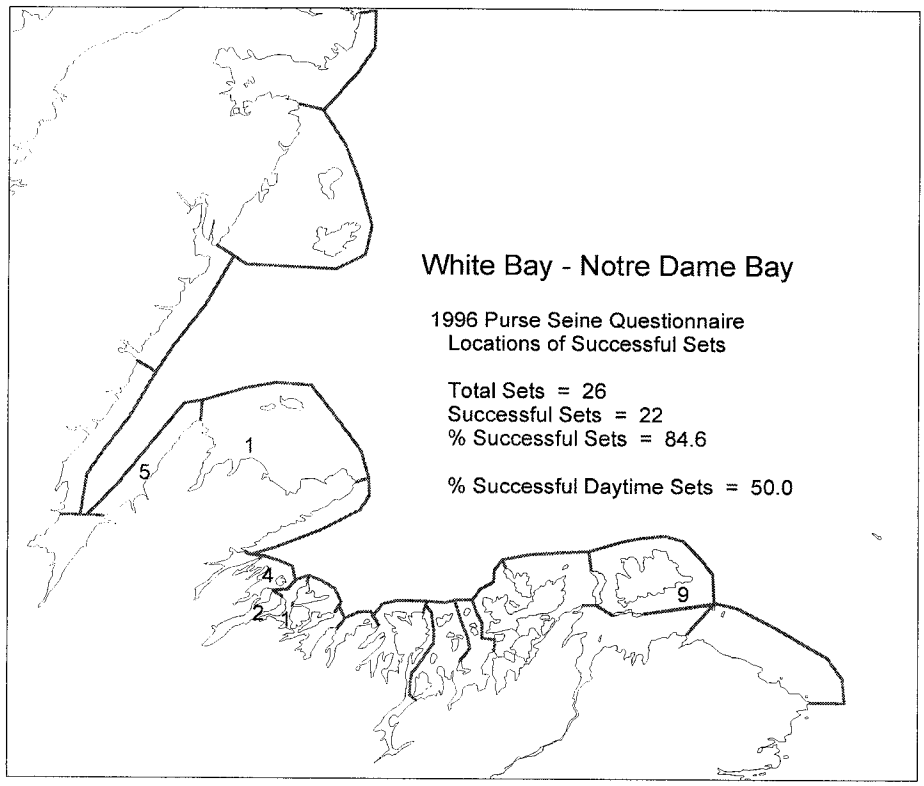


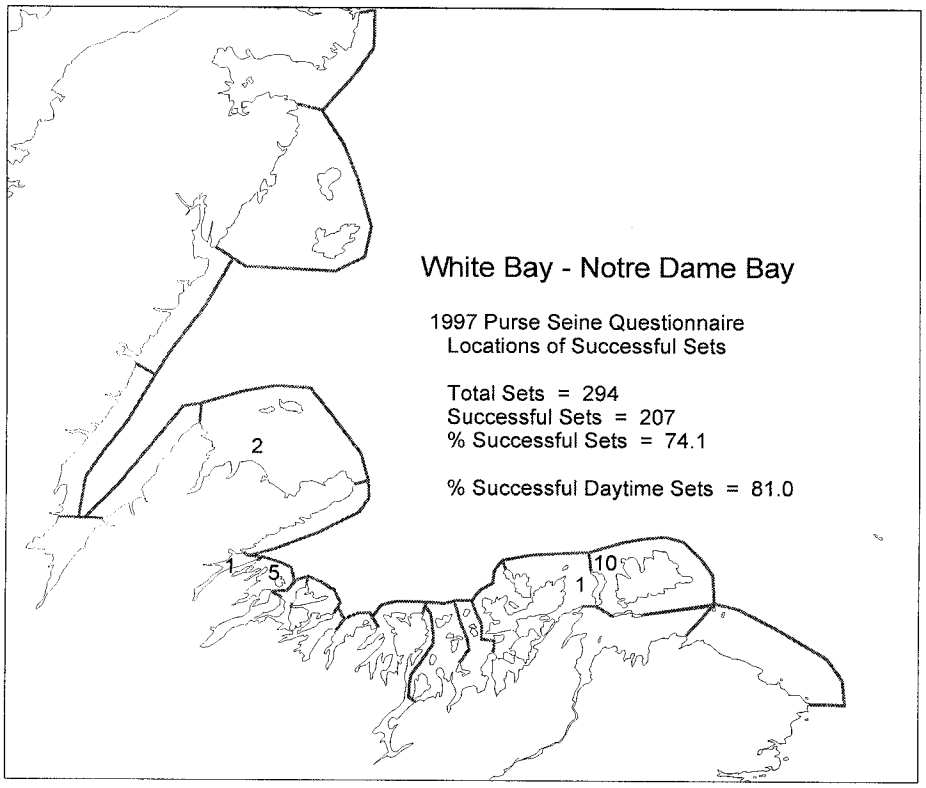


Figure 57. Responses to question 10 regarding locations of successful sets (sets in which herring were caught) in 1996 (upper panel) and 1997 (lower panel) for White Bay - NotreDame Bay (WB-NDB).

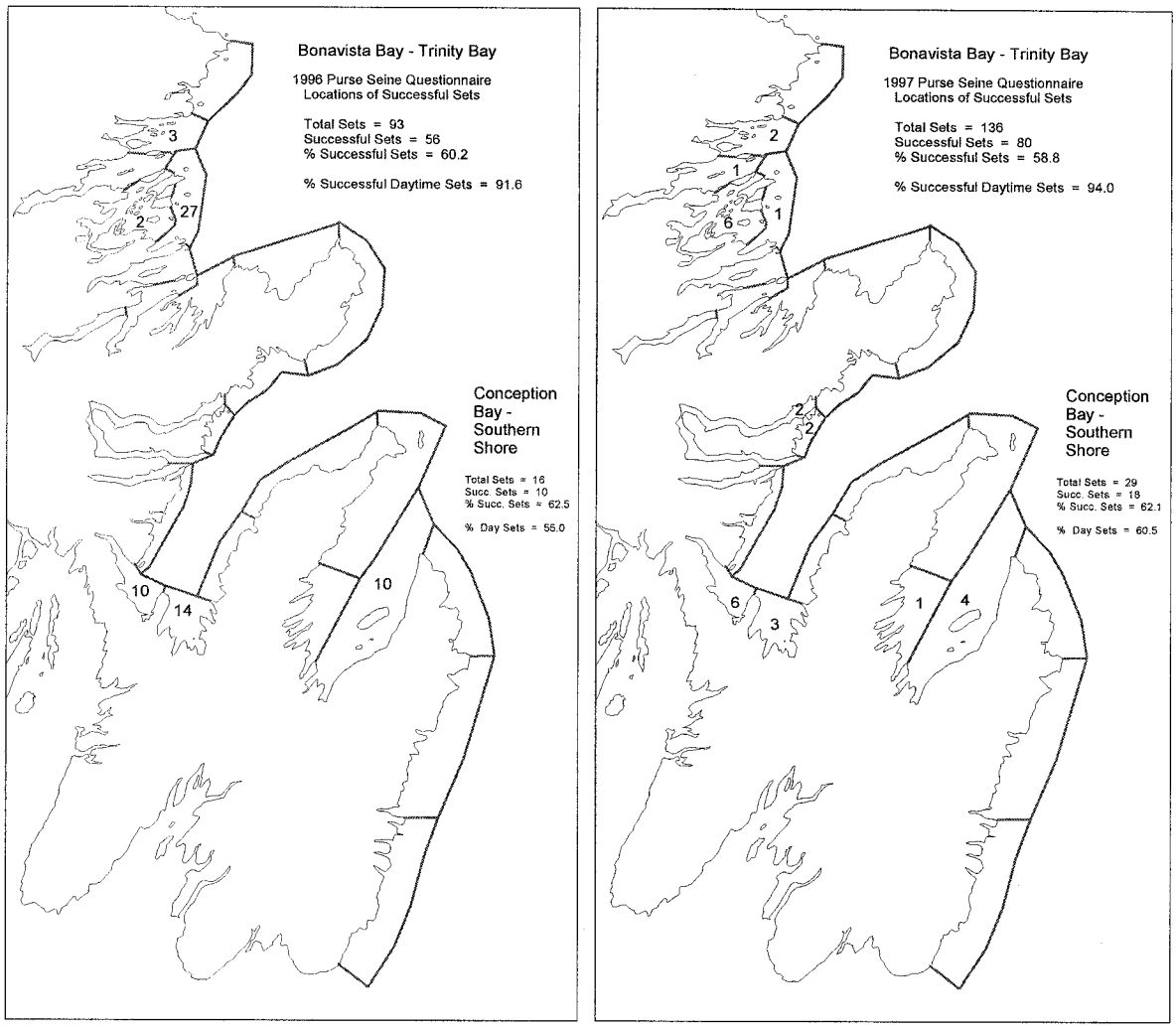


Figure 57 (cont.'). Responses to question 10 regarding locations of successful sets (sets in which herring were caught) in 1996 (left panel) and 1997 (right panel) for Bonavista Bay - Trinity Bay (BB-TB) and ConceptionBay - Southern Shore (CB-SS).

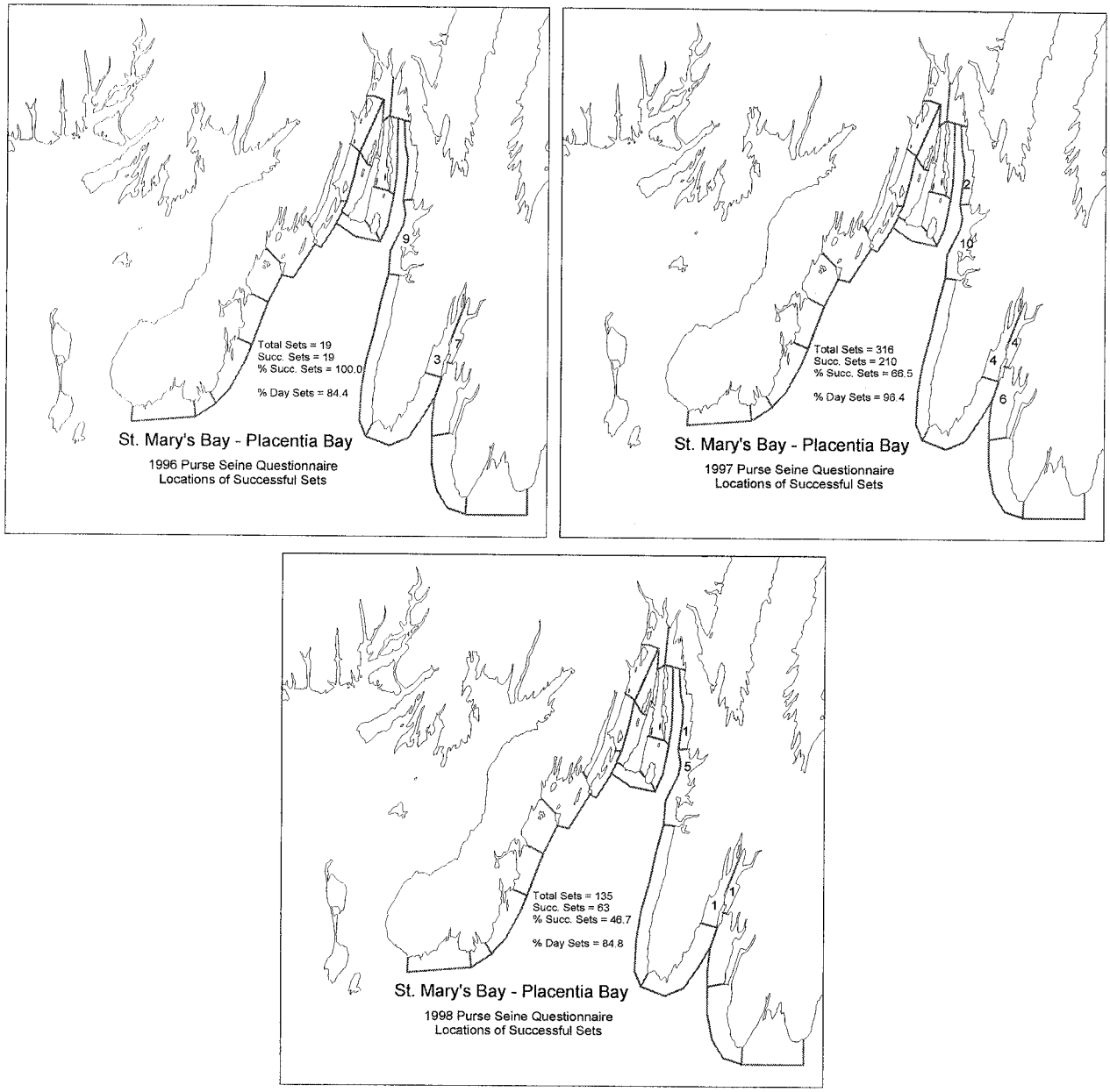


Figure. 57 (cont.'). Responses to question 10 regarding locations of successful sets (sets in which herring were caught) in 1996 (left panel), in 1997 (right panel), and 1998 (bottom panel) for St. Mary's Bay - Placentia Bay (SMB-PB).

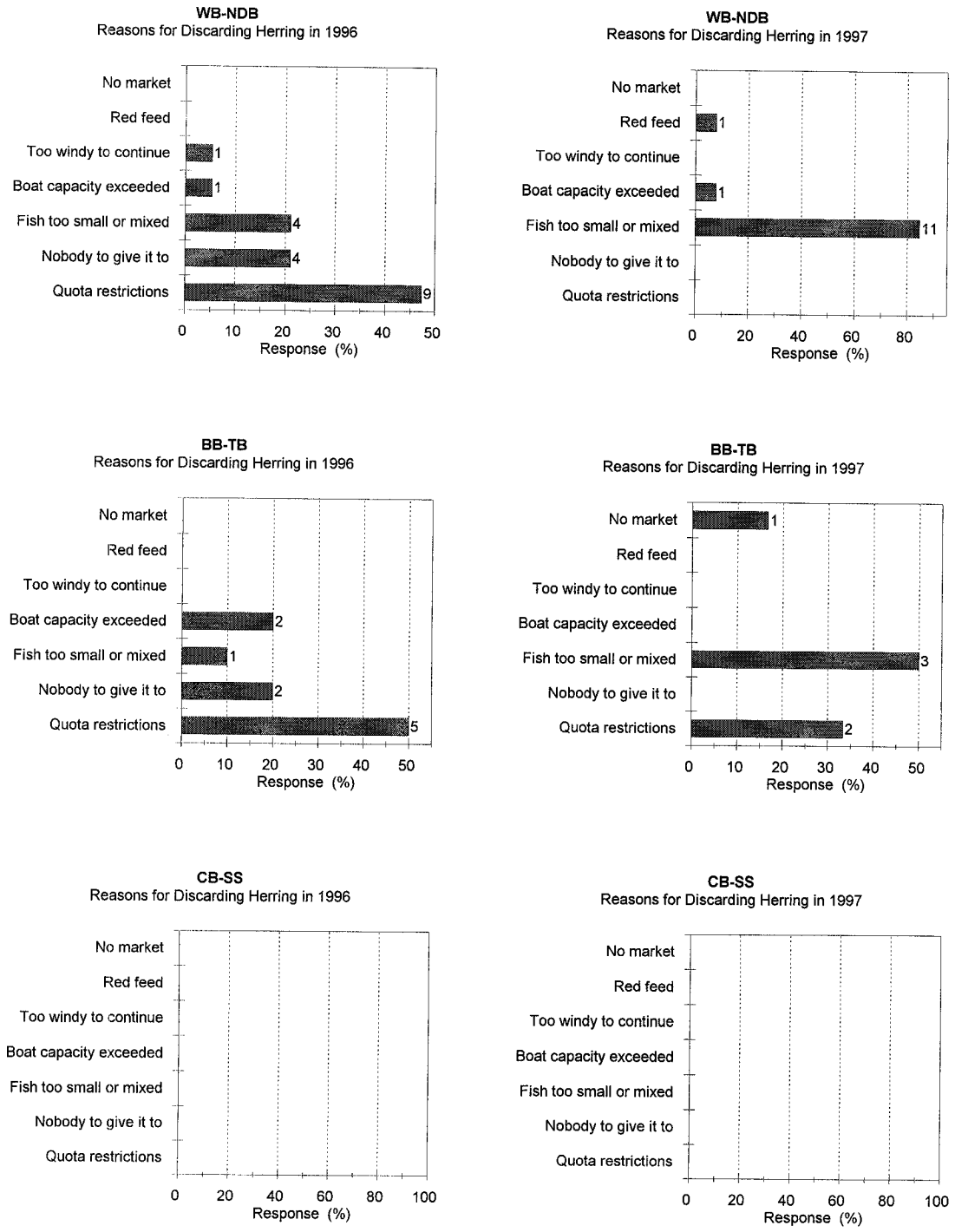


Figure 58. Responses to question 21 regarding why herring were discarded during the fishery in 1996 (left) and 1997 (right) for White Bay - Notre Dame Bay (WB-NDB), Bonavista Bay - Trinity Bay (BB-TB), and Conception Bay -Southern Shore (CB-SS).

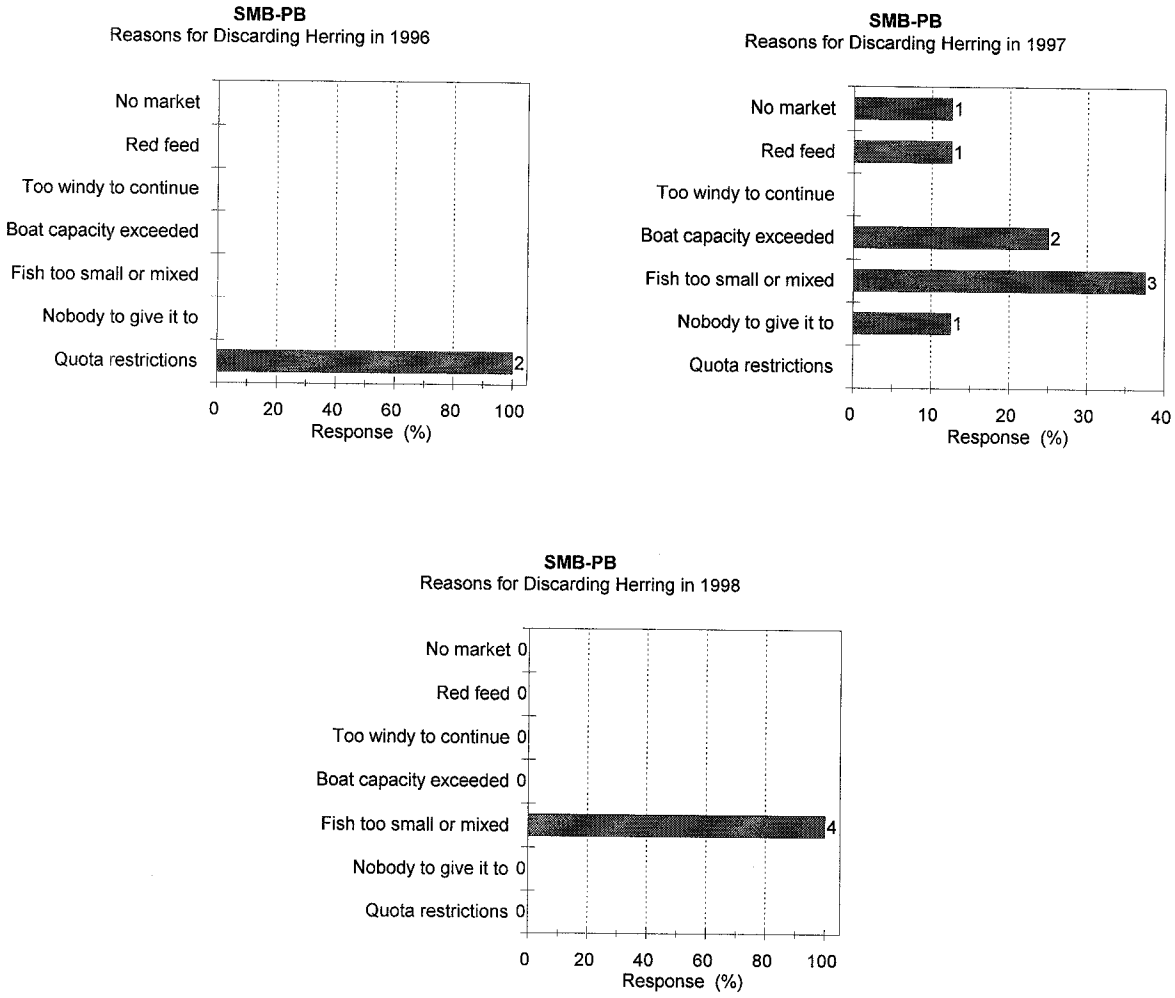


Figure 58 (cont.'). Responses to question 21 regarding why herring were discarded during the fishery in 1996 (left), 1997 (right), and 1998 (bottom) for St. Mary's Bay - Placentia Bay (SMB-PB).

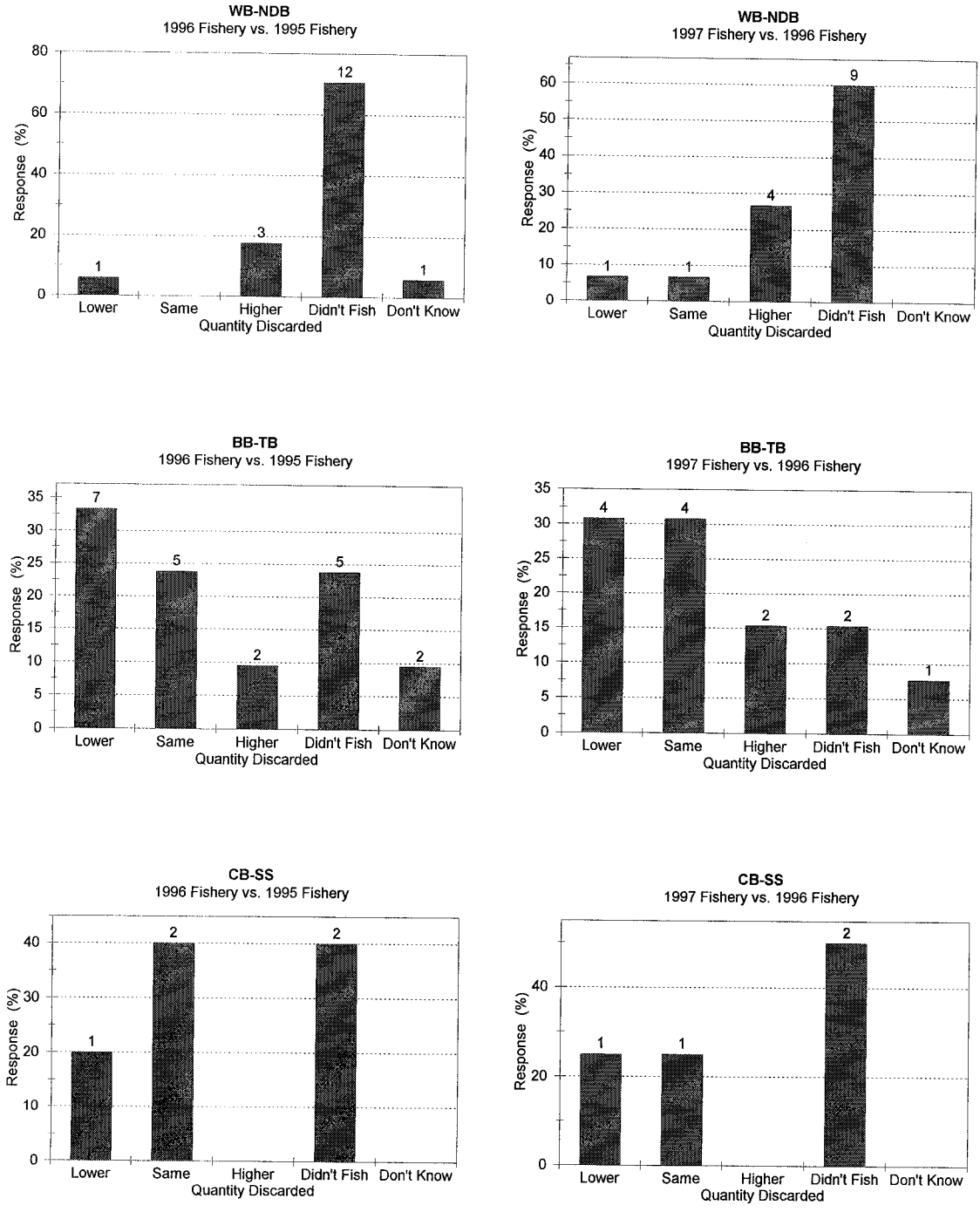


Figure 59. Responses to question 22 regarding the amount of herring discarded during the fishery in the current year compared to the previous year from the 1996 (left) and 1997 (right) fisheries in White Bay - Notre Dame Bay (WB-NDB), Bonavista Bay - Trinity Bay (BB-TB), and Conception Bay - Southern Shore (CB-SS).

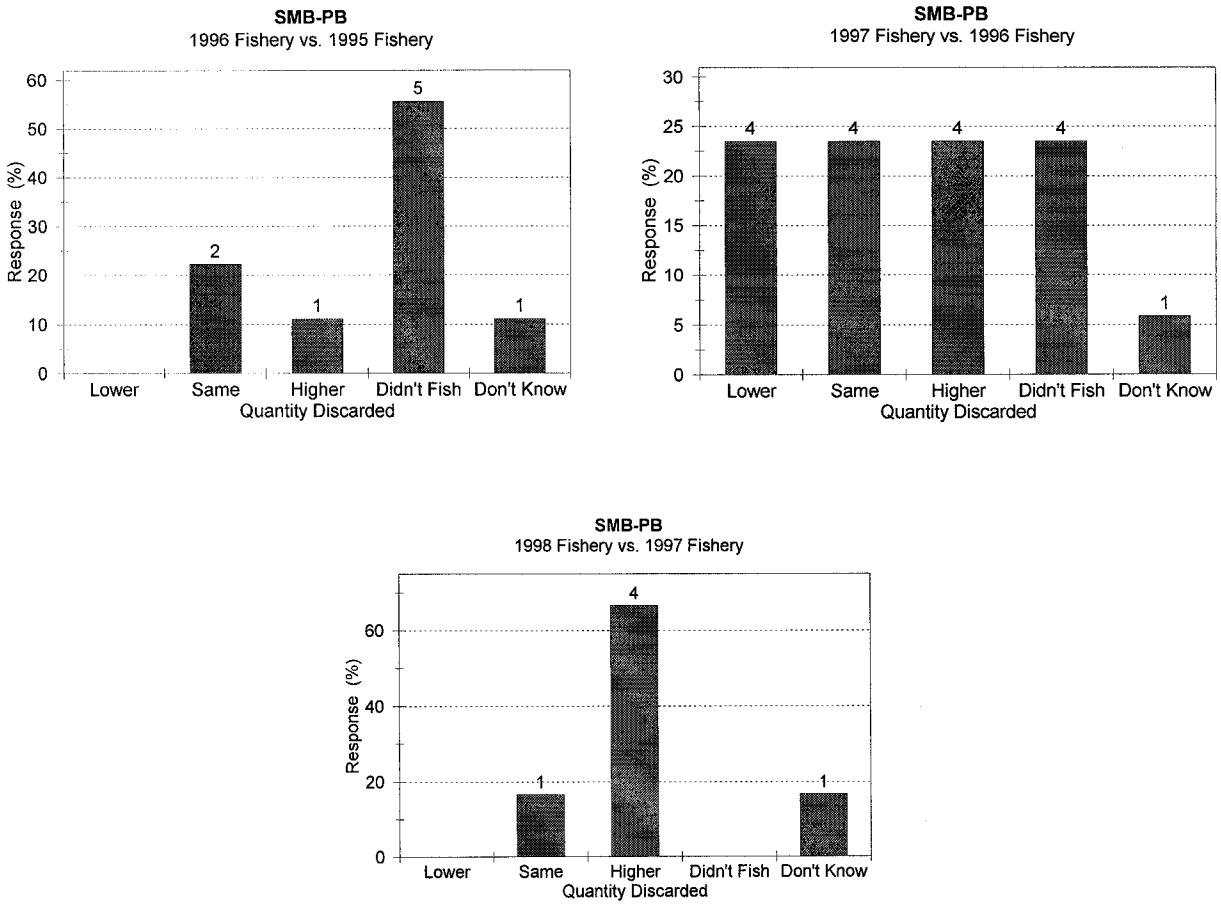


Figure 59 (cont.'). Responses to question 22 regarding the amount of herring discarded during the fishery in the current year compared to the previous year from the 1996 (left), 1997, (right) and 1998 (bottom) fisheries in St. Mary's Bay - Placentia Bay (SMB-PB).

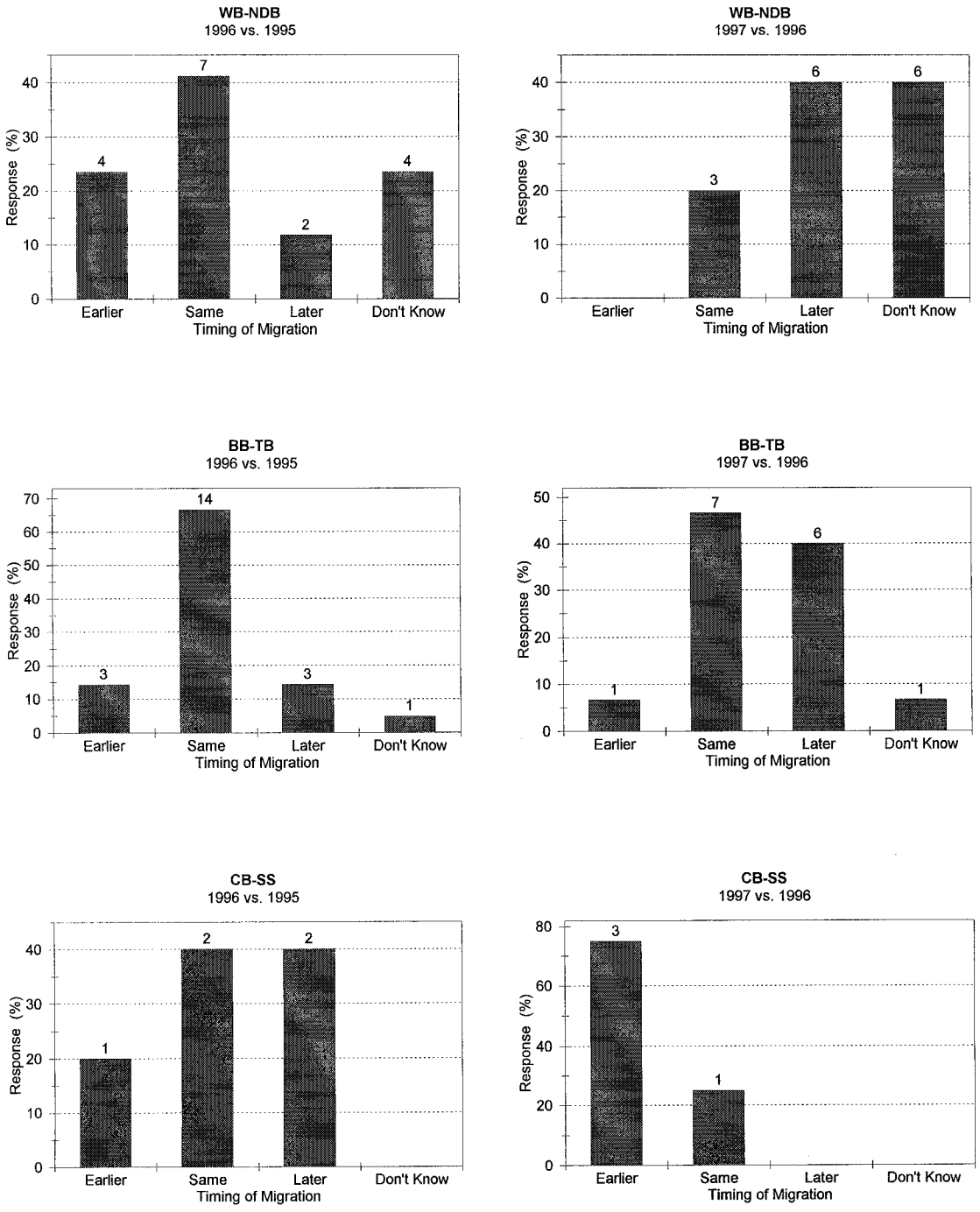


Figure 60. Responses to question 23 regarding the seasonal timing of herring migration in the current year compared to the previous year from the 1996 (left) and 1997 (right) surveys for White Bay - Notre Dame Bay, Bonavista Bay - Trinity Bay (BB-TB), and Conception Bay - Southern Shore (CB-SS).

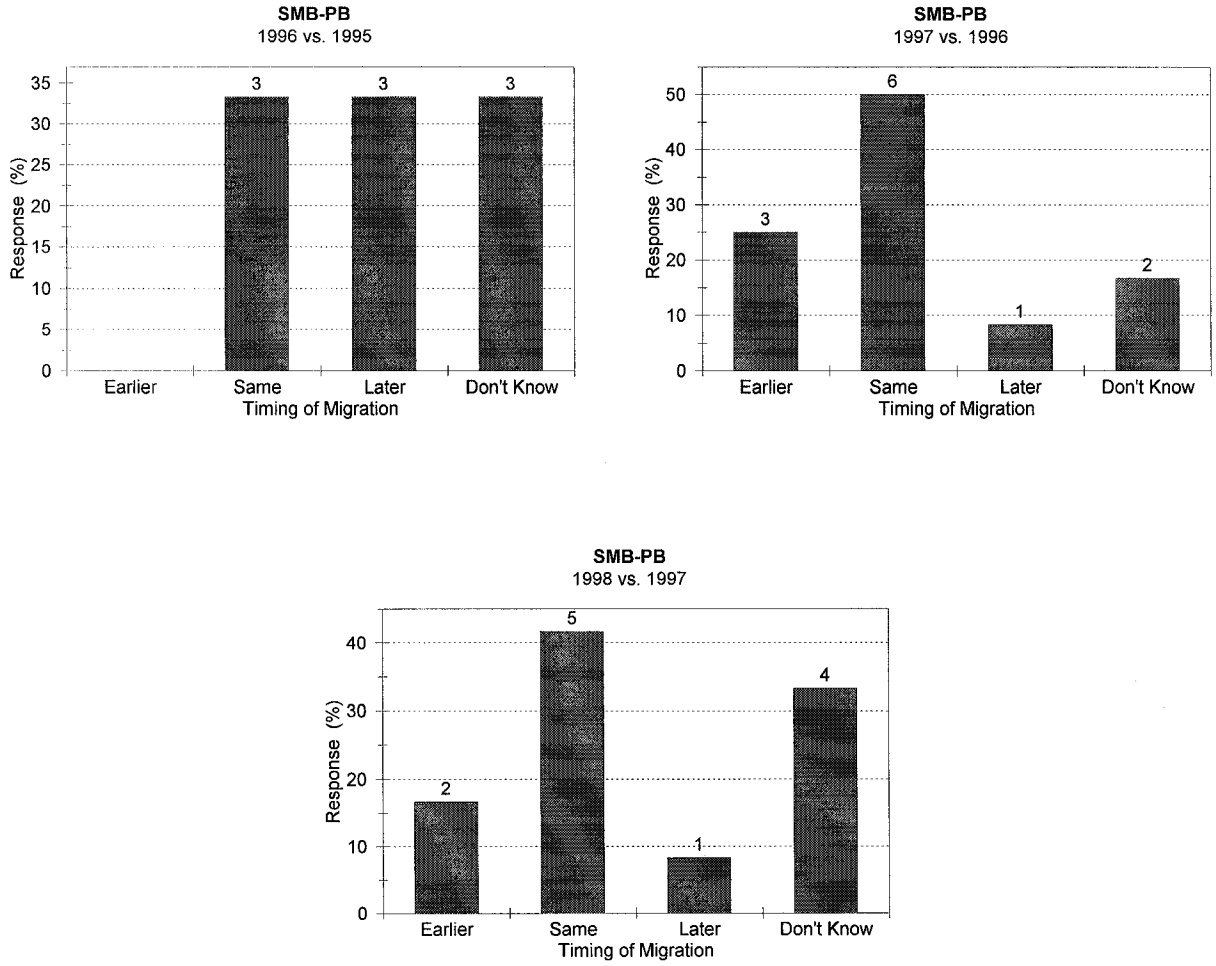


Figure 60 (cont.'). Responses to question 23 regarding the seasonal timing of herring migration in the current year compared to the previous year from the 1996 (left), 1997 (right), and 1998 (bottom) surveys for St. Mary's Bay - Placentia Bay (SMB-PB).

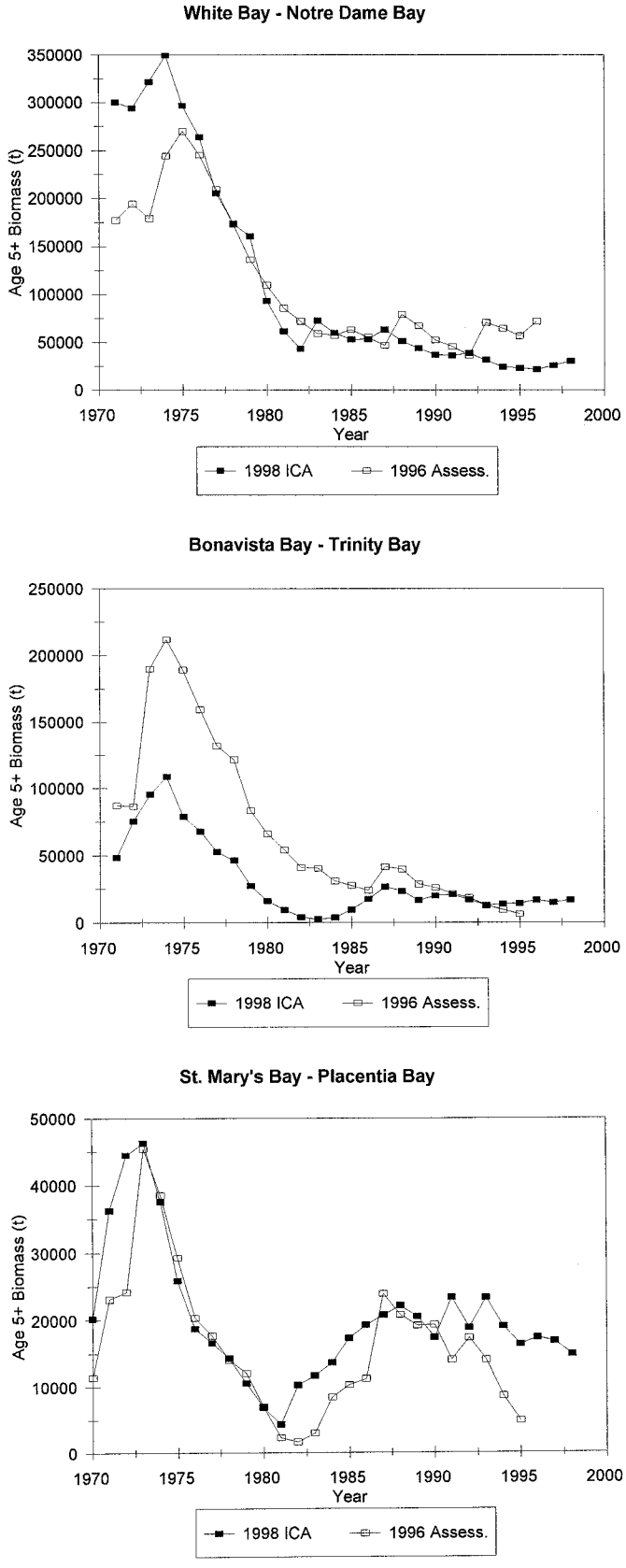


Figure 61. Comparison of age 5+ biomass estimates for WB-NDB, BB-TB, and SMB-PB from 1998 integrated catch at age analysis (ICA)

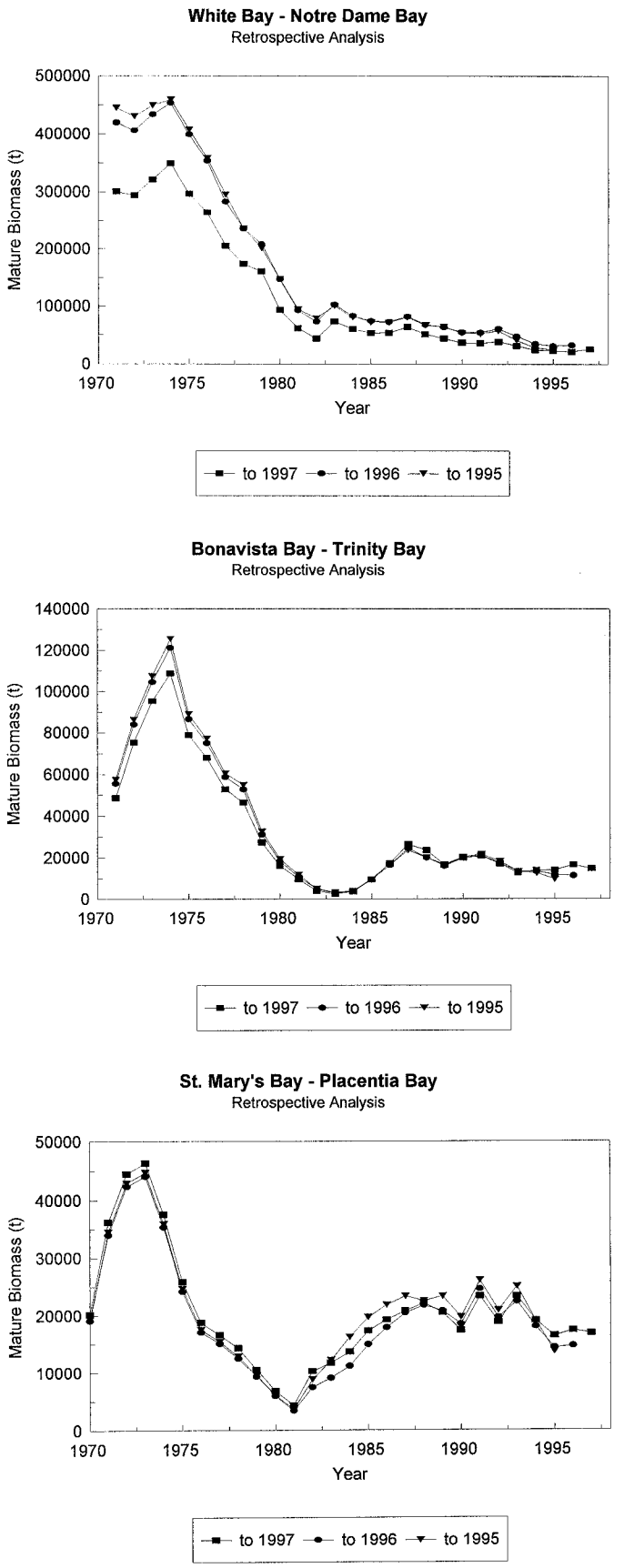
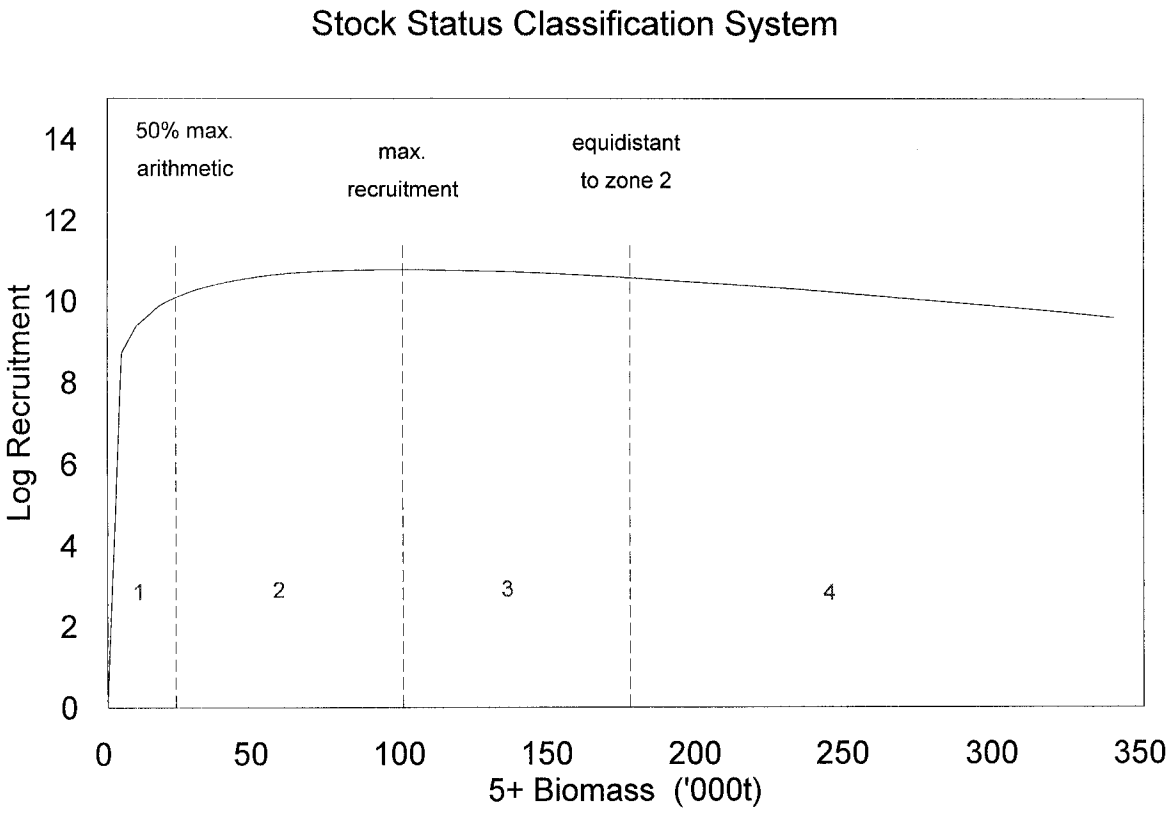


Figure 62. Comparison of retrospective estimates of mature biomass for WB-NDB, BB-TB, and SMB-PB from integrated catch at age analysis (ICA) to 1997, 1996, and 1995.



Zone	Stock Status	F	Type of Fishery
1	Very Poor	0.00 - 0.05	Scientific
2	Poor to Moderate	0.05 - 0.10	Restricted
3	Moderate to Good	0.10 - 0.20	Commercial
4	Good to Very Good	>=0.20	Accelerated

Figure 63. Definition of zones, descriptors, and exploitation rates for east and southeast Newfoundland herring stock status classification system.

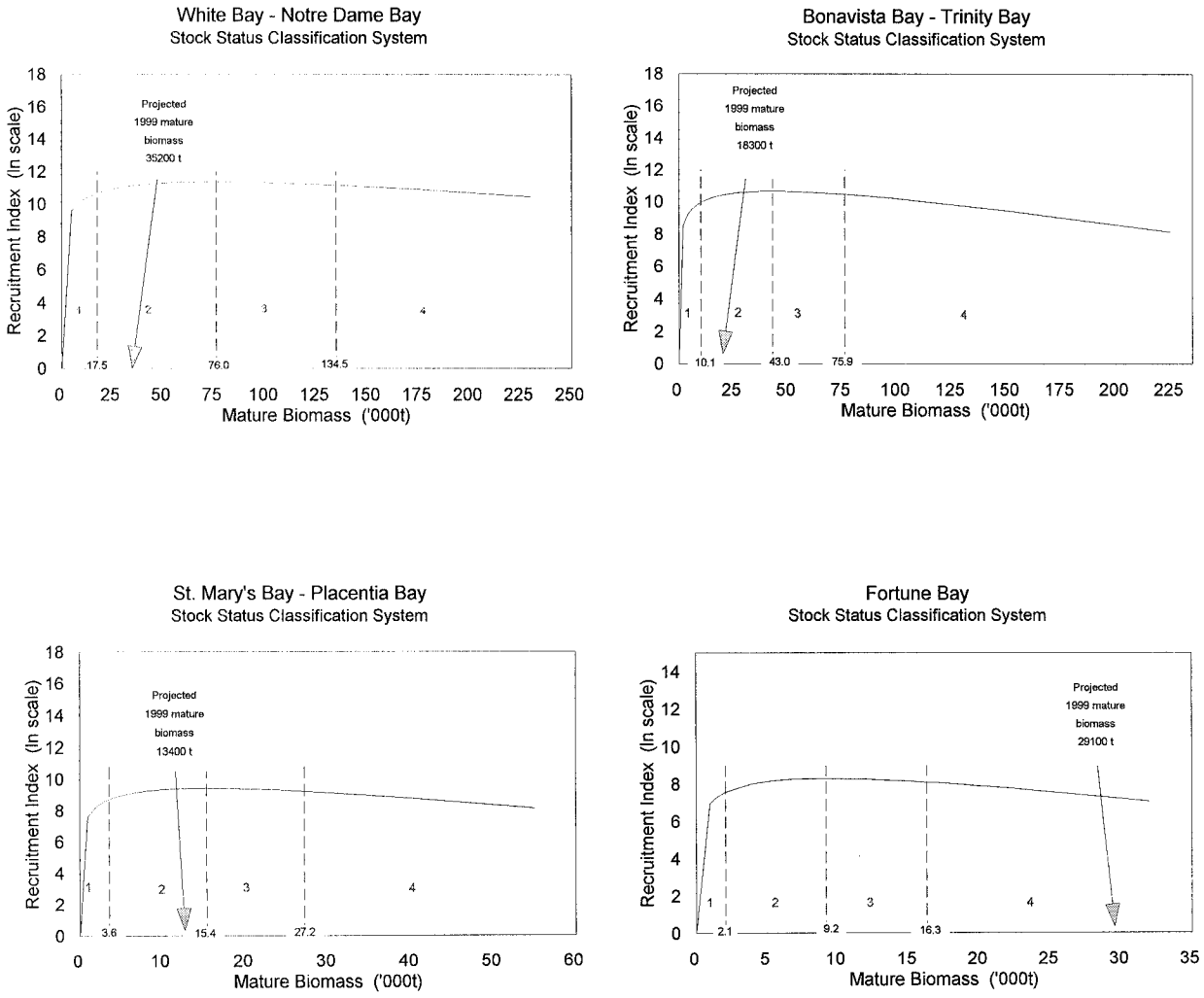


Figure 64. Stock status classification zones and projected 1999 mature biomass estimates for WB-NDB, BB-TB, SMB-PB and FB.

Appendix 1. Example of a summary sheet provided to fishers contracted under the herring research gill net program.

Department of Fisheries and Oceans
Science Branch

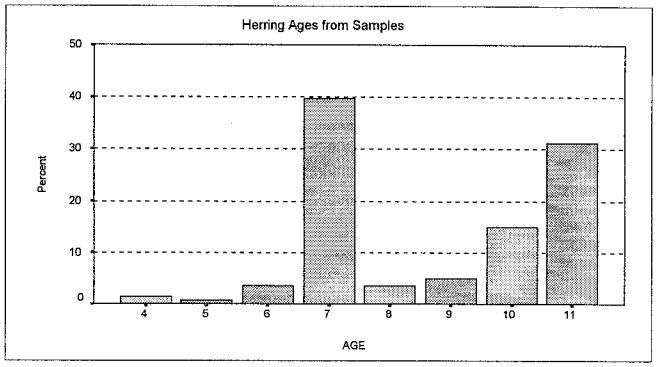
Name:
Location:
Stock Area:
Year: 1997

Herring Research Gill Net Program Summary Sheet

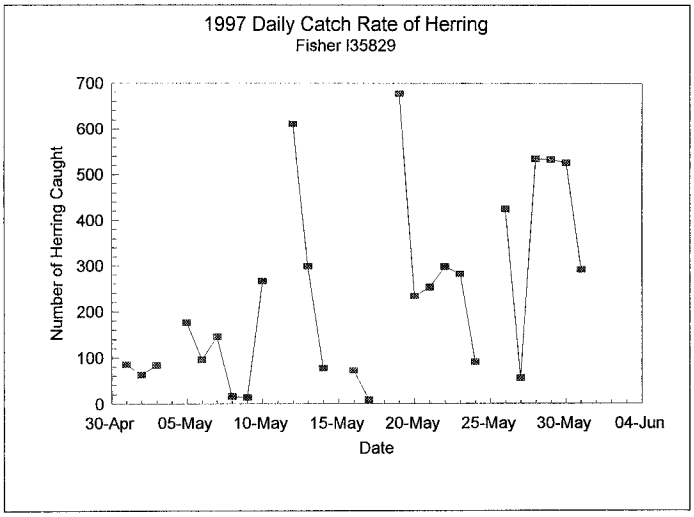
1) Herring Catch and Catch Rates by Net Size

Mesh Size	Catch (numbers)	Number of Days Fished	Days Hauled	Catch per Days Fished
2"	881	32	26	27.5
2 1/4"	937	32	26	29.3
2 1/2"	1693	32	26	52.9
2 3/4"	1816	32	26	56.8
3"	1603	32	26	50.1
All Nets	6930	32	26	216.6

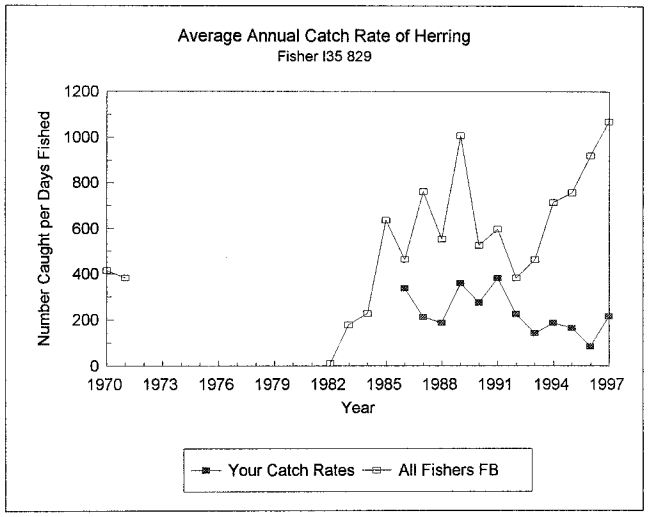
2) Age Distribution from Samples Collected by You



3) Total Daily Catch of Herring During Current Year



4) Annual Catch Rate of Herring



Appendix 2. Herring fixed gear logbook distributed to Newfoundland east and southeast coast commercial herring fixed gear fishers in 1997 and 1998.

Newfoundland East and Southeast Coast
1998 Herring Fixed Gear Logbook Program

Fishing Logsheets for the Enhanced Collection of Scientific Data

Name: _____

Mailing Address: _____

Community: _____

Postal Code: _____

Phone No.: _____

F.I.N. #: _____

Location Fished: _____

Net Mesh Size	Number of Nets Fished per Mesh Size	Net Size	
		Length (fathoms)	Depth (fathoms)
2 1/4"			
2 1/2"			
2 5/8"			
2 3/4"			
2 7/8"			
3"			

Comments: _____

Please answer the following questions as accurately as possible:

1. Using a scale of 1 to 10, with 1 being the lowest and 10 being the highest, how abundant (fish numbers) were herring in your fishing area in 1998 ? (Check one box)

[1] [2] [3] [4] [5] [6] [7] [8] [9] [10] [?]

2. Using a scale of 1 to 10, with 1 being the lowest and 10 being the highest, how abundant (fish numbers) were herring in your fishing area in 1997 ? (Check one box)

[1] [2] [3] [4] [5] [6] [7] [8] [9] [10] [?]

3. Do herring spawn each year in your area? If so, in what geographical location(s)?

_____

4. Using a scale of 1 to 10, with 1 being the lowest and 10 being the highest, how intense was herring spawning in your fishing area in 1998 ? (Check one box)

[1] [2] [3] [4] [5] [6] [7] [8] [9] [10] [?]

Please complete and return to:

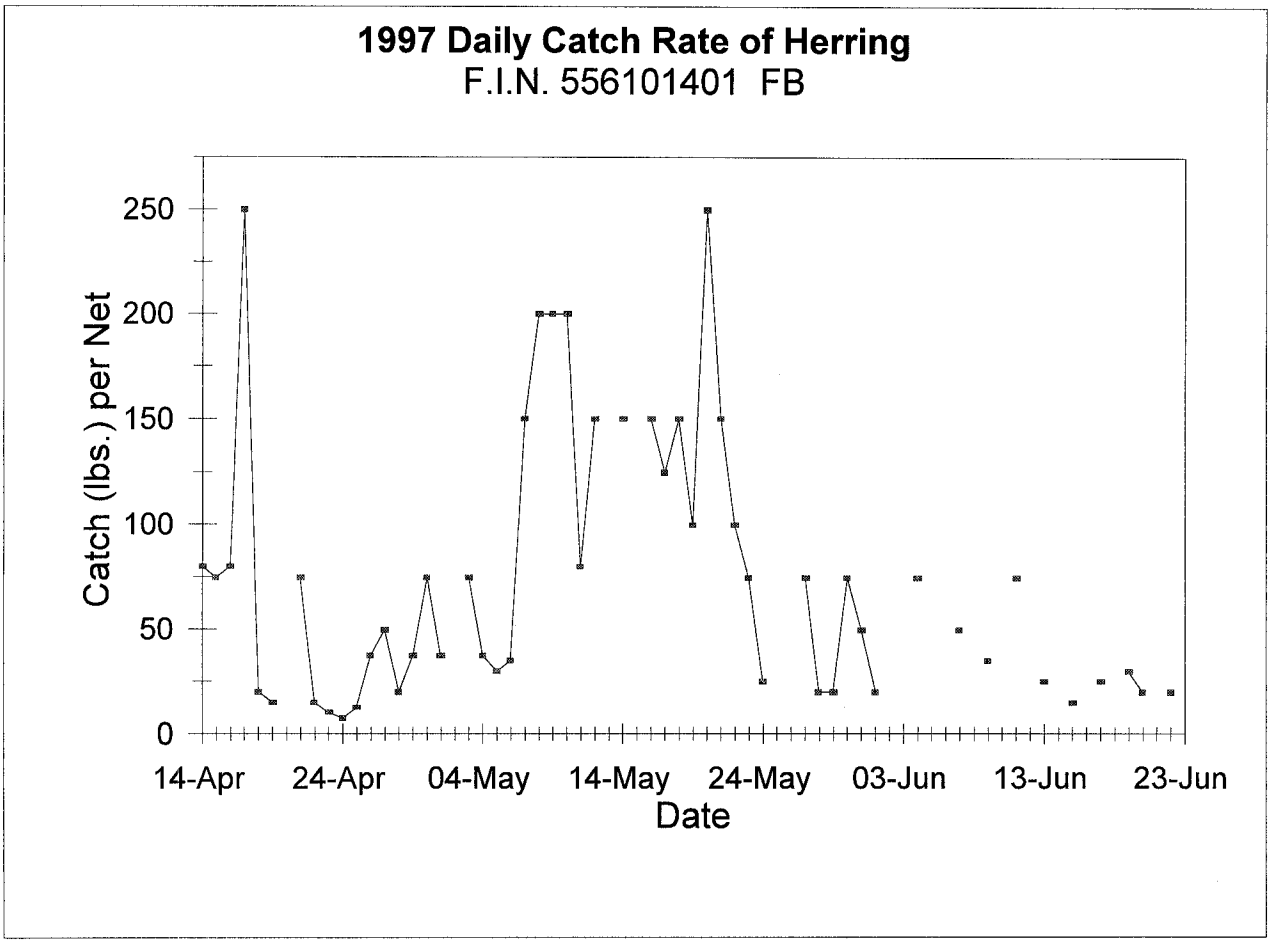
John Wheeler
Science Branch
Dept. Fisheries and Oceans
P. O. Box 5667
St. John's NF A1C 5X1

Appendix 2 (cont.'). Herring fixed gear logbook distributed to Newfoundland east and southeast coast commercial herring fixed gear fishers in 1997 and 1998.

Newfoundland East and Southeast Coast
1998 Herring Fixed Gear Logbook Program F.I.N.# ______________________

Month	Day	Number of Nets Hauled by Mesh Size 2 1/4"	2 1/2"	2 5/8"	2 3/4"	2 7/8"	3"	Number of Nights Fished	Approximate Catch Weight (pounds)	Wind Direction	Wind Speed

Appendix 3. Example of a summary graph sent as feedback to a fisher who participated in the 1997 fixed gear logbook program.



Appendix 4. Questionnaire used in 1998 to quantify observations of purse seine fishers.

East and Southeast Newfoundland Herring
Survey Questionnaire of Purse Seine Herring Fishers

Name of Interviewer: _____

Date Contacted: _____

The Pelagic Section of DFO Science currently collects information on herring stock status using various methods such as research gillnet catch rates, acoustic surveys, and commercial gillnet logbooks. To supplement these information sources and to quantify the observations of purse seine fishers, this questionnaire is designed to gather information on herring abundance, spawning behaviour and the fishery in your area. As we do not have the personnel to be aboard your vessel during the fishery, we are asking that you provide detailed observations. We are contacting all purse seine fishers involved in this year's fishery. Your answers will be confidential and will be combined with the answers of all respondents. The final results will resemble that of an opinion poll or marketing survey and will be used in the next assessment of these herring stocks. We will mail you a summary.

The questionnaire will take approximately 20 minutes to complete.

Questions on Herring Abundance

1. Using a scale of 1 to 10 with 1 being the lowest and 10 being the highest, how abundant (fish numbers) were herring in your home bay this year?

Ans: 1 2 3 4 5 6 7 8 9 10 ?

2. Using a scale of 1 to 10 with 1 being the lowest and 10 being the highest, how abundant (fish numbers) were herring in your home bay last year?

Ans: 1 2 3 4 5 6 7 8 9 10 ?

3. How would you describe the abundance of herring this year compared to when you first started fishing herring?

Ans: Lower Same Higher Don't Know

Appendix 4 (cont.'). Questionnaire used in 1998 to quantify observations of purse seine fishers.

Questions on the Fishery

8. In what bay(s) did you fish herring by purse seine this year (1998)? **If more than one bay, answer questions 9 - 22 for each bay fished**.

Ans: _____

9. In what month(s) did you fish this year (1998)?

Ans: 1 2 3 4 5 6 7 8 9 10 11 12

10. In what geographical location(s) did you have successful set(s) ie. sets in which herring were caught?

Ans: _____

11. How many directed purse seine sets did you make for herring during the fishery this year ie. successful and unsuccessful?

Ans: _____

12. How many successful purse seine sets did you make ie. sets in which herring were caught?

Ans: _____

13. Did you share herring from any of <u>your</u> successful sets with other fishers ie. give herring to other fishers from your sets? If so, how much (lbs.) and to whom?

Ans: _____lbs. _____

14. Of successful sets, what percentage were during daylight?

Ans: _____% Daylight

15. How did the number of herring schools detected (per day) during the fishery this year compare to last year?

Ans: Lower Same Higher Didn't Fish Don't Know

Appendix 4 (cont.'). Questionnaire used in 1998 to quantify observations of purse seine fishers.

16. How did the size of herring schools detected during the fishery this year compare to last year?

Ans: Lower Same Higher Didn't Fish Don't Know

17. How did the number and size of herring schools detected during the fishery this year compare to when you first started fishing herring?

Ans: Lower Same Higher Don't Know

18. How much herring (lbs.) did you land this year?

Ans: _____ lbs.

19. How much herring did you discard (did not land, sell or give away) this year? If none, go to question 22.

Ans: _____ lbs.

20. What percent of discarded herring do you think survived?

Ans: _____ %

21. Why were herring discarded (order of importance)?

Ans: _____

22. How does the amount of herring discarded this year compare to last year?

Ans: Less Same More Don't Know

23. How does the seasonal timing of herring migration into your home bay this year compare with last year?

Ans: Earlier Same Later Don't Know

Appendix 4 (cont.'). Questionnaire used in 1998 to quantify observations of purse seine fishers.

General Information

24. In what year did you first start fishing herring commercially by purse seine?

Ans: _____

25. What is the length and capacity (maximum weight of herring it can carry) of your vessel?

Ans: _____ft. _____lbs.

26. What is the size of your purse seine (length and depth)?

Ans: _____fathoms long _____fathoms deep

27. How old are you?

Ans: <25 25-34 35-44 45-55 >55

28. Thank you for your patience and time. Are there any comments you wish to make on the questionnaire itself or any comments in general?

Ans: _____

_____

_____

_____

_____

_____

_____

_____

_____

Appendix 5. Assessment Review Proceedings

Assessment Deliberations

Prior to the formal assessment meetings, the Herring Working Group of the Small Pelagics Advisory Committee met on September 22, 1998. An overview of all information available for the assessment was presented to the group for their review and comments. Some members of the Working Group suggested that declines in commercial and research gill net catch rates in Bonavista Bay - Trinity Bay did not concur with their observations. It was pointed out that 1998 commercial gill net catch rates for the area were calculated from only three logbooks from Trinity Bay, and none from Bonavista Bay, and may therefore not be representative. A discussion ensued on how to encourage gill net fishers to complete and return their logbooks. A suggestion was made to canvass these fishers by phone similar to the telephone survey of purse seine fishers. This was to be considered dependent upon cost.

The Regional Assessment Review Committee, under of the chair of Don Stansbury, met on several occasions between September 22nd and the end of October to review the status of east and southeast Newfoundland herring and to prepare a Stock Status Report. The participants (Appendix 6) included representatives from Science Branch within the Region, from Fisheries Management Branch, and from the Fishermen, Food and Allied Workers Union.

During the first meeting on September 24, 1998, John Wheeler presented a series of five Working Papers: 1) Description of the east and southeast Newfoundland 1996 and 1997 commercial herring fisheries and commercial catches at age, 2) Results of east and southeast Newfoundland herring commercial fixed gear logbooks for 1996, 1997, and 1998, 3) Results of east and southeast Newfoundland herring purse seine questionnaires for 1996, 1997, and 1998, 4) Results of east and southeast Newfoundland herring research gill net program for 1996, 1997, and 1998, and 5) Distribution and abundance of Atlantic herring from acoustic surveys of: Bonavista Bay - Trinity Bay November - December 1996, Fortune Bay January - February 1997, White Bay - Notre Dame Bay November - December 1997, and St. Mary's Bay - Placentia Bay March - April 1998. Results from these papers formed the basis of the assessment and have been incorporated in Research Document 99/13. No new data regarding ecological factors were available or presented at the assessment.

There was a limited discussion of the five Working Papers during the first meeting. There was questions regarding the potential for aging errors given that the 1990 year class was dominant in the fishery in White Bay - Notre Dame Bay but the 1991 year class was dominant in most other areas. However, aging errors were unlikely as the 1990 year class had been detected in White Bay during an acoustic survey in the fall of 1990 as 0 group but had not been detected in other areas. There was some discussion regarding the lack of information available on catches for bait purposes in the commercial catch statistics. It was suggested that fixed gear fishers be interviewed to better assess the problem. A concern was expressed regarding the potential for over-exploitation of stock components when fishing is concentrated in a localized area as was the case during the 1997 fall purse seine fishery in the eastern part of Notre Dame Bay. However, it was pointed out that spawning components tend to be intermixed in the fall and with exploitation rates of 10% - 20%, this should not be a problem. There was a question as to why older fish were not present in samples from the 1997 White Bay - Notre Dame Bay acoustic survey? This could not be fully explained; however, it was noted that the area around Fogo where most of the purse seine fishery occurred could not be surveyed due to weather conditions. The meeting concluded with a discussion regarding the sources of data to include in the assessment of the stocks. It was decided to attempt using an integrated catch at age analysis (ICA) to estimate stock sizes using research gill net catch rates at age and acoustic biomass estimates as abundance

indices. It was decided not to use the commercial gill net catch rates and the gill net and purse seine fisher observations due to their limited time series.

At the second meeting, a Working Paper was presented on the estimation of stock sizes of east and southeast Newfoundland herring to 1998. It listed the data and parameters used as input for ICA plus output population numbers, fishing mortality matrices and visual diagnostics. Discussion centered around the input data and parameters and interpretation of the visual diagnostics. It was apparent that the ICA model could not be fitted for Fortune Bay due to the extremely low levels of catch and associated fishing mortalities. Given no other suggestions, it was decided to revert to the catchability analysis used in the last assessment to again estimate the Fortune Bay stock size. It was pointed out that a fixed maturity ogive of 1.00 was used as ICA input. It was recommended that a partial selection pattern be used instead. There was considerable discussion of the sensitivity of ICA to various input data and parameters. It was recommended that the model be tested as to its sensitivity to such things as different abundance indices, varying years of separable constraint, the choice of a catchability relationship for the abundance index, and the choice of estimates of the extent to which errors in each age of the age structured indices are correlated.

At subsequent meetings, addenda to the Working Paper on the estimation of stock sizes were presented. The sensitivity analysis showed that results from the ICA model were not sensitive to the inclusion or exclusion of research gill net catch rates from the early 1970's. They were also not sensitive to the use of only the research gill net catch rates or a combination of research gill net catch rates and acoustic biomass estimates as abundance indices. With respect to the model parameters, results were somewhat sensitive to the choice for the number of years for separable constraint; choices of six years of less yielded less consistent results. Results were very sensitive to the choice of a catchability relationship for each of the abundance indices; ie. a direct identity relationship, a power relationship, or a linear proportionate relationship. Similarly, results were also very sensitive to the choice of estimates of the extent to which errors in each age of the age structured indices are correlated, where 0 indicates independence and 1 indicated correlated errors.

A final formulation of ICA was run using a maturity ogive from Wheeler et al. (1989), a range of fishing mortalities from 0.02 to 3.00, and the estimate of the extent to which errors in each age of the age structured indices are correlated = 0.50 for White Bay - Notre Dame Bay and Bonavista Bay - Trinity and = 1.00 for St. Mary's Bay - Placentia Bay. For Fortune Bay, 1970 and 1971 population numbers at age were calculated from an illustrative ICA run. A catchability coefficient was then calculated using 1970 and 1971 research gill net catch rates at age. This catchability coefficient was applied to current and historical research gill net catch rates to estimate population sizes. There was very little discussion of this procedure as it had been used in the previous assessment.

The Committee recommended that the environmentally dependent stock-recruit relationships be updated to include the most recent recruitment, temperature and salinity data. This was done using the recruitment estimates from the current ICA, and temperature and salinity data (provided by Oceanography Section) to 1996. The updated relationships for White Bay - Notre Dame Bay and St. Mary's Bay - Placentia Bay did not charge significantly; however, there was a substantial change for Bonavista Bay - Placentia Bay. The updated relationships also changed the reference points between the zones of the stock status classification system. It was decided to use the updated relationships this year but not to change them in the immediate future, ie. to wait until there were several years of more data. This would allow for stability in the stock status classification system during this time.

The Committee requested that a retrospective analysis be included for each of the three stocks assessed by ICA. A five year retrospective analysis was conducted back to 1993.

For each of the stock areas, retrospective analyses to 1995 were consistent. However, for White Bay - Notre Dame Bay and Bonavista Bay - Trinity Bay, retrospective analyses to 1994 and 1993 indicated significantly larger population sizes through the 1970's. Upon closer examination, it was concluded that these differences were due to the effect of the 11+ age group which consisted primarily of the 1982 year class in these analyses. The Committee recommended that the treatment of the 11+ age group in ICA be examined prior to the next assessment.

Catch projections were run using the integrated catch projection software provided with ICA. As well as providing catch projections, the software also included a risk analysis. It was decided to provide a two year projection to 2000 to coincide with Fishery Management's proposed two year management plan. A risk analysis was included of the probability of spawning stock biomass being less than the reference level between zone 1 and 2 for White Bay - Notre Dame Bay as the projected spawning biomass for this stock was in zone 2. For Bonavista Bay - Trinity Bay and St. Mary's Placentia Bay, a risk analysis was included of the probability of spawning stock biomass being less than the reference level between zone 1 and 2 and between zone 2 and 3 as the projected spawning biomass for these stock was in zone 3. A risk analysis of this type was not possible for Fortune Bay as it could not be assessed by ICA. As the projected biomass for Fortune Bay from the catchability analysis was the same as the last assessment, it was decided to use the same risk analysis as the last assessment. There was a general discussion regarding the acceptable levels of risk. Although there was no conclusion, it was noted that the 50% level is risk neutral.

The Committee reviewed three drafts before finalizing the Stock Status Report (SSR). The format of the SSR was similar to that of 1996. Under the sources of uncertainty, it was recommended to include a section on the sensitivity of the sequential population model (ICA) to the manner in which fishing mortality is applied to plus groups. Numerous editorial changes were also made to the SSR before it was finalized on November 4, 1998.

Management Deliberations

Subsequent to the release of the SSR by the Regional Director, Science, the Herring Working Group of the Small Pelagics Advisory Committee met on November 22, 1998. John Wheeler provided an overview of the SSR. There were questions as to why there was a significant change in the status of some stocks. It was pointed out that this was a combined result of the effects of the commercial fishery, poor recruitment and the inclusion of the most recent information in the assessment.

The Working Group suggested that a cautious approach should be maintained in establishing TAC levels. Although there were no specific recommendations regarding catch levels, the Group did provide general views as to where the TAC should be for each stock in relation to the catch ranges of the stock status classification system.

The Small Pelagics Advisory Committee met by conference call on December 16, 1998 to provide recommendations for the 1999 - 2000 Integrated Herring Management Plan. There was a further discussion of the SSR, abundance indices, and factors that may influence the stock assessment process. Industry participants suggested that certain abundance indices may not be representative due to their seasonal nature, eg: the research gill net program, or due to poor coverage, eg: limited logbook returns from the commercial gill net fishery. It was explained the stock status is based upon the analysis of all abundance indices and not just one component. Recommended catch levels were tabled for the Committee's review.

On January 15, 1999, Fisheries Management Branch released the 1999 - 2000 Integrated Management Plan for East and South Coast Newfoundland Herring which incorporated the results of the 1998 Stock Status Report.

Appendix 6. Assessment Review Participants

Name	Affiliation
John Boland	FFAW Union
Jim Carscadden	Science, DFO
Bruce Mayne	Fisheries Management, DFO
Brian Nakashima	Science, DFO
David Orr	Science, DFO
Brad Squires	Science, DFO
Don Stansbury	Science, DFO
John Wheeler	Science, DFO
Paul Williams	Science, DFO