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Results of a Silver Hake Otolith Exchange Between Canada and the USSR

by

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Abstract

Results of an exchange of silver hake otoliths between USSR and Canadian age readers are reported. The analyses include estimates of both inter-reader and intra-reader agreement. The source of disagreements, derived from photographs, was found to relate to interpretation of the otolith edge. Levels of agreement varied between 75 and 86% for the four comparisons.

Introduction

Exchanges of silver hake otoliths between Canadian and USSR age readers have been conducted for a number of years to determine inter-reader levels of agreement and monitor consistency in estimating catch at age (Hunt, 1987a and 1987b). Results of these exchanges indicate variable levels of agreement with some degree of bias between readers. Hunt (1987a) made a number of recommendations for improving the quality and type of analysis possible from otolith exchanges. The Scientific Council recommended that the exchange of silver hake otoliths and photographs between Canada, Cuba and the USSR be continued in 1989 (NAFO, 1988).

Material and Methods

Three objectives were included in the design of present exchange. hese included assessment of inter-reader and intra-reader agreement, and to document differences in interpretation. One hundred otoliths were selected from samples exchanged previously in 1986 and 1987 between Canada and the USSR. All samples were collected in July in NAFO Division 4W and were stored in vials with a 60:40 glycerin/water mixture. Ages estimated in the previous exchanges were used to determine the degree of intra-reader agreement.

The concave (proximal) surface of otolith pairs were photographed under the following conditions:

Camera: Nikon with 110mm bellows extension
Lens: Micro Nikkor 105mm with 23A red filter
Film: Kodak TMax 100
Exposure Reference: Kodak 18% grey color card
Printing: Kodak polycontrast RC II paper with #2 filter

All photographs were made at the same magnification set to provide full frame coverage for the largest otolith. Black and white prints were made on 17x11cm paper with a resultant total magnification factor of about seven. Readers were required to indicate their interpretation of each otolith on the photograph, although examination of the otolith was used to determine age.

Otolith samples and photographs were given to the USSR reader and fish length was available for reference. Sex of the fish was not included to avoid possible bias associated with differences in size at age. The USSR read was <u>not</u> aware that the samples had been previously aged and therefore

assigned ages as if reading for the first time. The Canadian reader (the author) was aware that ages had been previously estimated but these results were not examined until after the second readings were completed. Location of annuli was indicated on the accompanying photograph and the photographs were used to assess the source of differing estimates of age.

Comparisons between the USSR and Canada first and second reading were made to assess inter-reader and intra-reader agreement.

Results

Ages were assigned by both readers to all 100 of the otoliths exchanged and results are given in Table 1. Age range of the sample was 1-8 years and fish length from 16-44cm which approximates the range observed in the commercial fishery.

Comparison of agreements between first and second reading by the USSR indicate 77% concurrence between the two readings. Of the 23 differences, 15 (65%) resulted from a higher age in the first reading. Differences were spread over the age range. First and second readings for the Canadian reader were in agreement for 86% of the samples and differences appeared not to be biased. Results are summarized in Table 2.

The initial level of agreement between USSR and Canada was 75% with an apparent bias for USSR readings to be less than the Canadian (16 of 25 differences). The level of agreement improved to 82% when results of the second exchange were compared but the bias remained and increased to 14 out of 18 (78%) of USSR ages being one year less than the Canadian. Agreement in all four interpretations (2 USSR and 2 Canada) occurred in 62% of the samples. Results are summarized in Table 3.

An index of average percent error (Chilton and Beamish, 1982) was calculated for each of the comparisons and results are summarized below:

Test	Average percent error
USSR #1 vs. USSR #2	2.83
Cdn #1 vs. Cdn #2	1.96
USSR #1 vs. Cdn #1	3.12
USSR #2 vs. Cdn #2	2.03

Examination of photographs for samples with different interpretation identified the primary source of difference as the otolith edge which accounted for 12 of 18 (67%) differences. Checks or false annuli accounted for an additional 5 (28%) of differences and only one difference was attributed to interpretation of the center of the otolith. In general, the Canadian reader identified an additional ring at the periphery of the otolith which was included as an annulus.

Conclusions

Agreement achieved in these comparisons is similar to that observed in previous exchanges. However, the continuing bias between readers may indicate a potential impact on estimated age compositions. Hunt (1987b) concluded that differences in age determination as well as sampling were contributing factors in estimating age composition.

Results of this study provide more information on the source of different interpretation, most of which were attributed to the edge of the otolith. The level of intra-reader agreement suggests that silver hake otoliths have a moderate degree of difficulty for interpretation which causes inconsistency.

This exchange, as well as previous exchanges (Hunt, 1987a), show a similar level of agreement and a general bias with USSR ages tending to be lower than the Canadian estimate. Studies to reduce this bias could be undertaken. In the interim, exchanges could be continued to monitor the level of inter-reader agreement.

References

Chilton, D.E. and R.J. Beamish. 1982. Age determination methods for fishes studies by the Groundfish Program at the Pacific Biological Station. Can. Spec. Publ. Fish. Aquat. Sci. 60: 102p

Hunt, J.J. 1987a. Results of the 1986 and 1987 Canada-USSR silver hake otolith exchange. NAFO SCR. Doc. 87/52 Serial #N1341

Hunt, J.J. 1987b. An analysis of inconsistencies in estimates of silver hake catch at age. NAFO SCR. Doc. 87/51 Serial #N1340

NAFO 1987. Scientific Council Reports for 1987. p77

Table 1. Results of comparison ageing between Canada and the USSR. (A= 1986/87 age; B=1988 age)

FISH	LENGTH	SEX	AGE USSR A	AGE USSR B	AGE CDN A	AGE CDN B	FISH	LENGTH	SEX	AGE USSR A	AGE USSR B	AGE CDN A	AGE CDN B
1	42	F	7	6	7	7	51	18	M	1	1	1	1
2	32	M	4	5	5	5	52	34	M	5	5	5	5
3	26	M	2	2	2	2	53	16	M	1	1	1	1
4	32	F	3	3	3	2	54	34	F	4	3	3	4
5	33	F	4	3	3	3	55	30	F	4	4	3	4
6	29	F	2	2	2	2	56	27	M	2	2	3	2
7	36	F	5	5	5	5	57	27	M	2	2	2	2
8	28	M	2	2	2	2	58	41	F	6	5	6	6
9	25	M	2	2	2	2	59	33	M	4	4	4	4
10	22	F	2	2	2	2	60	38	F	5	5	6	6
11	19	M	1	1	2	1	61	29	M	3	3	3	3
12	28	M	3	3	3	3	62	19	F	1	1	1	1
13	26	M	2	2	2	2	63	27	M	2	2	2	2
14	43	F	6	6	5	6	64	44	F	7	6	7	6
15	32	F	4	4	4	4	65	30	F	3	3	3	3
16	47	F	7	5	6	6	66	33	M	4	4	4	4
17	29	M	3	4	3	3	67	37	M	6	6	6	6
18	32	F	4	5	4	5	68	17	F	1	1	1	1
19	32	F	3	3	3	3	69	18	M	1	1	1	1
20	26	M	2	2	2	2	70	31	F	3	3	3	3
21	30	F	3	4	4	4	71	31	M	4	5	4	4
22	33	F	4	4	4	4	72	31	F	3	3	3	3
23	41	F	7	7	8	8	73	25	M	2	2	2	2
24	27	M	2	2	2	2	74	26	M	2	2	2	2
25	30	F	4	4	4	4	75	35	F	4	5	5	5
26	27	M	3	3	3	3	76	28	F	2	2	2	2
27	31	F	3	3	3	3	77	17	F	1	1	1	1
28	33	M	4	4	4	4	78	40	F	6	6	6	6
29	35	F	5	4	5	5	79	17	M	1	1	1	1
30	41	F	5	5	5	5	80	27	M	2	2	2	2
31	33	F	4	2	3	3	81	18	M	1	1	1	1
32	27	F	2	2	2	2	82	33	M	4	5	4	4
33	38	M	7	7	7	7	83	25	M	2	2	2	2
34	34	M	4	4	5	5	84	33	M	4	4	4	4
35	18	F	1	1	1	1	85	30	M	3	3	4	3
36	46	F	7	6	7	7	86	30	F	3	3	3	3
37	29	F	3	4	4	4	87	36	F	5	4	5	5
38	31	M	4	4	4	4	88	16	F	1	1	1	1
39	21	F	1	1	1	1	89	29	F	2	2	2	2
40	38	F	5	4	4	4	90	33	M	4	4	4	4
41	38	F	5	5	5	5	91	35	M	6	6	6	6
42	35	M	5	4	5	4	92	33	M	4	4	3	4
43	28	M	3	3	3	3	93	27	F	4	4	4	4
44	28	F	2	2	2	2	94	33	F	4	4	4	4
45	42	F	6	6	6	6	95	30	F	4	4	5	5
46	33	F	3	3	3	3	96	38	F	5	5	6	6
47	27	F	2	2	2	2	97	39	F	5	6	6	6
48	31	F	4	4	5	4	98	38	F	7	7	8	7
49	24	M	2	2	2	2	99	35	F	5	5	6	5
50	43	F	6	5	6	6	100	38	F	5	4	4	4

Table 2. Comparison of first and second readings for USSR and Canada

(a)

USSR second \ USSR first	1	2	3	4	5	6	7	8	Total
1	12								12
2		21		1					22
3			14	2					16
4			3	15	6				24
5				4	7	2	1		14
6					1	5	3		9
7							3		3
8									0
Total	12	21	17	22	14	7	7	0	100

First reading relative to second

Difference	-2	-1	0	+1	+2
Percent	0	8	77	13	2

(b)

Canada second \ Canada first	1	2	3	4	5	6	7	8	Total
1	11	1							12
2		20	2						22
3			15	1					16
4			3	16	2				21
5				1	10	1			12
6					1	10	1		12
7							3	1	4
8								1	1
Total	11	21	20	18	13	11	4	2	100

First reading relative to second

-2	-1	0	+1	+2
0	5	86	9	0%

Table 3. Comparison of USSR and Canada readings.

(a)

Canada first	USSR first reading 1	2	3	4	5	6	7	8	Total
1	11								11
2	1	19							20
3		1	15	5					21
4			3	13	2				18
5				5	7	1			13
6					4	6	1		11
7							4		4
8							2		2
Total	12	20	18	23	13	7	7	0	100

USSR reading relative to Canada

-2	-1	0	+1	+2
0	16	75	9	0%

(b)

Canada second	USSR second reading 1	2	3	4	5	6	7	8	Total
1	12								12
2		21	1						22
3		1	14	1					16
4			1	18	2				21
5				4	8				12
6					5	7			12
7						2	2		4
8							1		1
Total	12	22	15	23	14	9	3	0	100

USSR reading relative to Canada

-2	-1	0	+1	+2
0	14	82	4	0%