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Evidence for Using Otoliths to Age Redfish

by

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INTRODUCTION

Since the late 50's there has been a controversy as to whether ageing Atlantic redfish by otoliths gives a better estimate of age than by scales. Some European authors using scales (Katthaus 1949, 1952, 1958, Kosswig 1970, 1971, 1973, 1974) suggest that redfish are a relatively fast growing species which do not live much beyond 20 years of age. Age validation studies which have used otoliths as a medium indicate that redfish grow slowly and that during the first 10 years of life, only one annulus is laid down each year, (Kelly and Wolf 1959, Bratberg 1955, 1956, Perlmutter and Clark 1949, Sandeman 1961, 1969 and many others). In the early years to about age 6 there is reasonable agreement in ageing by otoliths or scales of yellowtail rockfish (Kimura et al 1979) but in subsequent years redfish otoliths and scales became increasingly more difficult to read. In spite of this Sandeman (1961) and Beamish (1979) have found that otoliths can be read and frequently redfish are found to reach 60 years or older.

Length frequency distributions have been used to estimate the age of fish since late in the 19th century. The 1956 and 1958 S. mentella year-classes in the Gulf of St. Lawrence were exceptionally large relative to year-classes produced previously and subsequently. Thus, dominance of these year-classes allows for using the "Petersen" method of examination of length frequencies for verifying the validity of one of the two different methods of ageing. Previously Hansen (1959) reported a series of length frequency measurements of small redfish from Godthaab and Tunvgdoliarfik Fjords and Sandeman 1961 similarly for Hermitage Bay both of which illustrate progression of the modes of different year-classes during the early years of the life of the redfish, but no studies have been presented which have a longer time series. This study attempts to follow the modal lengths of the 1956 and 1958 S. mentella year-classes from the Gulf of St. Lawrence from 1959 to 1979 and compare to ageing data for certain years to support the use of otoliths for ageing Atlantic redfish.

METHODS

Sebastes mentella frequencies and otoliths have been collected from the Gulf of St. Lawrence by research surveys for most years from 1959. The numbers caught per hour trawled unsexed young fish, males and females were calculated (Figure 1) and the three categories are shown summed in Fig. 2. For those years in which otoliths were read the number per hour trawled were calculated for males and females (Fig. 3). From age length keys the average length-at-age has been calculated for the 1956 and 1958 year-class for the period 1972-80 (Table 1).

The Petersen method is generally used to estimate the age of a year-class and has been found to be less reliable on older age groups. Use of the method here is not to determine the age of the year-classes but to follow the two year-classes for approximately 20 years noting the lengths at age to demonstrate that S. mentella are long lived and slow growing; much longer lived than is indicated by ageing by scales but more in line with the ages indicated by otoliths.

RESULTS AND DISCUSSION

Because of the slow growth rate and the great age Atlantic redfish reach relative to their overall length, the absolute age may seldom be known. In most cases secondary evidence by length frequencies prove to be inadequate because of the failure to reliably separate the older age groups due to increased dispersion and lessening of the distance between modes. For the purpose of demonstrating that ageing by otoliths is superior to scales, it can readily be seen in Fig. 1 and 2 that one or more year-classes starting in 1959 have dominated the length frequencies throughout the period 1959-1979. The high catch per hour of unsexed small fish in 1959 are thought to represent the 1956 year-class and subsequently the frequencies show another year-class, thought to be that of 1958, enter in 1960. The progression of the modes of these two year-classes can clearly be followed from 1959 to the mid 70's with little interference from other year-classes because of the almost total failure of recruitment during the 1960's. In the late 70's the evidence is not as clear because of entry one year-class from the early 60's and the decrease in abundance in the two dominant year-classes. The importance of these frequencies, however, is not the absolute age but the length of the fish relative to the number of years they are clearly observed to dominate in the frequencies. If it is accepted that the unsexed small (mode 14 cm) redfish are 2 or 3 years old in 1959, then these same fish at 30-35 cm in 1974 would be 17 or 18 years old. From age length keys of redfish from other areas of the Northwest Atlantic using scales these fish would be considered to be 10-12 years old. Moreover, it has been found that growth rate differences cannot account for the large discrepancy in length indicated. Comparison of age length keys by the two methods (otoliths and scales) from other stocks show the same relative differences as for the Gulf of St. Lawrence. For a number of other species it has been found that ageing by scales tends to underestimate the age of older fish which apparently occurs in S. mentella also.

For those years after 1974 the dominance of the two year classes is not as clear in the length frequencies. If the estimated ages of the 56 and 58 year classes are accepted as reasonably accurate we can follow their progress to 1979. From the catch at age per tow the two yearclasses dominate the frequency in the older age groups from 1972-77 and continue to do so but to a lesser extent during 1978 and 1979, (Figure 3).

Table 1 indicates that male and female redfish from the 56 and 58 yearclass increased in length by between 3 and 4 cm between 1972 and 1980 which results in a growth rate of less than one cm per year after 14 years old.

In conclusion length frequencies of S. mentella indicate that ageing by otoliths gives a better estimate of the actual age than by scales. Second the growth rate of S. mentella is extremely low and does not fit the fast growth hypotheses.

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Table 1. Average length-at-age of the 1956 and 1958 year-class of S. mentella in the Gulf of St. Lawrence from 1972-1980.

Age	1972	1973	1974	1975	1976	1977	1978	1979	1980
					Males				
14	30.2								
15		30.15							
16	30.75		31.24						
17		31.57		30.97					
18			32.16		31.36				
19				31.12		31.12			
20					32.38		32.00		
21						32.87		32.80	
22							32.89		33.58
23								33.32	
24									34.04
					Females				
14	32.03								
15		32.88							
16	33.19		34.95						
17		33.84		33.67					
18			35.03		34.63				
19				33.75		33.83			
20					35.88		34.80		
21						34.90		35.67	
22							36.05		36.50
23								36.31	
24									37.08

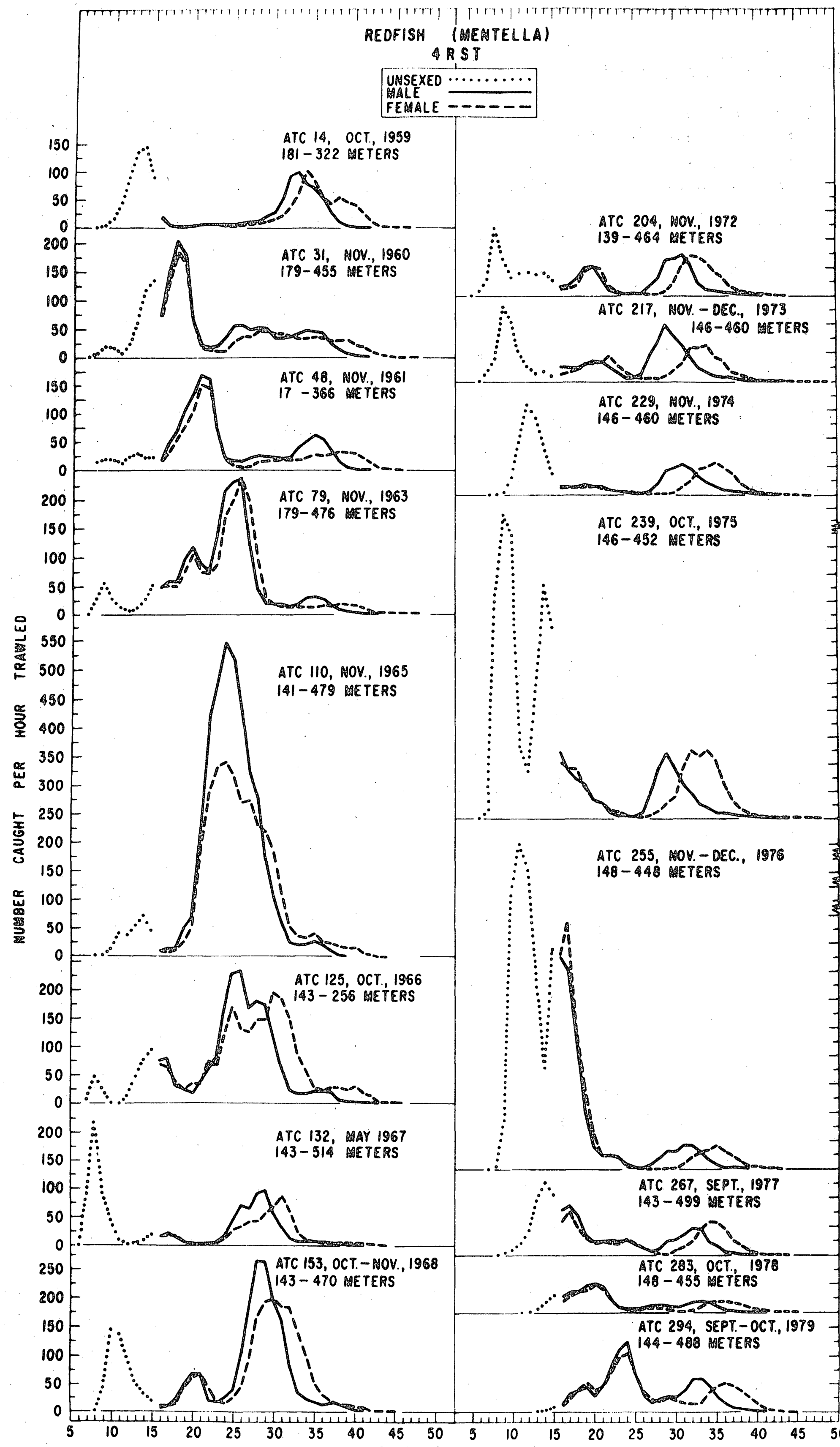

Fig. 1. Catch per hour trawled of unsexed, male and female S. mentella from research surveys in the Gulf of St. Lawrence from 1959 to 1979.

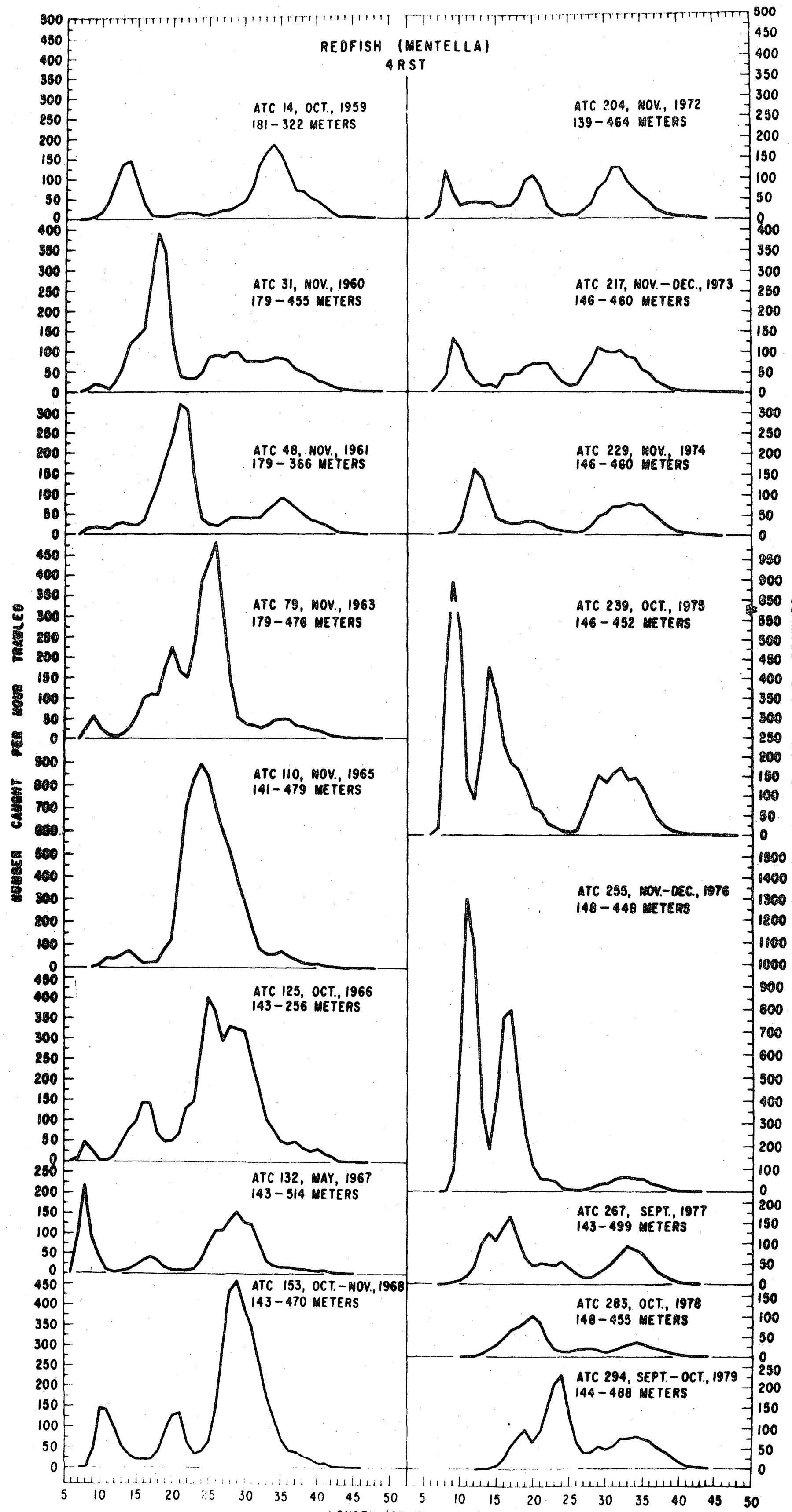

Fig. 2. Catch per hour trawled of combined sexes of S. mentella from research surveys in the Gulf of St. Lawrence from 1959 to 1979.

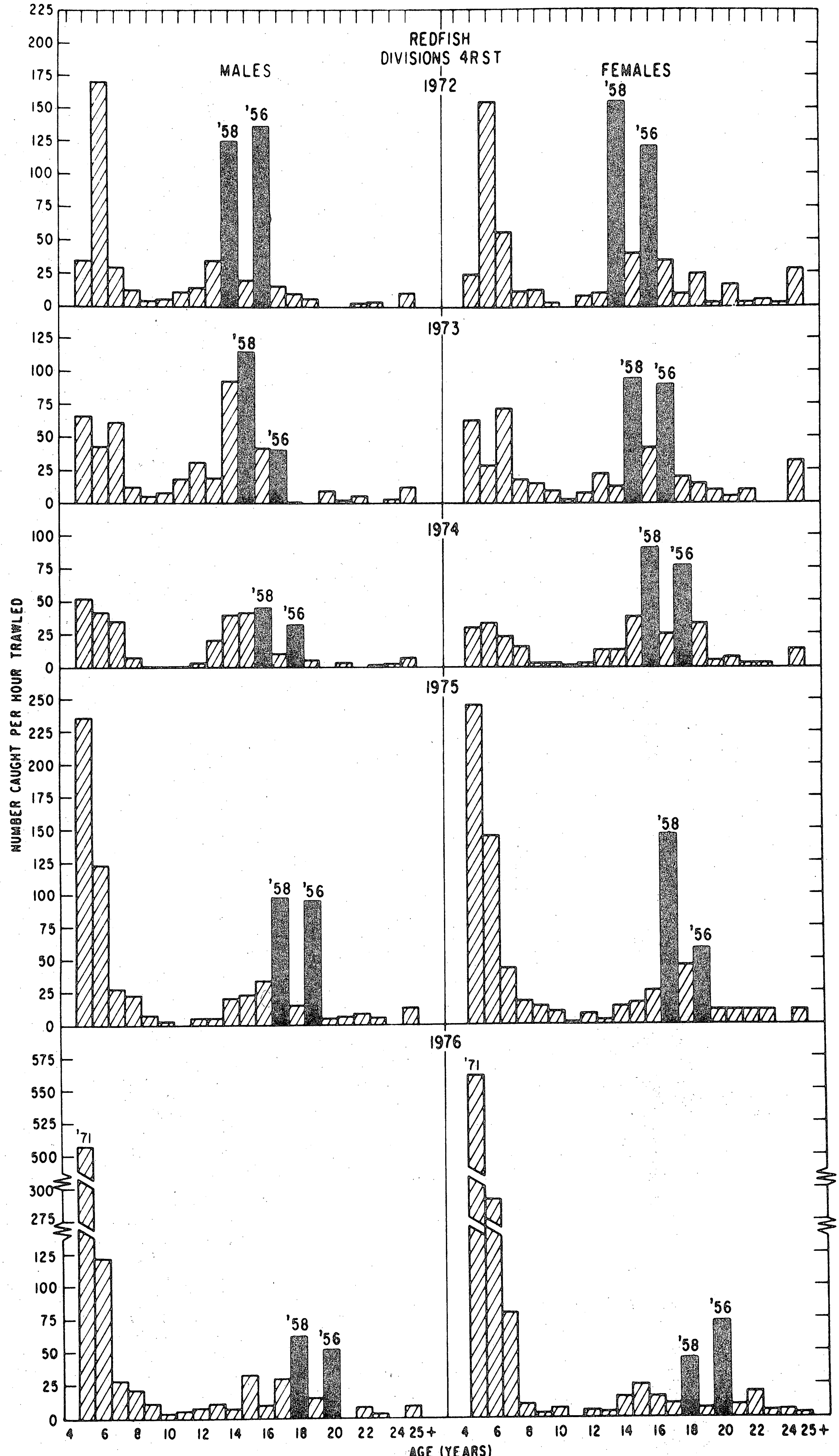

Fig. 3. Catch per hour trawled at age of male and female S. mentella from research surveys in the Gulf of St. Lawrence from 1972 to 1979.

Figure 3 continued -