International Commission for the Northwest Atlantic Fisheries

ANNUAL MEETING - JUNE 1976

Report of the Silver Hake Ageing Workshop, Dartmouth, Canada, 1-3 April 1976

Introduction

At the 1975 Annual Meeting, STACRES agreed to hold an Ageing Workshop at Vigo, Spain, in October 1975 to consider problems in ageing cod and silver hake stocks in the ICNAF Area. This Workshop was successfully completed for cod (Summ.Doc. 76/VI/13), but because of illness, the Soviet expert was unable to attend and discussion of silver hake was deferred until a later date. A request by the USSR to the Chairman of STACRES to arrange a Silver Hake Ageing Workshop in Dartmouth on 1-3 April was agreed to by the USA and Canada and Mr. J.J. Hunt (Canada) was appointed coordinator.

Objectives

Differences between the USA, USSR and Canada in estimating the age of silver hake from otoliths (Res. Doc. 75/13) and indirect ageing techniques (Res. Doc. 76/VI/59) indicated a need to discuss both techniques of ageing and interpretation of otoliths by experts from respective countries. In particular, evaluation of a new technique of viewing otoliths developed by the USA with the aim of standardizing techniques for all reporting ICNAF Countries was considered basic to the resolution of ageing diffi- culties. Discussion of age validation studies was also considered a prerequisite for establishing growth characteristics of silver hake and relating these characteristics to age-length keys. It was again emphasized that only experts actively involved in ageing silver hake could discuss and resolve differences of opinion and establish agreed criteria for determining ages.

Time and Place

Facilities for participants were arranged in Dartmouth by the ICNAF Secretariat for 1-3 April. Microscopes and associated equipment as well as apparatus for demonstrating the USA technique of preparing otolith sections were made available. The Workshop opened 1 April with Canada and USA in attendance but without the USSR representative who was unavailable until the afternoon of 2 April. Meetings of participants were limited to the afternoon of 2 April, afternoon and evening of 3 April and the morning of 4 April because of commitments of the USSR representative to attend ongoing Assessments Subcommittee Meetings.

Participants

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Materials and Methods

Otolith samples from Subarea 4 and 5 were provided by Canada and USA and a previously exchanged sample by USSR. A desk-top computer (Hewlett-Packard 9821A and digital plotter were also available for demonstration of the Canadian technique for resolving length frequencies by modal analysis (Res. Doc. 75/104). Results of a USA-USSR otolith exchange carried out in 1975 were available for discussion. Considering the short time available for the Workshop, it was not possible to complete extensive group age readings and as a result these were limited to examination and extensive discussion of relatively few examples. In addition, the technique employed by the USA for preparing otoliths required considerable time to demonstrate and assess as a potential standardized method for examining silver hake otoliths.

Results

a) Technique

It was agreed that radical differences in preparing and storing otoliths could be a contributing factor in differing estimates of age. It was pointed out by the USA that they had initially used whole otoliths stored in a glycerine solution for age determination but had abandoned this when unable to reconcile differences in age at length and apparent modes in length frequencies. They attributed this difference to the possible masking effect of glycerine and the incidence of over-growth in the otolith and felt that a dry cross-section would minimize these problems. As a further enhancement technique, otoliths were baked prior to sectioning. The USA process consists of storing otoliths dry, baking at approximately 285°C for 4½ minutes, embedding in a paraffin wax solution and sectioning with a low-speed diamond blade saw. The resultant thin section ($\approx$ 0.25 mm) is then optionally stained with oil of cloves and viewed at a magnification of 25-50 diameters. Essentially the same effect could be achieved by baking and then breaking the otolith and examining the halves for annuli. Some difficulty could be expected in ensuring the break was close to the center of the otolith. A much clearer image of the center of the otolith was possible from sections than from whole otoliths although the problem of identifying annuli was still subject to interpretation. General agreement was reached, subject to further study, that the USA technique for examining otoliths be adopted for use in ageing silver hake.

b) Age Readings

Samples prepared by the above technique were examined by the participants and assigned ages. While the number of examples was small and considering this was the first time the USSR expert had observed sections, a high level of agreement was achieved. Results are summarized in Table 1 and unresolved ages are shown in parentheses. In discussing individual otoliths, it was apparent that all readers could identify specific zones and relate annuli to these and they agreed that disputed zones were generally diffuse and unclear. No disagreement over the first and second annuli was apparent but differences were found in identifying the third and subsequent annuli.

Results of an otolith exchange between the USSR and USA were presented to the Workshop and are summarized in Table 2. USSR ages were assigned from whole glycerine-stored otoliths while USA ages were derived from cross-sections. Close to 60% agreement was achieved in this exchange and a much higher agreement was evident in ages 1-3. These results suggest that agreement is reasonably good for fish less than 30 cm but that considerable difference exists for fish > 30 cm or older than age three. A general tendency for USSR readers to assign greater ages than the USA reader(s) also exists. It was pointed out that USA length at age distributions appeared to be extended over a longer length range with a resultant larger mean length. It was suggested by the USA that this extension could be attributed to differing growth rates for males and females, particularly at lengths in excess of 30 cm. Figure 1 shows mean lengths at age by sexes derived from the above sample.

Both sections and whole otoliths were available from the above exchange and the participants agreed to re-examine a number of these in an attempt to explain or resolve differences. Results are summarized in Table 3 and indicate less agreement than results of Table 1. While the number of samples was too small to be conclusive, some tendency for the present USSR estimates to be lower than previous ones was noted. Discussion of individual examples again suggested minimal difference in identifying the first and second annuli but considerable difference in the third and older zones.

c) Modal Analysis of Length Frequencies

Some discussion of this technique was attempted and general agreement reached in its use as an age validation study but it was recognized that modal analysis could not be considered a replacement for age determination. A demonstration of the apparatus and explanation of principle were carried out. It was generally accepted that modal analysis agreed reasonably well with USA age length keys. Figure 2 shows a Canadian survey length frequency for July 1975 resolved into modes with calculated mean lengths and standard deviations. Analysis of 1975 catch length frequencies were completed in Res. Doc. 76/VI/59 but results were not reviewed at this Workshop.

Discussion

Considering time and facilities available at this Workshop, it was recognized that agreement by all participants on correct age estimates and technique would not be possible. However, agreement in principle and introduction to techniques was achieved and the basis for a more extensive Workshop established.

Several important aspects of silver hake biology in relation to age determination were reviewed and the need to define basic growth characteristics was considered necessary before agreement in ages could be accomplished. In particular, differences in male and female growth rates and the need for age length keys by sexes are required to eliminate these effects. It was also emphasized that catch length frequencies should not be biased towards one or the other sex and must be recorded by 1-cm length intervals.

The need for a more extensive Workshop with adequate time to examine a large number of samples was accepted by the participants as the best way of resolving ageing differences. The USSR informed the Workshop that a senior ageing expert would be available for extensive review of silver hake ageing in Woods Hole, USA, at some time this autumn (1976) and it was agreed that Member Countries be invited to attend.

Conclusions

It is unfortunate that ageing problems could not be resolved at this Workshop. While participants were anxious to consider as many samples as possible and to discuss silver hake ageing problems, the time available was limited by conflicting interests in other ongoing meetings, particularly for the USSR representative.

The Workshop cannot, therefore, recommend to STACRES a mutually acceptable age length key for silver hake. At the same time, age reading of sectioned otoliths indicates a possible bias towards older age groups in the glycerine technique.

Table 1. Comparison of age estimates from USA prepared cross-sections of an April 1975 sample.

Length	Sex	USSR	USA	Canada A	Canada B	Agreed
34	♂	3	3	3	3	100%
25	♀	2	2	2	3	75%
25	♂	1	1	1	1	100%
25	♀	2	2	2	2	100%
38	♀	3	3	3	3	100%
23	♂	1	1	1	1	100%
52	♀	5	4	4	4	75%
42	♀	4(5)	4	4	4	75%
44	♀	4(5)	4	5	4	50%
25	♂	1	1	1	1	100%
47	♀	3	3	4	3	75%

Table 2. Comparison of USSR and USA age readings from April 1974 exchange sample. USSR readings from whole otoliths and USA readings from cross-sections.

Length	1 USSA	1 USA	2 USSR	2 USA	3 USSR	3 USA	4 USSR	4 USA	5 USSR	5 USA	6 USSR	6 USA	7 USSR	7 USA	8 USSR	8 USA	9 USSR	9 USA
12-13	2	2																
14-15	2	2																
16-17																		
18-19																		
20-21			1	1														
22-23			3	3														
24-25			4	5	2	1												
26-27			2	2	4	3												
28-29				1	4	2												
30-31					5	7	5	1										
32-33					3	7	4		3	1								
34-35						4	4	1	2	1	1		1					
36-37						2	2	2	6	2								
38-39								1			2	1						
40-41								1			3	3	2	1				
42-43										2	1	2	3					
44-45								1		1		2		2	3			
46-47														2	2			
48-49																		
50-51															1	1		
52-54															1			
54-55													1				1	
Total	4	4	10	12	18	26	15	7	11	7	7	8	7	5	7	1	1	0
Mean	13.0	13.0	23.9	24.3	28.8	31.3	32.9	37.3	35.0	38.5	39.3	41.7	42.5	44.5	47.1	50.0	54.5	

Table 3. Comparison of present and previous age readings of USA-USSR exchange sample.

Length	Sex	USSR Present	USSR Previous	USA Present	USA Previous	Canada A	Canada B
26	♀	3	3	3	-	3	3
42	♀	6	7	5	6	5	5
29	♀	4	3	3	3	3	3
42	♀	6	7	5	5	5	4
24	♀	3	2	3	2	2	3
33	♂	7	5	7(8)	6	7	6(7)
26	♀	3	3	4	3	3(4)	3
31	♀	3	3	3	3	3	3
22	♀	2	2	3(2)	2	2	2
30	♂	4	4	5	-	4	5
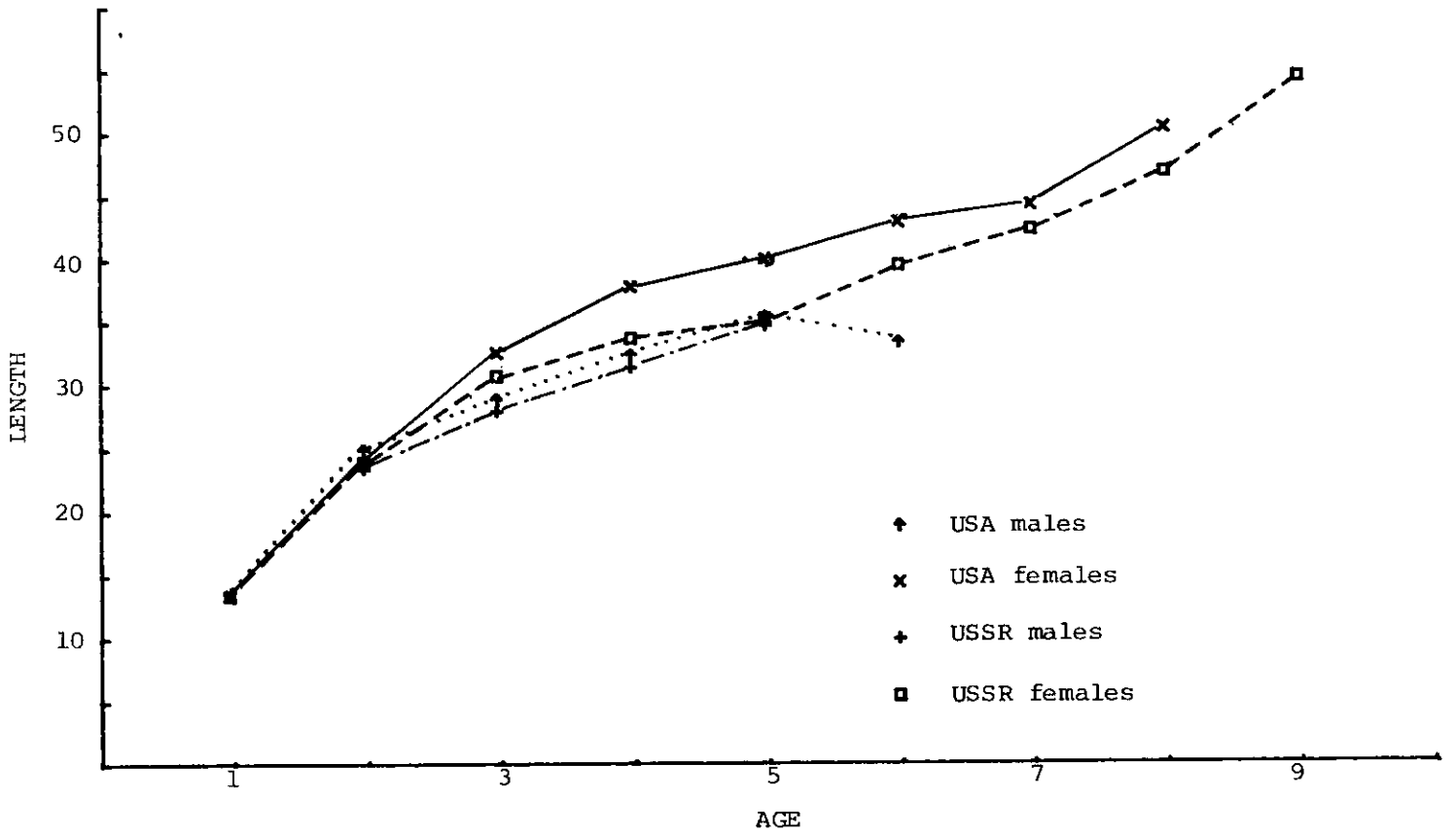
Figure 1. Comparison of USA-USSR mean lengths at age by sex.

Mode at 21.24 cm
SD   2.598
R^2 0.97

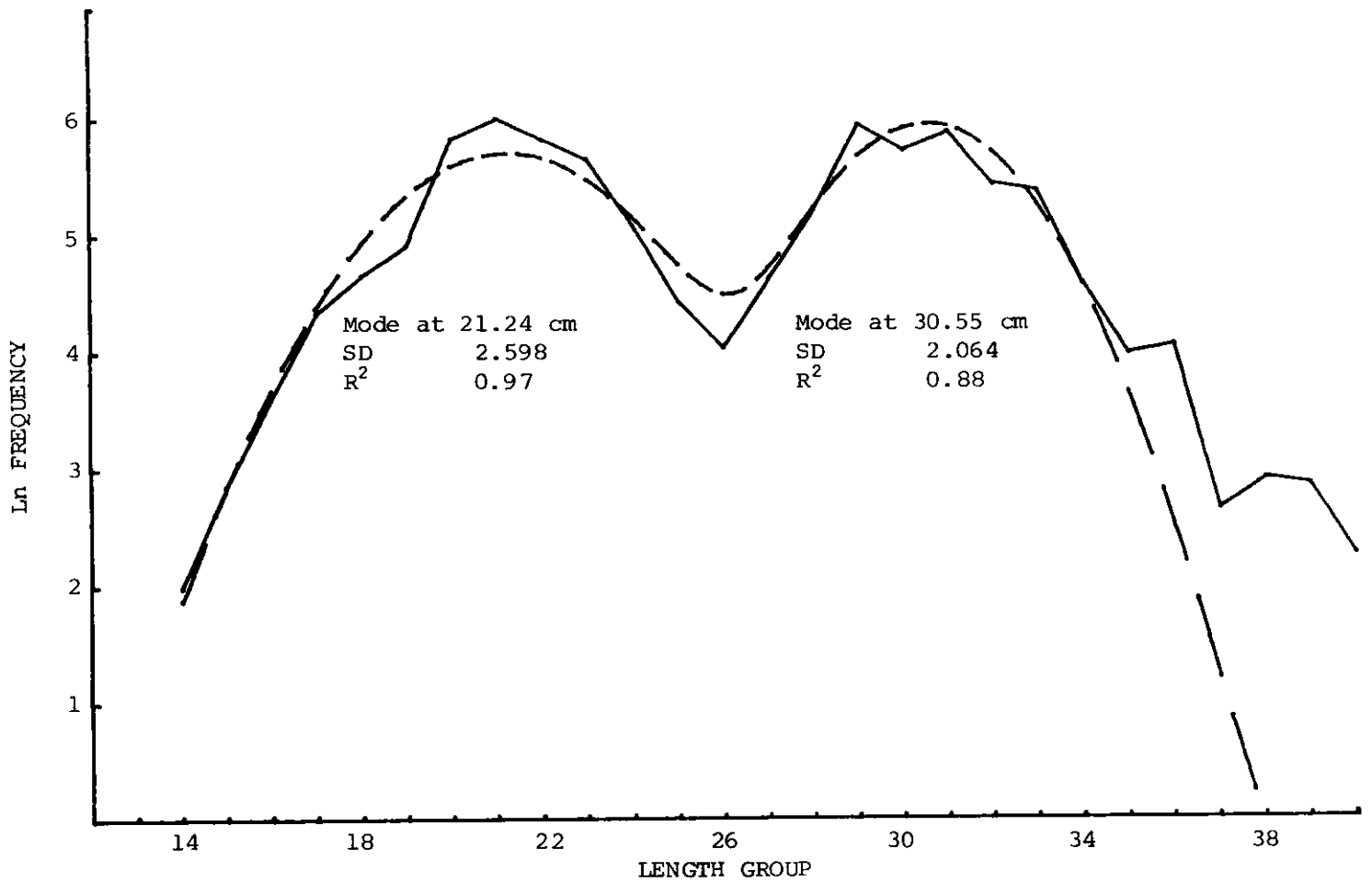Mode at 30.55 cm
SD   2.064
R^2 0.88

Figure 2. Resolution of 1975 Canadian silver hake survey length frequency by modal analysis.

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