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**ICNAF Scale and Otolith Exchange Program 1969-70**

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At last reporting (ICNAF Res. Doc. 69/29) the results of a herring scale and otolith exchange program among seven member countries were incomplete. The material, consisting of 50 pairs of otoliths and photographs of 50 scales from a sample of herring taken at Leonardville, Deer Island, Canada (Div. 4X) on August 6, 1968, had not been examined by two of the countries and the reporting was a simple tabulation of year-class estimates.

The exercise has now been completed and the results are contained in the three tables presented below. Table 1 is a tabulation of year-classes. Table 2 gives age distributions obtained by subtracting year-classes from sampling year. Table 3 summarizes the results of a statistical analysis of the data in Table 2.

Examination of the tables suggests the following:

- (a) The number of fish included in the sample was small and hence the results may not be meaningful.
- (b) There is a bias in favour of small fish which have easily readable scales and otoliths. Only 20 percent of the fish in the sample were longer than 30 cm - the size at about which both scales and otoliths become difficult to interpret.

2.

- (c) It would appear (Tables 1 and 2) that the level of agreement for age- and year-classes gets progressively worse with the increase in size (and presumably age) of the fish.
- (d) For all comparisons the differences between USSR readings for both scales and otoliths and those from other countries were statistically significant (Table 3).
- (e) Readings by Romanian workers differed from all others except for otolith readings between Canada and Romania and between the United States and Romania.
- (f) There is no significant difference between age estimates from scales and otoliths within countries. This is contrary to the frequently expressed opinion that otoliths are better than scales or vice versa.

The completed results support the view expressed in the previous report that there is a lack of uniformity (Figure 1) in age estimates between countries. The exchange program has been useful for examining the problem but has done little towards solving it. Further study would appear to be necessary to resolve differences and to set uniform standards and definitions.

Table 1. COMPARISON OF SCALE AND OTOLITH READINGS /YEAR CLASSES/  
SAMPLE FROM LEONARDVILLE, DEER ISLAND, CANADA - AUGUST 6, 1968.

Length /mm/	CANADA		UNITED STATES		GERMANY		ENGLAND		POLAND		USSR		ROMANIA		
	0	S	0	S	0	S	0	S	0	S	0	S	0	S	
118	1966	1966	1966	1966	1966	1966	1966	1966	1966	1966	1966	1967	1967	1966	1966
117	66	66	66	66	66	66	66	66	66	66	66	67	67	66	66
121	66	66	66	66	66	66	66	66	66	66	66	67	67	66	66
117	66	66	66	66	66	66	66	66	66	66	66	67	67	66	66
116	66	66	66	66	66	66	66	66	66	66	66	67	67	66	66
126	66	66	66	66	66	66	66	66	66	66	66	67	67	66	66
140	66	66	66	66	66	66	66	66	66	66	66	67	67	66	66
140	66	66	66	66	66	66	66	66	66	66	66	67	67	66	66
142	66	66	66	66	66	66	66	66	66	66	--	67	67	66	66
142	66	66	66	66	66	66	66	66	66	66	66	67	67	65	66
163	66	66	66	65	66	66	66	66	66	66	66	67	67	65	65
167	66	66	66	66	66	66	66	66	66	66	66	67	66	65	65
161	66	66	66	66	66	66	66	66	66	66	66	67	67	65	65
172	66	66	66	66	66	66	66	66	66	66	66	67	67	65	65
173	66	66	66	65	66	66	66	66	66	66	65	66	66	65	65
196	66	66	66	65	66	66	66	66	66	66	65	66	66	64	64
188	65	66	65	65	65	66	65	65	65	65	65	65	65	64	64
182	65	66	65	64	65	66	65	65	65	65	65	65	65	64	64
194	66	66	66	65	66	66	66	66	66	66	65	65	65	--	64
192	65	66	65	64	65	65	65	65	65	65	65	65	65	--	64
215	65	66	65	65	66	66	65	65	65	65	65	65	65	63	63
223	65	66	65	63	65	65	65	65	65	65	64	64	64	63	63
212	65	66	65	62	65	65	65	65	65	65	--	65	65	63	63
208	65	66	65	63	65	65	65	65	65	64	64	65	65	63	63
202	66	65	66	65	65	65	66	65	65	66	65	65	64	--	63
245	65	65	64	60	65	64	65	65	65	64	--	64	64	--	62
241	65	65	65	63	65	65	65	65	65	65	65	65	64	--	62
248	65	65	65	60	65	65	65	65	65	65	64	64	63	62	62
228	65	65	65	64	65	65	65	65	65	65	64	65	65	--	62
228	65	65	65	65	65	65	65	65	65	65	65	65	65	--	62
265	65	64	--	63	64	64	64	64	64	--	64	63	63	62	62

ctd.

Table 1 (continued)

Length /mm/	CANADA		UNITED STATES		GERMANY		ENGLAND		POLAND		USSR		ROMANIA	
	O	S	O	S	O	S	O	S	O	S	O	S	O	S
251	65	65	64	64	65	65	65	65	65	65	63	63	62	62
261	64	64	64	62	64	64	64	64	64	--	63	63	62	62
273	64	64	63	61	64	64	64	64	63	--	63	63	62	62
251	64	64	64	64	64	64	--	--	64	64	64	64	62	62
280	63	63	62	61	63	63	64	64	63	63	62	62	62	62
291	63	63	63	63	63	63	63	64	63	63	62	62	62	61
292	63	63	63	61	63	62	64	--	63	--	62	62	62	61
293	63	64	62	62	63	64	63	--	63	64	62	62	62	61
280	64	64	64	61	64	64	64	64	63	63	62	61	--	61
307	63	63	63	62	63	63	63	63	63	64	62	61	--	61
320	62	62	62	62	60	59	61	61	61	61	61	61	61	60
314	63	63	63	60	63	61	--	62	63	--	61	61	61	61
310	62	63	61	61	61	59	61	--	61	--	61	61	60	60
319	62	62	61	62	60	60	61	62	61	61	61	61	60	60
327	62	61	61	60	60	59	61	62	61	--	60	60	60	60
327	62	60	61	61	59	59	61	61	61	60	61	60	60	60
340	62	62	--	62	--	--	--	--	61	--	61	61	60	60
329	62	62	61	60	--	59	59	60	60	59	60	60	60	60
326	61	61	61	61	59	59	60	61	60	--	60	60	60	60

O = Estimates from Otoliths;  
 S = Estimates from Scales.

Table 2. Comparison of age distributions from otoliths and scales. Ages calculated from Table 1 and hence directly comparable between countries.

Age (Otoliths) - Distribution by countries										
Age	1	2	3	4	5	6	7	8	9	Unidentified
<b>Countries</b>										
Canada	-	18	14	4	6	7	1	-	-	-
United States	-	18	11	5	5	3	6	-	-	2
Germany	-	18	13	5	6	-	1	3	2	2
England	-	18	13	6	3	-	5	1	1	3
Poland	-	18	11	4	8	-	6	-	1	2
USSR	14	2	11	4	4	6	6	3	-	-
Romania	-	9	6	3	4	10	2	7	-	9

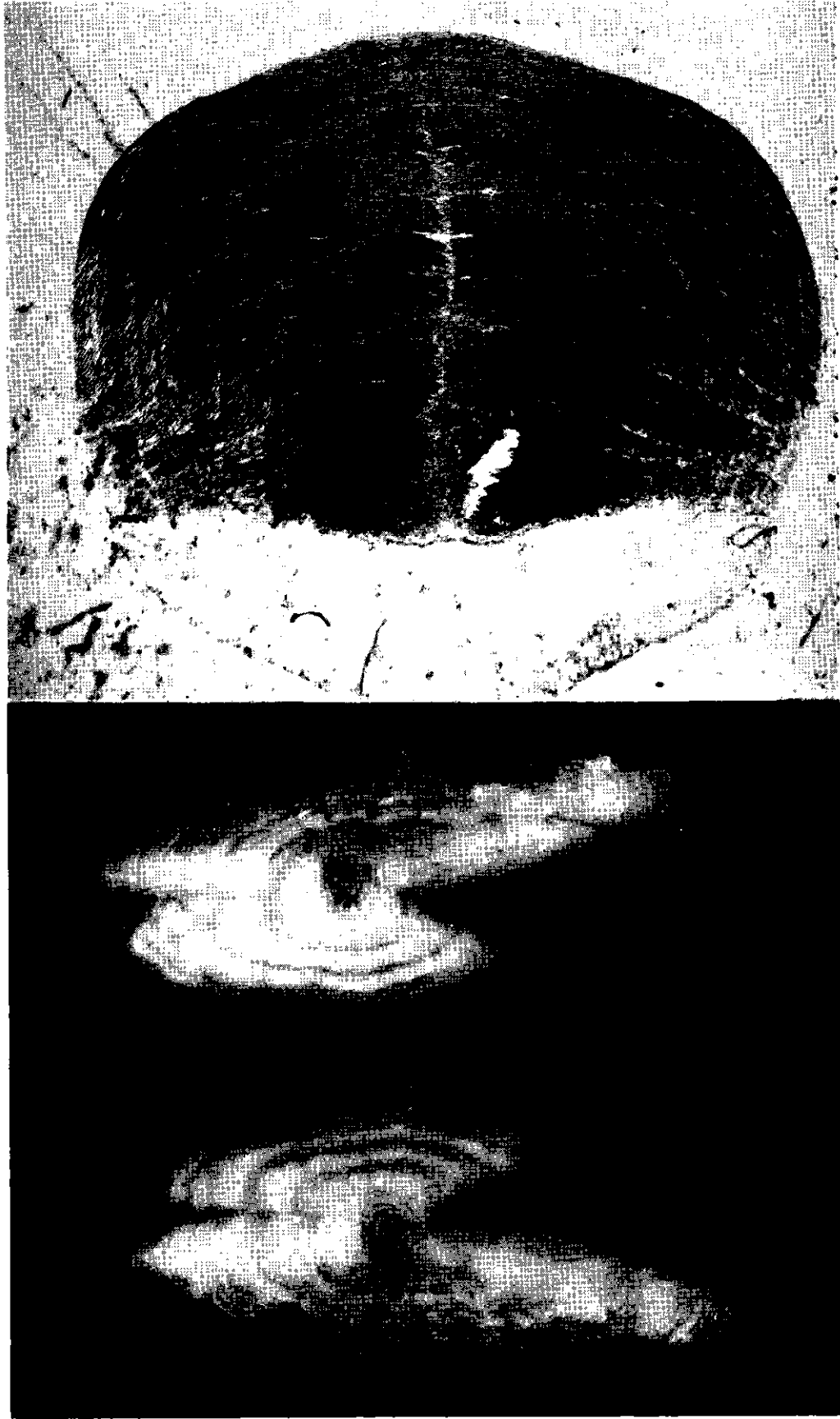
Age (Scales) - Distribution by countries										
Age	1	2	3	4	5	6	7	8	9	Unidentified
<b>Countries</b>										
Canada	-	24	7	6	6	4	2	1	-	-
United States	-	13	8	5	5	7	7	5	-	-
Germany	-	20	10	7	3	1	1	1	6	1
England	-	17	14	6	1	3	3	1	-	5
Poland	-	13	11	8	3	-	2	1	1	11
USSR	13	3	9	5	5	4	7	4	-	-
Romania	-	10	5	5	5	11	6	8	-	-

Table 3. Summary results of chi-square tests for statistical significance of differences between and within countries.

	Canada		United States		Germany		England		Poland		USSR		Romania	
	Sc	Ot	Sc	Ot	Sc	Ot	Sc	Ot	Sc	Ot	Sc	Ot	Sc	Ot
Canada	NS		NS		NS		NS		NS		**		*	
	Scales		Scales		Scales		Scales		Scales		Scales		Scales	
	Otoliths		Otoliths		Otoliths		Otoliths		Otoliths		Otoliths		Otoliths	
United States			NS		NS	**	NS		NS	*	**		*	NS
	Scales		Scales		Scales		Scales		Scales		Scales		Scales	
	Otoliths		Otoliths		Otoliths		Otoliths		Otoliths		Otoliths		Otoliths	
Germany					NS		NS		NS		**		**	**
	Scales		Scales		Scales		Scales		Scales		Scales		Scales	
	Otoliths		Otoliths		Otoliths		Otoliths		Otoliths		Otoliths		Otoliths	
England							NS		NS		**		*	*
	Scales		Scales		Scales		Scales		Scales		Scales		Scales	
	Otoliths		Otoliths		Otoliths		Otoliths		Otoliths		Otoliths		Otoliths	
Poland									NS		**		*	**
	Scales		Scales		Scales		Scales		Scales		Scales		Scales	
	Otoliths		Otoliths		Otoliths		Otoliths		Otoliths		Otoliths		Otoliths	
USSR											NS		**	**
	Scales		Scales		Scales		Scales		Scales		Scales		Scales	
	Otoliths		Otoliths		Otoliths		Otoliths		Otoliths		Otoliths		Otoliths	
Romania													NS	NS
	Scales		Scales		Scales		Scales		Scales		Scales		Scales	
	Otoliths		Otoliths		Otoliths		Otoliths		Otoliths		Otoliths		Otoliths	

NS = Differences not statistically significant  
 \* = Significant at 5% level  
 \*\* = Significant at 1% level





**Figure 1. Examples of ageing problems:**

**Top: Scale from 314-mm herring variously identified as 5, 6, 7, and 8 years old.**

**Bottom: Otoliths from 329-mm herring identified as 6, 7, 8, and 9 years.**