

Recent Problems in Ageing Sea Herring from  
the Gulf of Maine

by

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## INTRODUCTION

Otoliths from adult Gult of Maine sea herring collected during the fall and winter of 1978 and 1979 have shown several growth anomalies which could lead to difficulty in age interpretation. Although growth checks on herring otoliths reaquently appear during summer opaque growth, they are usually readily distinguishable from the hyaline zones of winter annuli. Routine examination of 1973, 1973, and 1975 year class age samples from the winter of 1978 to 1979 indicated that a number of otoliths had one or more of the following anomalies: an unusually narrow 1978 summer opaque zone, a strong fall check, and an opaque edge where there is normally winter hyaline. These anomalies may also be present on otoliths of older herring but increasing zone thinness makes this analysis difficult. It was considered advisable to document these anomalies by examining otolith growth for the above year classes using samples collected from September, 1978, to March, 1979. In this way, ageing errors due to overinterpretation (when a strong fall check is present) may hopefully be avoided.

## METHODS

Sixty to a hundred pairs of herring otoliths, from age groups 3+-4, 4+-5, and 5+-6 (fall to winter), were sampled randomly each month from September, 1978, to February, 1979 (see Table 1). Only seventeen pairs were available from these age groups in March, the month when this study was done. Relatively few of the 1974 year class were represented, as this year class is less abundant than the 1973 or 1975 year classes.

The otoliths used in this study had been routinely prepared for ageing by imbedding in a synthetic resin (Permout) on black plastic trays with circular depressions. They were examined at 20X jointly by two experienced

herring age readers. The width of the last summer growth zone near the edge was classed as either "normal" or unusually "narrow" a judgment based upon summer zone widths observed in previous years. Also noted were the presence of any strong checks in this summer zone, and the otolith edge type - "opaque" (summer) or "hyaline" (winter)<sup>1</sup>.

## RESULTS

Tables 2-4 indicate the trend of otolith growth from September, 1978, to March, 1979, for each year class. Resulting observations may be summarized as follows:

1. The presence of a strong fall check was indicated on some otoliths beginning in October, but more noticeably in November. The percentage occurrence in each year class, November through March, was: 37% of the 1973 year class, as compared with 50% of the 1974, and 15% of the 1975 year class.

2. Most otoliths with opaque edges in the winter also had strong fall checks: 12 out of 15 for the 1973 year class, and 22 out of 23 for the 1974. Otoliths of the 1975 year class had normal winter hyaline edges.

3. Summer growth, based upon otolith edge type, appeared to be largely complete<sup>2</sup> for the 1975 year class in October and for the 1974 and 1973 year classes in November (the growth period seems to begin and end later for older herring). For the summer zones of the 1975 year class, only 1 out of 152 was classified as unusually narrow (October through March samples).

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<sup>1</sup>Otoliths seeming to have thin hyaline edges were included in the "hyaline" category. Since distinguishing thin hyaline from opaque edges is difficult, some overestimation of the numbers of "narrow" summer zone otoliths may have occurred in the fall samples. These otoliths may still have been depositing opaque edge. The posterior edge of the otolith was consistently used in evaluating edge type.

<sup>2</sup>Summer growth is defined here as all opaque material deposited from the last winter annulus up to the first appearance of hyaline edge in the fall (whether of a check or an annulus).

However, 24% and 39% of 1974 and 1973 year class otoliths, respectively, had this anomaly (November through March samples).

4. A small proportion of the 1973 and 1974 year class otoliths had both a narrow summer zone and a strong fall check (11% for the 1973 year class and 6% for the 1974). However, on most, all three anomalies were present.

#### CONCLUSIONS

It is evident that a strong fall check occurs frequently among otoliths of the 1973 and 1974 year classes in 1978. A small proportion of these appears to also exhibit two other anomalies, an unusually narrow 1978 summer ring and an opaque edge in the winter. A reasonable hypothesis is that a small amount of summer growth was compensated for in the winter. Whether or not a late winter/early spring check will occur can not be determined at this time, as samples are not yet available for examination. However, some of the opaque edges of winter samples on hand hint of hyaline edge formation. Although strong fall checks occurred on some otoliths of the 1975 year class, few other anomalies were present.

Of major concern, however, to age determination is the large number of otoliths with strong fall checks and normal winter annuli. Since these checks are very similar in appearance to winter annuli, ages may easily be overinterpreted. It is recommended that otoliths be prepared for ageing such that a good contrast between hyaline and opaque zones is achieved (use of a resin to imbed them is helpful), and that ages be determined by examining the rostrum as well as the posterior edge of the otolith since checks seem to be more readily discernable on the former.

Table 1. Herring otolith samples examined for growth anomalies from the Gulf of Maine, fall 1978 to spring 1979.

Month	Sample Date	Area Sampled	Number Sampled					
			Age 3+	Age 4+	Age 5+	Age 4	Age 5	Age 6
September	9-05-78	Off Gloucester	6	5	14			
	9-11-78	Jeffries Ledge	6	4	14			
	9-19-78	Jeffries Ledge	6	3	14			
	9-22-78	Jeffries Ledge	3	9	4			
<i>Total for September</i>			21	21	46			
October	10-01-78	Jeffries Ledge	6	5	17			
	10-11-78	40°E of Jeffries Ledge	8	3	9			
	10-17-78	Cape Cod Bay	1	4	11			
	10-23-78	40°E of Jeffries Ledge	5	3	5			
	10-30-78	40°E of Jeffries Ledge	1	5	5			
<i>Total for October</i>			21	20	47			
November	11-03-78	40°E of Jeffries Ledge	5	5	6			
	11-07-78	40°E of Jeffries Ledge	-	6	9			
	11-14-78	40°E of Jeffries Ledge	5	7	9			
	11-19-78	Jeffries Ledge	7	6	5			
	11-30-78	Off Gloucester	17	1	3			
<i>Total for November</i>			34	25	32			
December	12-01-78	Massachusetts Bay	15	3	3			
	12-06-78	Massachusetts Bay	13	6	4			
	12-13-78	40°E of Jeffries Ledge	13	2	3			
<i>Total for December</i>			41	11	10			
January	1-10-79	Massachusetts Bay				5	1	3
	1-10-79	Off Gloucester				4	1	-
	1-17-79	Massachusetts Bay				6	1	1
	1-20-79	Massachusetts Bay				9	1	-
	1-21-79	Cape Cod Bay				10	1	6
	1-24-79	Off Gloucester				11	1	1
	1-29-79	Cape Cod Bay				10	1	2
<i>Total for January</i>						55	7	13
February	2-01-79	Massachusetts Bay				5	2	8
	2-06-79	Off Gloucester				10	6	6
	2-08-79	Massachusetts Bay				10	4	3
	2-21-79	Off Gloucester				12	-	2
	2-28-79	Massachusetts Bay				12	2	3
	2-28-79	Massachusetts Bay				5	4	5
<i>Total for February</i>						54	18	27
March	3-14-79	Massachusetts Bay				8	8	1

Table 2. Herring otolith growth of the 1975 year class (September 1978 through March 1979). A = Strong 3rd summer check, B = Weak 3rd summer check, C = No 3rd summer check.

Month	Check information	"Narrow" 3rd Summer Opaque Edge	"Normal" 3rd Summer Opaque Edge	"Narrow" 3rd Summer Hyaline Edge	"Normal" 3rd Summer Hyaline Edge	Total number of samples
Sept.	A		1			
	B		1		1	
	C	3	14		1	21
Oct.	A		1			
	B				8	
	C		2		10	21
Nov.	A		2		5	
	B				5	
	C		1		20	33
Dec.	A		1		4	
	B				8	
	C			1	27	41
Jan.	A				5	
	B				5	
	C				43	53
Feb.	A		1		8	
	B				6	
	C				37	52
Mar.	A				2	
	B				1	
	C				5	8

Table 3. Herring otolith growth of the 1974 year class. (September 1978 through March 1979). A = Strong 4th summer check; B = Weak 4th summer check; C = No 4th summer check.

Month	Check information	"Narrow" 4th Summer Opaque Edge	"Normal" 4th Summer Opaque Edge	"Narrow" 4th Summer Hyaline Edge	"Normal" 4th Summer Hyaline Edge	Total number of samples
Sept.	A					
	B	2	2		1	
	C	8	6		2	21
Oct.	A					
	B	2			1	
	C	3	2	9	3	20
Nov.	A	1	3		2	
	B			1	1	
	C			10	7	25
Dec.	A	3	2			
	B		1		1	
	C			1	3	11
Jan.	A		1		3	
	B				1	
	C				1, 1*	7
Feb.	A		5		7	
	B				3	
	C				1, 1*	17
Mar.	A		7			
	B			1		
	C					8

\*Some opaque material added to hyaline edge.

Table 4. Herring otolith growth of the 1973 year class (September 1978 through March 1979). A = Strong 5th summer check; B = Weak 5th summer check; C = No 5th summer check.

Month	Check information	"Narrow" 5th Summer Opaque Edge	"Normal" 5th Summer Opaque Edge	"Narrow" 5th Summer Hyaline Edge	"Normal" 5th Summer Hyaline Edge	Total number of samples
Sept.	A		5			
	B					
	C	36	4	1		46
Oct.	A	1		1		
	B					
	C	10	5	26	4	47
Nov.	A	2	2		2	
	B	1			1	
	C			15	9	32
Dec.	A	1	1		1	
	B					
	C			4	2	9
Jan.	A		1	3	3	
	B				2	
	C		1		4	14
Feb.	A	1	4	1	4	
	B				2	
	C	1		2	8 , 4*	27
Mar.	A					
	B					
	C			1*		1

\*Some opaque material added to hyaline edge.