International Commission for the Northwest Atlantic Fisheries

Serial No. 3457
(D.c.2)

ICNAF Res.Doc. 75/13

ANNUAL MEETING - JUNE 1975

A comparison between US and USSR silver hake ageing

by

E. D. Anderson and F. E. Nichy

National Marine Fisheries Service
Northeast Fisheries Center
Woods Hole, Massachusetts 02543

ABSTRACT

A new method of silver hake age determination using thin sections of otoliths is briefly described. Comparison of 1973 US and USSR age determinations from Subdivision 5Ze catches indicated a greater mean length and range in lengths for a given age from US ageing. Comparison of numbers landed at age from fourth quarter 1973 international landings (5Ze) calculated using US and USSR age-length tables and USSR length frequencies revealed marked differences in year-class strength. Since accurate age compositions of landings are critical for stock assessments and for the estimation of total allowable catches, it is recommended that differences in ageing be resolved.

INTRODUCTION

Samples of silver hake otoliths taken from 1973 spring and fall *Albatross IV* surveys were recently aged utilizing a new technique of reading thin sections. Earlier attempts at ageing silver hake were difficult because of the variable position of the first annulus and the presence of checks or accessory rings in the inner portion of the otoliths (Nichy, 1969). Age determination from whole otoliths preserved in various media to maintain transparency can often be difficult because the variable thickness or excessive opacity of the otolith often conceals the inner zones rendering it impossible to differentiate weak annuli from accessory rings. Determination of age from a thin section removed from the otolith appears to circumvent these problems.

Preliminary comparison of 1973 age determinations made by the US with USSR age-length tables submitted to the Secretariat (ICNAF, 1975a) revealed marked differences. The purpose of this paper, therefore, is to describe a new procedure for age determination and to compare the results with USSR age readings.

METHODS OF AGEING

Otoliths were stored dry following collection aboard *Albatross IV*. A macrotome with two circular carborundum blades, each 7.62 cm in diameter and 200 microns thick and separated by a small spacer the thickness of the intended section, was employed to cut a cross-section 300 microns thick from an area on the sulcus of each otolith. This type of blade produced a very smooth finish on each surface of the section and insured a high degree of resolution during examination. A standardized procedure was followed to obtain each section from the same area on the sulcus of all otoliths. The otolith was mounted on a paper tab and cemented in place with molten wax for cutting. Each section required approximately two minutes for mounting and cutting.

The otolith sections were examined over a black background while immersed in oil of cloves using a microscope at a magnification of 15-20X.

Over 3,000 silver hake otoliths were aged from the 1973 spring and fall *Albatross IV* surveys encompassing ICNAF Subarea 5 and Statistical Area 6. Only a portion of

the data are presented in this paper. All of the otolith zones from center to edge were uniformly visible in the thin cross-section. Hence, greater confidence was placed in the ages determined from this method than from examination of the whole otolith as done previously.

RESULTS

An age-length table (Table 1) was prepared using data from survey sampling strata 13-25 (Subdivision 5Ze) obtained during the 1973 fall survey (4th quarter). Fish in the sample of 391 ranged from the 6-7 cm group to the 58-59 cm group and ages varied from 0 (1973 year-class) to 13 years (1960 year-class).

The USSR age-length table submitted to the Secretariat (ICNAF, 1975a) for catches in Subdivision 5Ze in the 4th quarter of 1973 is given in Table 2. Fish in that sample of 213 were from the 14-15 cm group to the 50-51 cm group and ranged from 1 to 10 years of age.

Comparison of mean length at age between the two tables indicates marked differences (Table 3). Some of the differences probably result from the fact that the US samples were stratified and the USSR samples were taken completely at random. Mean length was much greater for all ages in the US table. The US data indicated a mean length of 25.2, 30.3, 34.5, and 41.2 cm for ages 1-4, respectively, compared to 21.3, 25.0, 28.8, and 32.8 cm for the USSR data. The US ageing also indicated a much greater range in lengths for a given age group than did the USSR results.

Numbers of fish landed per length interval were determined for the international landings (ICNAF, 1975b) from Subdivision 5Ze in October-December 1973 using USSR length frequencies submitted to the Secretariat (ICNAF, 1975a). Weight landed each month was converted to numbers landed using the mean weight from the length frequencies. The per mille length frequencies were applied to the total number to determine numbers landed at length. The US and USSR age-length tables were each applied to the numbers at length data to estimate numbers landed at age (Tables 1 and 2).

Comparison of the two sets of results indicates striking differences (Table 3). The US data showed that the 1971 year-class was predominant in the landings contributing 58.4% of the total followed by the 1972 year-class (20.8%), the 1970 year-class (16.1%), and the 1969 year-class (3.7%). In contrast, the USSR data indicated that the 1970 year-class supported the bulk of the landings (42.5%) followed by the 1969 year-class (24.6%), the 1971 year-class (15.7%) and the 1972 year-class (3.7%).

US fall survey catches of young-of-the-year silver hake have provided an estimate of relative year-class strength (Table 4). These data suggest a very good 1971 year-class for the Georges Bank (Subdivision 5Ze) stock followed by a good 1972 year-class. The 1970 year-class, however, was weak according to young-of-the-year catches, with the 1969 year-class being stronger but less than the 1971 and 1972 year-classes. The percentage contribution of the various year-classes to the commercial landings, as indicated by US age data, agrees well with the relative year-class strength shown by US fall survey data. This close agreement tends to give some degree of validity to the US age determinations.

CONCLUSION

The difficulties involved in accurate age determination of silver hake otoliths are probable causes for the disagreement between the US and USSR age-length tables. Application of these tables to length frequencies of landings for estimation of numbers of fish landed at age would give different results when used in virtual population analysis for silver hake stock assessment purposes. Accurate age compositions of the landings are critical in the estimation of total allowable catch (TAC). The lack of agreement between the US and USSR age determinations emphasizes the need for immediate efforts to resolve the differences so that future ageing can be accomplished by employing standardized procedures which would insure the greatest probability of accurate results.

LITERATURE CITED

ICNAF. 1975a. Int. Comm. Northw. Atlant. Fish., Sampling Yearbook, Vol. 18.

_____. 1975b. Int. Comm. Northw. Atlant. Fish., Statistical Bulletin, Vol. 23.

Nichy, F. E. 1969. Growth patterns on otoliths from young silver hake, *Merluccius bilinearis* (Mitch.). Int. Comm. Northw. Atlant. Fish., Res. Bull. 6: 107-117.

Table 1. U.S. silver hake age-length table from 1973 fall survey catches (4th quarter) in Subdivision 5Ze; numbers at length from international landings determined from USSR length frequencies; and numbers at age calculated from age-length table and numbers at length.

Length (cm)	Year-class and age: 1973 (0)	1972 (1)	1971 (2)	1970 (3)	1969 (4)	1968 (5)	1967 (6)	1966 (7)	1965 (8)	1964 (9)	1963 (10)	1962 (11)	1961 (12)	1960 (13)	Total	Month: Oct	Nov	Dec
	Number aged															Number landed (000's)		
6-7	2	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-
8-9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10-11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
12-13	1	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-
14-15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
16-17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	66.2
18-19	-	1	-	-	-	-	-	-	-	-	-	-	-	-	1	11.0	-	66.2
20-21	-	5	1	-	-	-	-	-	-	-	-	-	-	-	6	87.8	28.9	9.5
22-23	-	7	-	-	-	-	-	-	-	-	-	-	-	-	7	241.4	173.6	28.4
24-25	-	14	3	-	-	-	-	-	-	-	-	-	-	-	17	395.1	1220.4	56.7
26-27	-	17	12	-	-	-	-	-	-	-	-	-	-	-	29	598.1	2487.6	2057.5
28-29	-	10	74	7	1	-	-	-	-	-	-	-	-	-	92	1536.3	2574.4	2250.9
30-31	-	-	68	13	2	-	-	-	-	-	-	-	-	-	83	1311.4	2762.4	1815.8
32-33	-	-	43	20	4	2	-	-	-	-	-	-	-	-	69	652.9	2138.3	1257.8
34-35	-	-	18	11	1	1	-	-	-	-	-	-	-	-	31	230.4	1388.4	624.2
36-37	-	-	3	2	1	-	-	-	-	-	-	-	-	-	6	159.1	737.6	302.6
38-39	-	-	1	4	2	1	-	-	-	-	-	-	-	-	8	98.8	449.3	104.0
40-41	-	-	-	4	-	-	-	-	-	-	-	-	-	-	4	60.4	249.9	75.6
42-43	-	-	-	3	2	-	-	-	-	-	-	-	-	-	5	49.4	191.2	56.2
44-45	-	-	-	4	2	-	-	-	-	-	-	-	-	-	6	11.0	72.3	28.4
46-47	-	-	-	1	5	1	-	-	-	-	-	-	-	-	7	21.9	43.4	28.4
48-49	-	-	-	1	1	-	1	-	-	-	-	-	-	-	3	21.9	-	9.5
50-51	-	-	-	-	2	2	-	-	-	-	1	-	-	1	6	-	-	9.5
52-53	-	-	-	-	1	-	1	-	-	-	-	-	-	-	2	-	-	-
54-55	-	-	-	-	1	1	1	-	-	-	-	-	-	-	3	-	-	-
56-57	-	-	-	-	-	-	-	1	-	-	-	-	-	-	1	-	-	-
58-59	-	-	-	-	-	1	-	-	-	-	1	-	-	-	2	-	-	-
Total	3	54	223	70	25	9	3	1	-	-	2	-	-	1	391	5486.9	14462.7	9457.4
Mean length	8.5	25.2	30.3	34.5	41.2	44.3	51.8	56.5	-	-	54.5	-	-	50.5				
	Number landed (000's)																	
Oct	-	1168.6	3274.6	803.4	191.1	41.9	7.3	-	-	-	-	-	-	-	5486.9			
Nov	-	2924.3	8180.9	2589.6	597.3	170.6	-	-	-	-	-	-	-	-	14462.7			
Dec	-	2017.9	5719.9	1336.1	300.2	76.9	3.2	-	-	-	1.6	-	-	1.6	9457.4			
Total	-	6110.8	17175.4	4729.1	1088.6	289.4	10.5	-	-	-	1.6	-	-	1.6	29407.0			
Pct.	-	20.8	58.4	16.1	3.7	1.0	<0.1	-	-	-	<0.1	-	-	<0.1	100.0			

Table 2. USSR silver hake age-length table from 1973 4th quarter catches in Subdivision 5Ze; numbers at length from international landings determined from USSR length frequencies; and numbers at age calculated from age-length table and numbers at length.

Length (cm)	Year-class and age: 1972 1	1971 2	1970 3	1969 4	1968 5	1967 6	1966 7	1965 8	1964 9	1963 10	Total	Month: Oct	Nov	Dec
	Number aged											Number landed (000's)		
14-15	2	-	-	-	-	-	-	-	-	-	2	-	-	-
16-17	1	-	-	-	-	-	-	-	-	-	1	-	-	66.2
18-19	-	-	-	-	-	-	-	-	-	-	-	11.0	-	66.2
20-21	5	-	-	-	-	-	-	-	-	-	5	87.8	28.9	9.5
22-23	6	6	-	-	-	-	-	-	-	-	12	241.4	173.6	28.4
24-25	5	9	-	-	-	-	-	-	-	-	14	395.1	1200.4	56.7
26-27	-	9	11	-	-	-	-	-	-	-	20	598.1	2487.6	2657.5
28-29	-	2	15	-	-	-	-	-	-	-	17	1536.3	2574.4	2250.9
30-31	-	-	13	10	-	-	-	-	-	-	23	1311.4	2762.4	1815.8
32-33	-	-	2	17	1	-	-	-	-	-	20	652.9	2198.3	1257.8
34-35	-	-	-	9	11	-	-	-	-	-	20	230.4	1388.4	624.2
36-37	-	-	-	3	16	1	-	-	-	-	20	159.1	737.6	302.6
38-39	-	-	-	-	4	8	1	-	-	-	13	98.8	443.3	104.0
40-41	-	-	-	-	1	9	3	1	-	-	14	60.4	245.9	75.6
42-43	-	-	-	-	-	2	7	2	-	-	11	49.4	101.2	66.2
44-45	-	-	-	-	-	-	1	4	-	-	5	11.0	72.3	28.4
46-47	-	-	-	-	-	1	3	4	-	-	8	21.9	43.4	28.4
48-49	-	-	-	-	-	-	-	3	2	-	5	21.9	-	9.5
50-51	-	-	-	-	-	-	-	-	2	1	3	-	-	9.5
Total	19	26	41	39	33	21	15	14	4	1	213	5486.9	14462.7	9457.4
Mean length	21.3	25.0	28.8	32.8	36.1	40.0	42.8	45.4	49.5	50.5				
	Number landed (000's)													
Oct	360.6	824.6	2491.0	1252.8	321.3	119.2	62.4	46.2	8.8	-	5486.9			
Nov	544.4	2280.8	5420.9	3805.0	1619.1	494.7	182.3	115.5	-	-	14462.7			
Dec	176.3	1511.4	4599.8	2184.9	685.7	143.3	82.7	60.0	10.1	3.2	9457.4			
Total	1081.3	4616.8	12511.7	7242.7	2626.1	757.2	327.4	221.7	18.9	3.2	29407.0			
Pct.	3.7	15.7	42.5	24.6	8.9	2.6	1.1	0.8	0.1	<0.1	100.0			

Table 3. Comparison of summaries from US and USSR age-length tables from 1973 4th quarter catches in Subdivision 5Ze and percentage age composition of international landings calculated from age-length tables and USSR length frequencies.

	Year-class and age														
	1973	1972	1971	1970	1969	1968	1967	1966	1965	1964	1963	1962	1961	1960	Total
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	
	Number aged														
US	3	54	223	70	25	9	3	1	-	-	2	-	-	1	391
USSR	-	19	26	41	39	33	21	15	14	4	1	-	-	-	213
	Mean length (cm)														
US	8.5	25.2	30.3	34.5	41.2	44.3	51.8	56.5	-	-	54.5	-	-	50.5	
USSR	-	21.3	25.0	28.8	32.8	36.1	40.0	42.8	45.4	49.5	50.5	-	-	-	
	Number landed (%)														
US	-	20.8	58.4	16.1	3.7	1.0	<0.1	-	-	-	<0.1	-	-	<0.1	100.0
USSR	-	3.7	15.7	42.5	24.6	8.9	2.6	1.1	0.8	0.1	<0.1	-	-	-	100.0

Table 4. Stratified mean number per tow of young-of-the-year silver hake from US *Albatross IV* fall groundfish surveys.

	Southern New England	Georges Bank	Gulf of Maine
Year	Strata 1-12	Strata 13-23, 25	Strata 24, 26-30, 36-40
1963	12.66	3.09	11.77
1964	4.77	0.03	0.15
1965	17.04	0.18	0.47
1966	161.16	1.92	0.11
1967	1.24	1.91	0.02
1968	85.82	13.10	0.59
1969	26.13	9.10	0.43
1970	28.65	0.28	0.33
1971	69.90	34.99	9.56
1972	78.20	12.52	3.28
1973	19.96	9.15	4.88
1974	97.31	172.53	8.62