

# Discarding of Small Redfish in the Shrimp Fishery off Port au Choix, Newfoundland, 1976-80

D. B. Atkinson

Department of Fisheries and Oceans, Fisheries Research Branch  
Northwest Atlantic Fisheries Centre, P. O. Box 5667  
St. John's, Newfoundland, Canada A1C 5X1

## Abstract

The quantities of small ( $\leq 25$  cm) redfish *Sebastes* sp., caught and discarded off Port au Choix, Newfoundland, in 1976-80 were estimated from monthly sampling at sea of the catches of Newfoundland trawlers engaged in this fishery, in order to assess the impact of these discards on the redfish stock of the Gulf of St. Lawrence. Minimum estimates of population size of small redfish in the region were derived from stratified-random trawl surveys in the summers of 1976 and 1978-80. Although the quantities of small redfish discarded by shrimp-fishing vessels may have been visibly alarming, the analysis indicated that the quantities of redfish discarded annually represented less than 3.4% by number and 2.0% by weight of the estimated population of small redfish in the northeastern region of the Gulf of St. Lawrence, implying that recruitment to the exploitable stock would not be seriously affected by the discarding practices evident in 1976-80.

## Introduction

Year-class strength of redfish in the Gulf of St. Lawrence (NAFO Divisions 4R, 4S and 4T) have fluctuated greatly (Sandeman, MS 1973). Strong year-classes of the late 1950's yielded nominal catches in excess of 60,000 (metric) tons annually during 1966-75 (ICNAF, 1968-1977). Catches declined rapidly to a level of about 15,000 tons in 1979-80, due to continued poor recruitment during the 1960's, but increased to about 21,000 and 26,000 tons in 1981 and 1982 respectively (NAFO, 1981-1984), due to recruitment of good year-classes in the early 1970's.

A fishery for shrimp began in the northeastern Gulf of St. Lawrence (Esquiman Channel) in the early 1970's, with nominal catches from Div. 4R increasing from 1,400 tons in 1976 to 3,000 tons in 1980. During the early development of the shrimp fishery, it soon became apparent that substantial quantities of juvenile redfish were being caught in the small-mesh shrimp trawls and discarded at sea. Following expressions of concern by fishermen that the catching and discarding of these juveniles would have a detrimental effect on the fishery for redfish in future years when these year-classes recruit to the exploited stock, studies were initiated in 1976 and continued until 1980. The results of these investigations are presented in this paper.

## Materials and Methods

The shrimp fishery off Port au Choix (Fig. 1) is prosecuted mainly by small Newfoundland trawlers which make daily trips to the fishing grounds, with

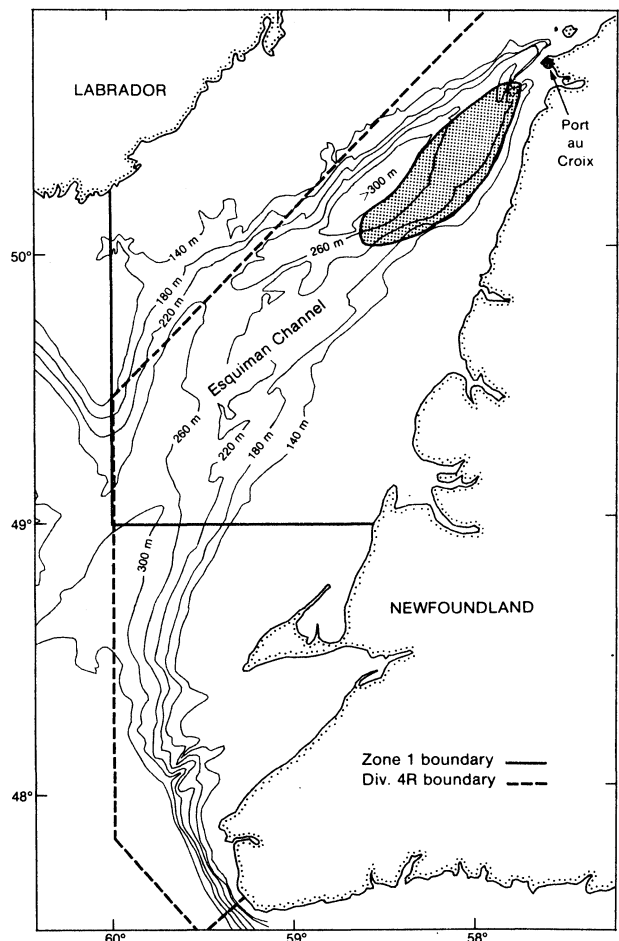


Fig. 1. Location of shrimp-fishing grounds off Port au Choix and area covered by stratified-random trawls surveys of the northeastern Gulf of St. Lawrence.

some participation by vessels from New Brunswick and Quebec since 1978. Most vessels use a Yankee No. 36 otter trawl, modified for catching shrimp, with mesh size (stretched) of 38 mm throughout. The best catches are usually obtained at depths of 220–260 m. The catches of shrimp in the Esquiman Channel off Port au Choix constitute more than 90% of the nominal catch of shrimp reported annually for Div. 4R.

Observations on the discarding of small redfish from vessels engaged in the shrimp fishery were made on a monthly basis during 1976–80. For a week in each month during the fishing season (usually April–December), two observers, stationed at Port au Choix, accompanied a different vessel to the fishing ground each day. Data were collected on weight, number and length composition of small redfish ( $\leq 25$  cm fork length) caught and discarded during these trips, together with the weight of shrimp caught and landed. The ratio of the weight of small redfish caught and discarded to the weight of shrimp caught in each weekly sampling period was computed and applied to the nominal catch of shrimp in each corresponding month for Div. 4R, to derive estimates of the number, weight and length compositions of small redfish destroyed during the shrimp fishery. For months in which no redfish data were obtained due to inclement weather during the weekly sampling periods, estimates of the quantities of discarded redfish were derived by using ratios pertinent to the preceding and/or following months. This procedure usually had to be followed at the beginning (March–April) and at the end (December) of the fishing season when fewer vessels were engaged in the fishery.

Annual estimates of the quantities and length compositions of redfish discarded during the shrimp fishery in Div. 4R were derived by summing the monthly estimates. Appropriate age-length keys were applied to the yearly length frequencies to obtain the age structure of the discarded redfish. The age-length keys for 1976 and 1978–80 were based on otolith-ageing of redfish in samples from stratified-random trawl surveys of the Gulf of St. Lawrence in the summer of these years. For 1977, when no survey was conducted, the age-length key was derived from ageing of redfish otoliths collected during the Port au Choix sampling program. The application of age-length keys to yearly length compositions is not considered to be a serious deficiency due to the slow growth of redfish (Sandeman, 1961).

Estimates of population sizes of small redfish in various parts of the Gulf of St. Lawrence during 1976 and 1978–80 were derived from stratified-random surveys in July–August with a Yankee No. 36 otter trawl adapted for shrimp fishing with 38-mm mesh throughout the net and 13-mm liner in the codend. Tows were

typically of 30-min duration and fishing was restricted to daylight hours. The stratification scheme (designed by E. J. Sandeman, Northwest Atlantic Fisheries Centre, St. John's, Newfoundland) involved division of the Gulf of St. Lawrence into four major zones which were further divided into subzones containing depth strata by 40-m intervals: 141–180, 181–220, 221–260, 261–300, and 301–340, where applicable.

The survey data for zone 1, which includes the shrimp-fishing grounds in the northeastern Gulf of St. Lawrence (Fig. 1) were analyzed to obtain standard estimates of minimum biomass and abundance of small redfish ( $\leq 25$  cm) by the method described by Smith (1981) and Smith and Somerton (MS 1981). Although the population of small redfish in zone 1 may have varied from month to month during the course of the shrimp fishery (April–December), these estimates of minimum abundance are the only data available for use, with estimates of the quantities of small redfish discarded annually in Div. 4R, in determining the proportions of the population destroyed in 1976 and 1978–80 (no survey in 1977).

## Results and Discussion

The estimated quantities of small redfish ( $\leq 25$  cm) caught and discarded by vessels engaged in the shrimp fishery off western Newfoundland (Div. 4R) declined rapidly from 1976 to 1980 as the nominal catch of shrimp increased approximately twofold during the same period (Table 1). The continued increase in mean weight of discarded redfish is attributable mostly to growth in size of fish of pre-1976 year-classes, with no indications of significant recruitment of more recent year-classes during the study period.

Length and age frequencies of small redfish caught and discarded in the shrimp fishery (Fig. 2) indicate the continued dominance of the 1973 and 1974 year-classes during 1976–80, with no evidence of significant recruitment of more recent year-classes. The 1974 year-class was dominant in 1976, 1977 and 1979, whereas the 1973 year-class dominated in 1978 and

TABLE 1. Estimated quantities of small redfish caught and discarded in Div. 4R based on monthly sampling of the shrimp fishery off Port au Choix, Newfoundland, 1976–80.

Year	Redfish-shrimp catch ratio <sup>a</sup>	Nominal catch shrimp (tons)	Small redfish discards (tons)	Mean wt. redfish discards (gm)	No. of redfish discards (10 <sup>6</sup> )
1976	1.39	1,446	1,995	18	108.4
1977	0.87	1,222	1,058	36	29.7
1978	0.26	2,123	541	52	10.5
1979	0.16	3,071	477	67	7.2
1980	0.10	2,350	233	102	2.3

<sup>a</sup> Ratio of redfish caught and discarded to landed weight of shrimp.

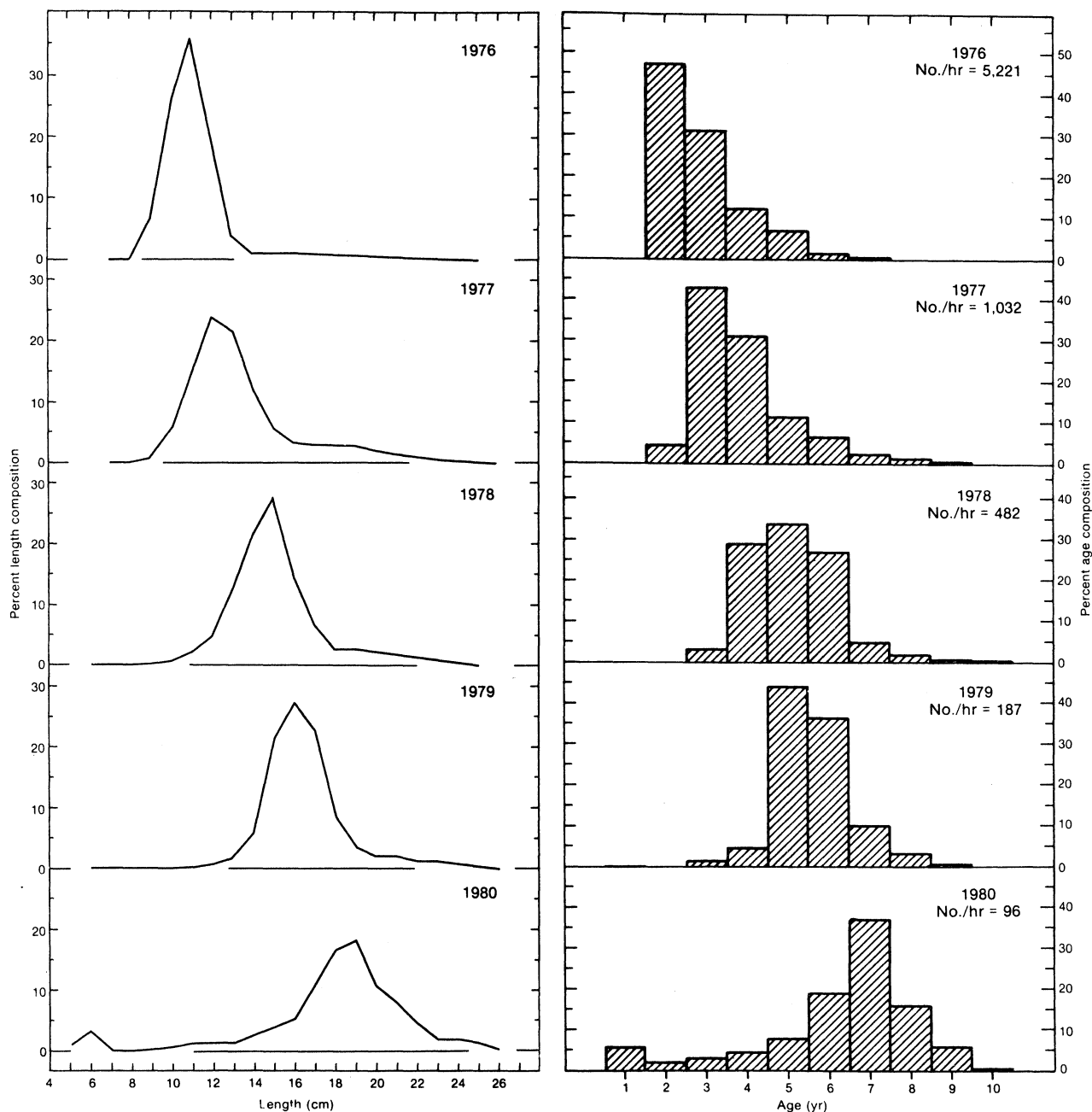


Fig. 2. Length and age composition of small redfish ( $\leq 25$  cm) caught and discarded during the shrimp fishery off Port au Choix, 1976-80.

1980. The 1971 and 1972 year-classes (age-groups 5 and 4 in 1976) also persisted throughout the study period, their declines being approximately proportional to the declines in abundance of the 1973 and 1974 year-classes, except in 1978 and 1980 when the 1973 year-class was relatively more abundant. These apparent changes in the age distributions may have resulted from ageing problems, because age interpretation of very young redfish are known to present some difficulty (Anderson and Akenhead, 1981; Lilly and Gavaris, 1982), or they may represent changes in distribution of these small fish. Because redfish migrate

from the northern part of the Esquiman Channel during winter and concentrate in the southern part of Div. 4R off St. George's Bay (D. B. Atkinson, unpubl. MS), it is possible that immigration was disproportionate to emigration for the different year-classes during 1976-80. The somewhat anomalous distributions of age-groups in 1978 and 1980 relative to those of the remaining 3 years (Fig. 2) are also reflected in the modes of the length frequencies for these years, an indication that the observed differences in age composition may not be due entirely to misinterpretation of ages. In 1980, the 1979 year-class appeared to be more

TABLE 2. Percentages of small redfish discarded in the shrimp fishery of Div. 4R relative to the estimates of minimum abundance and biomass in zone 1 from trawl surveys in 1976 and 1978-80.

Year	Number (10 <sup>6</sup> )		Percent discards	Biomass (tons)		Percent discards
	Population	Discards		Population	Discards	
1976	10,928	108.4	0.99	253,061	1,995	0.79
1978	1,599	10.5	0.66	117,298	541	0.46
1979	212	7.2	3.40	24,585	477	1.96
1980	151	2.3	1.52	22,245	233	1.05

abundant than the immediately preceding ones. This group of 5-6 cm fish was observed only in October 1980 and may represent the sizes at which juveniles first become susceptible to capture by the commercial gear. Although this group has been designated age-group 1 (1979 year-class) in Fig. 2, it is possible, due to the difficulty in ageing of small redfish, that it may represent 0-group fish (1980 year-class) which have just settled to the bottom.

Abundance and biomass of small redfish ( $\leq 25$  cm) in zone 1, derived from stratified random surveys, declined considerably from 1976 to 1980, the decrease in numbers being much greater than the decrease in biomass (Table 2), due mainly to growth in the absence of significant recruitment. In 1976, when both the abundance (from the summer survey) and the catch rate (from the shrimp fishery) of small redfish were highest, the quantities discarded represented about 1% by number and 0.8% by weight of the small redfish population in zone 1. In the remaining 3 years, when the population of small redfish in zone 1 was apparently much lower, the proportions of the population caught and discarded did not exceed 3.5% by number and 2% by weight. Because the estimates of population size are minimum estimates, these percentages are likely to be maximum values.

The implication from the results of this study is that a rather insignificant proportion of the juvenile redfish population in the northeastern part of the Gulf of St. Lawrence was destroyed during the course of the shrimp fishery off Port au Choix in 1976-80. Evidence that this area may be a major nursery ground for juvenile redfish, as postulated by E. J. Sandeman (Northwest Atlantic Fisheries Centre, St. John's, Newfoundland, pers. comm., 1978), is apparent from the presence of relatively large numbers of the 1974 and 1973 year-classes (2- and 3-year-olds) in 1976 and their subsequent rapid decline in abundance, due pos-

sibly to emigration from the region as they became older.

Although estimates of redfish abundance and biomass are available for the Gulf of St. Lawrence as a whole from the research vessel surveys for the same period, extrapolation of the results of this study in zone 1 to other regions of the Gulf where shrimp fisheries are conducted is not feasible without a knowledge of redfish discarding practices in these regions.

### Acknowledgements

The author gratefully acknowledges the assistance and helpful comments of S. Gavaris in the preparation of this paper and of D. G. Parsons under whose supervision the study was initiated.

### References

- ANDERSON, J. T., and S. A. AKENHEAD. 1981. Distribution and abundance of redfish and cod larvae on Flemish Cap in 1978 and 1979. *NAFO Sci. Coun. Studies*, 1: 57-63.
- ICNAF. 1968-1977. Fisheries statistics of the Northwest Atlantic for the years 1966 to 1975. *ICNAF Stat. Bull.*, Vol. 16-25.
- LILLY, G. R., and C. A. GAVARIS. 1982. Distribution and year-class strength of juvenile redfish, *Sebastes* sp., on Flemish Cap in the winters of 1978-82. *J. Northw. Atl. Fish. Sci.*, 3: 115-122.
- NAFO. 1981-1984. Fisheries statistics of the Northwest Atlantic for 1979 to 1982. *NAFO Stat. Bull.*, Vol. 29-32.
- SANDEMAN, E. J. 1961. A contribution to the problem of age determination and growth rate in *Sebastes*. *ICNAF Spec. Publ.*, 3: 276-284.
- MS 1973. The redfish fishery of the Gulf of St. Lawrence: biological considerations, past, present and future? *Can. Fish. Mar. Serv., St. John's Biol. Sta. Circ.*, No. 20, 19 p.
- SMITH, S. J. 1981. A comparison of estimators of location for skewed populations, with applications to groundfish trawl surveys. In *Bottom trawl surveys*, W. G. Doubleday and D. Rivard (ed.), *Can. Spec. Publ. Fish. Aquat. Sci.*, 58: 154-163.
- SMITH, S. J., and G. D. SOMERTON, MS 1981. STRAP: a user-oriented computer analysis system for groundfish research trawl survey data. *Can. Tech. Rep. Fish. Aquat. Sci.*, No. 1030, 65 p.