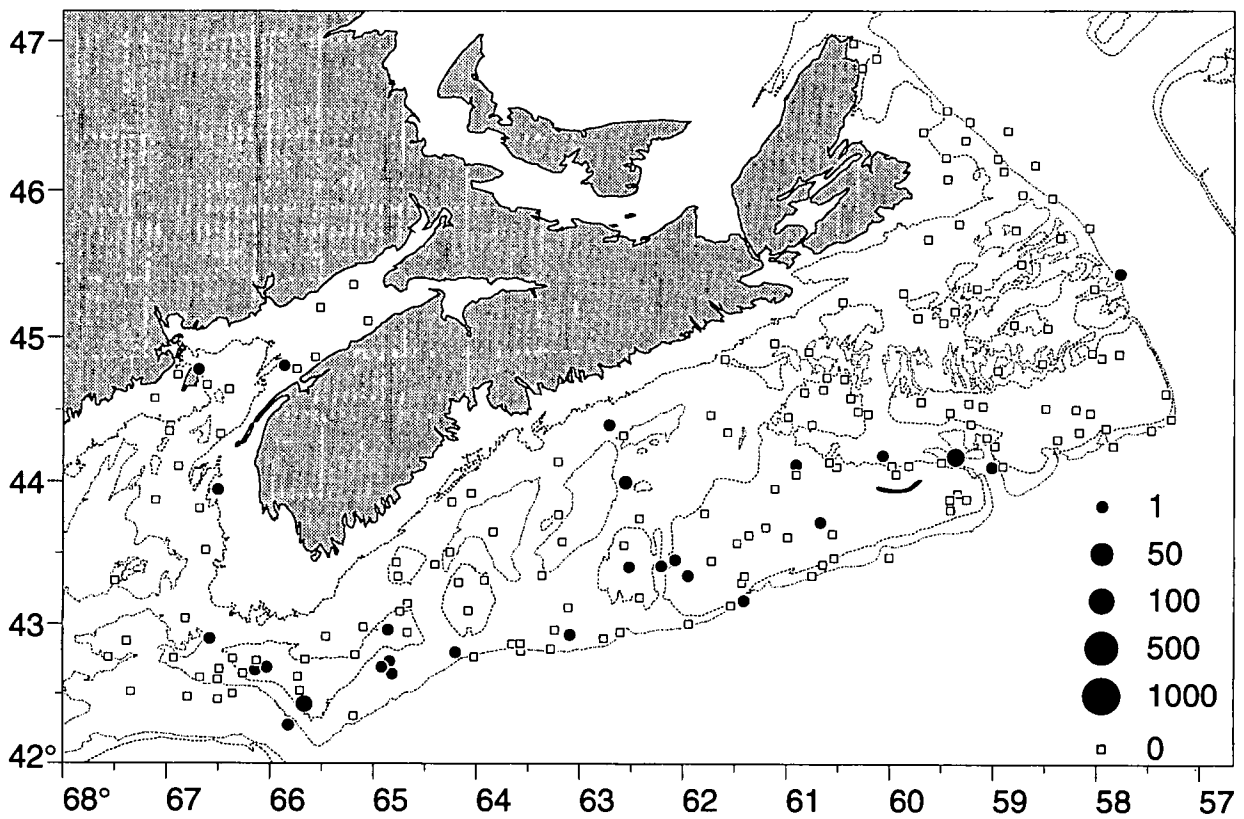
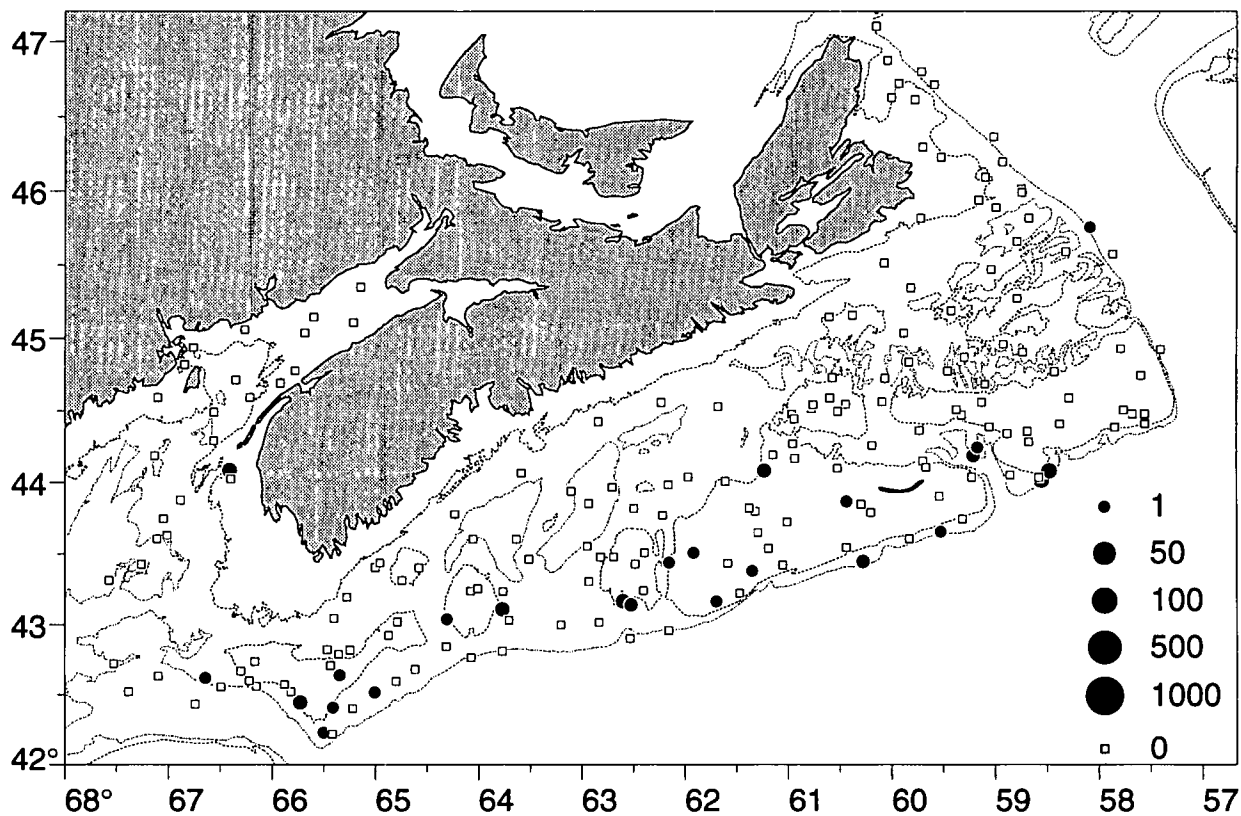
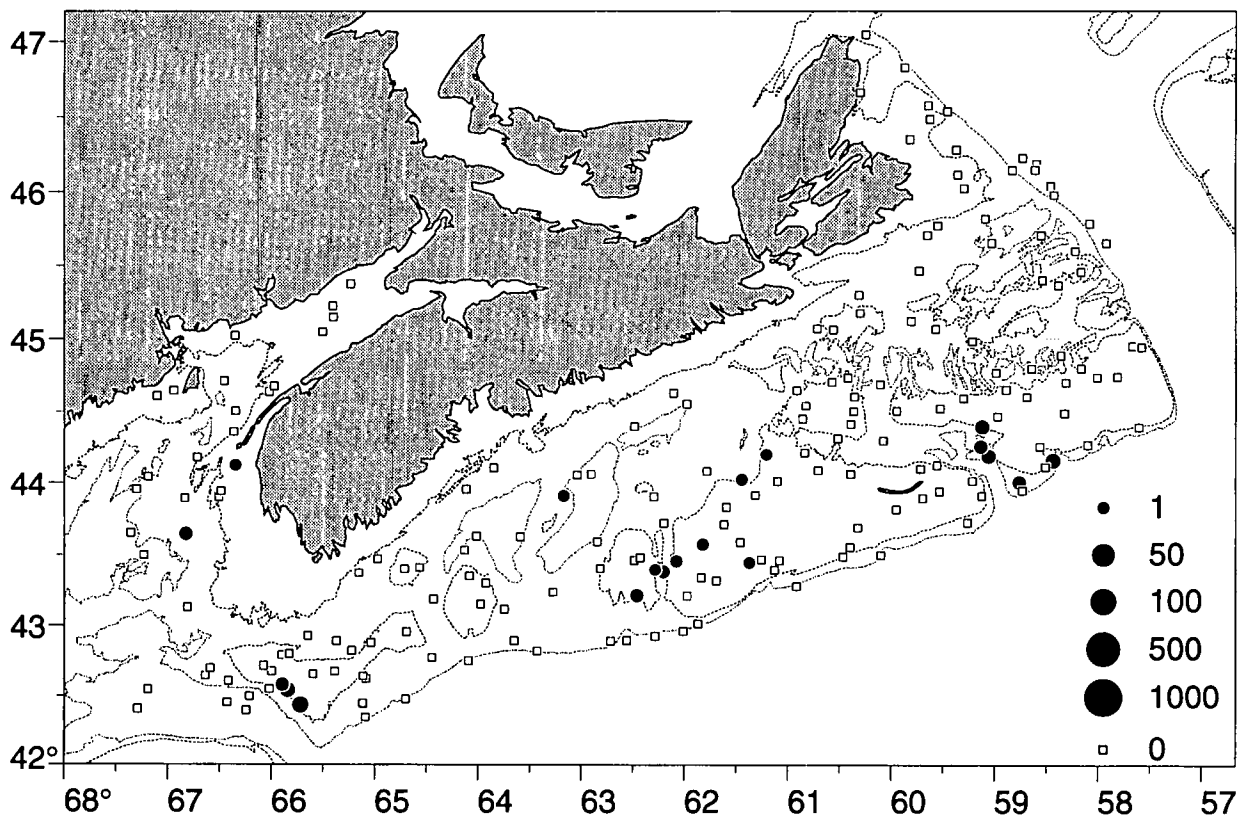


Fig. 47. Summer Groundfish Survey 4VWX Halibut Biomass (kg/tow) July 1993



Summer Groundfish Survey 4VWX Halibut Biomass (kg/tow) July 1994



Summer Groundfish Survey 4VWX Halibut Biomass (kg/tow) July 1995