Northwest Atlantic Fisheries Organization

Serial No. N1705 NAFO SCS Doc. 90/2

SCIENTIFIC COUNCIL - JUNE 1990

Report of the Workshop on Silver Hake Database

by

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The workshop on silver hake assessment data and analysis was held at the Greenland Fisheries Research Institute, Copenhagen, Denmark during 8-12 January 1990 with H. Lassen as Chairman. Representatives attended from Canada, Denmark (Greenland), EEC, and USSR. The Assistant Executive Secretary was in attendance. The list of participants is given in Appendix I.

The Chairman welcomed everyone, and requested the Assistant Executive Secretary to act as general rapporteur while scientists dealing with specific topics were requested to prepare those reports. It was noted that no new SCR Documents would be presented at this meeting, although previously issued SCR and SCS Documents and new data tabulations the scientists had brought to the meeting would be reviewed.

With respect to the agenda, the six topics identified at the September 1989 Meeting were first reviewed and the Chairman noted that the outline prepared in September 1989 (Appendix II - Agenda) for the workshop was complete and suitable. In general it was noted that the silver hake fishing regime changed in 1977 when the Canadian new management plan came into effect. It was therefore decided that only the time series from 1977 would be considered.

Each topic was then discussed.

a) Sampling the Commercial Fisheries for Length and Ageing Material

It was agreed that the Canadian and USSR methods of sampling would be completely described for the purpose of this workshop.

The Canadian sampling scheme by the International Observer Program (IOP) had been described by Kulka and Waldron (1983) and the USSR scheme had been described by Noskov and Rikhter (1985). It was noted that the Canadian and USSR sampling schemes were very similar. However a discrepancy had been observed between the Canadian data, and the Cuban and USSR data at fish lengths below 20 cm for 1988. The Canadian data seemed to have a higher proportion of the age 1 year-class compared to the USSR and Cuban samples, and that needed to be resolved.

Historic and current data from Canada and USSR were tabulated to reconcile the discrepancies noted above (Table 1). Data from 1984-89 focusing on fish less than 28 cm showed no significant difference between the data sets except in the 1988 where the Canadian IOP data showed a wider distribution in the smaller size groups. It was recognized that because of the larger sample size of the IOP data, they would exhibit such details. Figure 1 indicates the comparability of both data sets for length below 28 cm, except for 1988.

The group was confident that the IOP length sample database represented an extensive sampling of the commercial fishery. This was the preferred database for estimating length composition of the commercial catches.

It was noted that Canada and USSR were both sampling biological data onboard the vessels with similar objectives. The group therefore felt that when observers from both parties were onboard the same vessel, the parties should explore the possibility of cooperatively collecting the biological data, rather than duplicating their efforts.

Details of sampling methods for ageing material by Canada (Kulka and Waldron, 1983) and USSR (Noskov and Rikhter, 1985) were reviewed. Similar methods were being employed. The ageing effort by Canada and USSR, with each party ageing approximately 1,500 otoliths annually, was also comparable and was considered adequate.

b) Ageing Methods

The results of Canadian and USSR otoliths exchange reported by Hunt (1989) showed high levels of agreement within and between age readings from both sources. Previous studies had shown much lower levels of agreement.

The group felt that combining age data from both Canada and USSR could be advantageous. However, the agreement obtained recently by the otolith exchange program, was not reflected in the Canadian and USSR age-length keys (ALK) which showed marked differences (as discussed under item c)). It was therefore concluded that the data should not yet be combined.

The group agreed that the causes of these discrepancies need to be identified. In spite of the successful otolith exchange, the group still felt that the ageing methods were a significant part of the problem and if required the Canadian and USSR age readers should meet in an attempt to develop more appropriate methods of improving inter-reader and intra-reader agreement.

c) Methods Used in the Construction of Yearly Catch Compositions

The group reviewed the raising procedures used by Canada and USSR to achieve an estimated age composition of the total annual catches. Both use a single season ALK. As discussed under item (a), the group felt that the ALK should be applied to the IOP length composition estimate.

The method by which length frequency and age data from Canada and USSR could be aggregated, and how those data could then generate catch-at-age matrices, in time for the assessment meetings, was considered.

Three age compositions of the 1989 commercial catches were constructed, based on the length composition of the catch originating from the IOP samples. For the first the Canadian ALK was used while for the second dataset USSR ALK was used. The third data set was based on a combined Canada-USSR ALK (Table 2). The estimated number caught for age groups 2 and 4 differed markedly and it was obvious that a combined ALK would not give a reasonable estimate. If the age composition was based on a single ALK, the outcome of an analytical assessment would be very different depending on which dataset it was based. The group was not able at this time to resolve why these ALKs differed, but noted that while the problem remained, a reliable analytical assessment of the silver hake stock was not possible. The solution of this problem was therefore most urgent.

d) Research Vessel Survey Data

Two research vessel survey data series currently being used for assessment purposes were described. These were (1) the Canadian groundfish surveys conducted in July of each year since 1970, and (2) the Canadian-USSR juvenile silver hake surveys conducted in October/November each year since 1981 on a consistent basis.

The Canadian groundfish series consisted of a multispecies stratified-random bottom trawl survey covering the entire area. This represented an unbiased dataset with coefficients of variation of mean abundance of silver hake comparable to those obtained for other species estimated by this survey. High interannual variability was suggested by Waldron *et al.* (1989) the reason for which was not understood. The group noted that high variability could make it difficult to use this data series for calibrating an SPA. It was proposed that adding extra stations to the survey, which could be achieved without modifying the database, may help. The stratification of the survey was reviewed and it was noted that strata along the shelf break could be subdivided, for the purpose of estimating silver hake abundance, to increase the number of stations in the silver hake high density areas.

The Canada-USSR juvenile silver hake survey series is a pelagic survey targeting silver hake age 0. This is randomly stratified using an IGYPT net and is conducted in strata 60 to 78, which is the core area of juvenile silver hake distribution. The Scientific Council made a decision in 1986, which it reiterated in 1987, as to how the survey index of abundance should be calculated. This forms the basis of the Canadian database. The accepted protocol was discussed by Koeller et al. (1986) and the resulting mean abundance estimates are given in Table 3. Survey results presented by Waldron *et al.* (1989) suggest the survey method was acceptable and there were no observed difficulties in the generated data.

e) Commercial Catch Rate Data Series

The group noted that two sets of data were currently being collected. The USSR data are taken from daily summaries when the fishery was directed to silver hake. The other data series originates from the IOP which has a 100% coverage of the silver hake fishery on a set-by-set basis. IOP takes its data from all vessels, particularly Cuban, Japanese and USSR, fishing silver hake. This latter dataset therefore has the USSR data as a subset. When national catch and effort data are reported to the NAFO Statistical database, these contributions are compiled on a monthly basis. These constituted the monthly catch rate data and have been used in preference to the IOP dataset for assessment purposes.
The catch rate series has previously been standardized using multiplicative models. However, the group noted that the inclusion of data for each additional year would cause variation within the estimation accuracy, and therefore a fixed time series of standardized catch rates could not be constructed using the accepted procedure. The group investigated this standardization procedure and met with simple computer problems which will have to be resolved before the June 1990 Meeting. The database on catch-effort is given in Table 4.

The catch and effort (hrs) series is composed of both NAFO statistics and IOP data as described above. The categories used are: data source (NAFO or IOP), month, year, fishing regime (fishing method), and country (Cuba and USSR). During the period 1977-79, 4 Soviet vessels were licensed to fish silver hake with 40 mm trawl codends and operate in areas landward of the small mesh gear line. The group agreed that those data should be included in the model in accordance with previous STACFIS assessments.

f) Assessment Methods

As a result of the problems identified in the database, the group realized that an analytical assessment would not be likely in June 1990.

The assessment would therefore have to be based on those elements of the database which were undisputed. Those seemed to be:

- Total catches and effort
- Length compositions of total catches

- Survey results when those results do not involve ageing e.g. biomass
- Canadian-USSR juvenile survey results

Investigation into the ALKs of Canada and USSR may indicate that ageing of 0 and 1 groups are undisputed and the research surveys may therefore provide indices of abundance of certain age groups as follows:

0 group - from Canada-USSR juvenile survey
1 group - from Canada-USSR juvenile survey, and Canadian groundfish survey
2+ group - from Canadian groundfish survey

This breakdown may also be made using decomposition of the length compositions from the surveys.

Based on this information, either additive or multiplicative models, relating catch to recruitment indices and effort may be developed. Although such models may have some predictive power, they would not provide anything about where the exploitation level ought to be. This latter question will then have to be addressed based on past experience e.g. defining a catch level which may be sustained for the time series available.

Status quo and SHOT approaches may also have some merits.

Redfish in the Flemish Cap is managed using a real-time general production model. A similar approach may be feasible for the silver hake.

References

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NOSKOV and V. A. RIKHTER. 1985. Manual for collecting length and age data and for conducting biological analysis. (In Russian) Atlantic Research Institute of Marine Fisheries and Oceanography (AtlantNIRO), 5 Dmitry Donskoy Street, Kaliningrad, 236000, USSR.

WALDRON, D. E., M. C. BOURBONNAIS, and M. A. SHOWELL. 1989. Size of the Scotian Shelf silver hake population in 1988 with projections to 1990. NAFO SCR Doc. 89/48, Serial No. N1626, 36 p.

Table 1. Comparison of Canadian and USSR commercial sampling of silver hake. Lengths given as percent by numbers (after adjustment to catch). Canadian data cut off at 28 cm.

	1984		1985		1986		1987		1988		1989	
Length	Canada	USSR	Canada	USSR	Canada	USSR	Canada	USSR	Canada	USSR	Canada	USSR
10												
11												
12									0.01			
13	0.01		0.02						0.02		0.01	
14	0.01		0.02		0.01				0.06		0.06	
15	0.06		0.04		0.10		0.05		0.10		0.15	0.20
16	0.35		0.06		0.42	0.30	0.10	0.10	0.21		0.29	0.40
17	0.91		0.15	0.10	1.08	0.60	0.26	0.30	0.29		0.38	0.50
18	1.68	0.30	0.27	0.20	1.79	1.10	0.44	0.30	0.16		0.41	0.50
19	2.47	0.60	0.38	0.40	2.02	1.20	0.34	0.30	0.17		0.47	0.40
20	3.10	1.10	0.61	0.70	2.12	1.60	0.26	0.20	0.21		0.65	0.50
21	2.71	1.50	0.83	0.80	1.57	1.40	0.16	0.10	0.20		0.99	1.30
22	2.13	1.60	0.92	1.00	1.11	1.00	0.39	0.20	0.13		1.17	1.70
23	1.48	1.30	0.97	1.10	0.71	0.80	2.28	1.20	0.16	0.10	1.00	1.70
24	0.99	1.00	1.13	1.20	0.48	0.60	7.42	5.50	0.94	0.50	1.68	1.60
25	1.45	0.70	2.32	1.80	0.78	0.80	14.57	12.20	2.54	1.80	3.09	3.00
26	3.64	0.60	5.52	4.20	2.22	2.00	17.25	15.20	5.03	4.90	4.43	4.80
27	7.95	1.90	9.65	8.80	5.57	4.50	14.11	13.20	10.16	10.90	5.02	5.20
28	12.31	5.10	11.95	11.40	9.93	8.20	9.49	9.00	16.05	17.50	8.12	7.30
29		10.00		11.00	14.73	13.10	6.79	7.20	18.79	19.80	13.18	11.60
30		16.20		11.30	16.36	16.90	6.15	7.30	16.79	16.20	16.53	15.20
31		16.30		11.20	13.90	14.80	5.95	6.90	11.52	11.80	15.21	15.00
32		14.00		9.80	10.52	12.80	4.76	6.70	7.05	7.00	11.53	12.20
33		9.20		8.30	6.63	8.70	3.57	4.90	3.90	4.00	6.84	7.50
34		6.30		5.90	3.74	4.50	2.44	3.40	2.35	2.70	3.62	4.00
35		4.40		4.00	1.66	2.40	1.35	2.20	1.26	1.30	1.87	2.20
36		2.80		2.50	0.93	1.40	0.65	1.30	0.69	0.70	1.12	1.20
37		2.10		1.50	0.57	0.60		0.80	0.42	0.30	0.72	0.80
38		1.30		0.90	0.31	0.40		0.50	0.23	0.10	0.46	0.40
39		0.60		0.70	0.20	0.20		0.30	0.11	0.10	0.34	0.30
40		0.50		0.40	0.15	0.10		0.20	0.07		0.19	0.20
41		0.30		0.30				0.10			0.11	0.10
42		0.20		0.20				0.10			0.10	0.10
43		0.10		0.10							0.07	0.10
44				0.10							0.06	
45				0.10							0.04	
46											0.02	

Table 2. Catch-at-age ('000) for 1989 calculated from the International Observer Program (IOP) length composition applied to the age-length key (ALK) from USSR, ALK from Canada and from combining these two ALKS.

Age	USSR	CANADA	CAN + USSR
1	20,311	25,721	23,132
2	153,800	92,039	128,293
3	189,630	169,903	175,231
4	88,856	153,666	113,614
5	17,700	21,289	20,735
6	3,800	9,975	11,037
7	1,129	1,669	2,291
8	323	1,274	1,213
9	70	41	69
10	0	22	6
11	0	35	5

Table 3. Stratified mean catch/tow for the joint Canada/USSR juvenile silver hake survey. Strata 60-78 only.

	1981	1982	1983	1984	1985	1986	1987	1988	1989
Stratified mean catch/tow	579.0	8.0	232.2	43.4	284.8	198.0	102.0	204.8	131.5
Standard error of mean	0.11	0.14	0.11	0.16	0.22	0.19	0.11	0.17	0.14
Number of Sets	77	61	64	71	82	74	105	116	

Table 4. Commercial silver hake catch and effort used in the multiplicative model.

Catch	Effort	Source	Month	Year	Area	Regime	Country
14	10	1	8	77	450	2	1
3295	1841	1	4	77	460	2	1
3721	1933	1	5	77	460	2	1
1796	889	1	6	77	460	2	1
8261	4117	1	7	77	460	2	1
1704	435	1	8	77	460	2	1
470	332	1	9	77	460	2	1
2423	1083	1	4	77	470	2	1
1576	875	1	5	77	470	2	1
236	82	1	6	77	470	2	1
1051	524	1	7	77	470	2	1
232	186	1	4	78	450	2	1
2995	1406	1	5	78	450	2	1
326	203	1	6	78	450	2	1
1591	1087	1	4	78	460	2	1
5219	4812	1	5	78	460	2	1
6169	5196	1	6	78	460	2	1
7847	5626	1	7	78	460	2	1
4183	2031	1	8	78	460	2	1
330	247	1	4	78	470	2	1
133	88	1	5	78	470	2	1
1064	649	1	6	78	470	2	1
27	38	1	7	78	470	2	1
13	10	1	8	79	450	2	1
2103	1244	1	4	79	460	2	1
8847	4874	1	5	79	460	2	1
8390	4985	1	6	79	460	2	1
7470	3948	1	7	79	460	2	1
2014	1338	1	8	79	460	2	1
713	411	1	9	79	460	2	1
65	31	1	4	79	470	2	1
739	436	1	5	79	470	2	1
98	65	1	6	79	470	2	1
1531	1176	1	4	80	460	2	1
9033	7902	1	5	80	460	2	1
11333	9056	1	6	80	460	2	1
9018	7083	1	7	80	460	2	1
3665	5683	1	8	80	460	2	1
168	118	1	5	80	470	2	1
1639	906	1	6	80	470	2	1
4494	2725	1	7	80	470	2	1
66	113	1	8	80	470	2	1
117	80	1	6	81	450	2	1
363	275	1	7	81	450	2	1
601	490	1	4	81	460	2	1
13317	6091	1	5	81	460	2	1
11804	8717	1	6	81	460	2	1
9940	7100	1	7	81	460	2	1
763	543	1	8	81	460	2	1
220	192	1	6	81	470	2	1
17	14	1	8	81	470	2	1
2165	386	1	4	82	460	2	1
16644	3895	1	5	82	460	2	1

Table 4. (continued)

Catch	Effort	Source	Month	Year	Area	Regime	Country
20985	5441	1	6	82	460	2	1
6653	2348	1	7	82	460	2	1
5134	1726	1	4	83	460	2	1
13127	6030	1	5	83	460	2	1
7110	4935	1	6	83	460	2	1
229	267	1	7	83	460	2	1
15732	3794	1	5	84	460	2	1
17276	7077	1	6	84	460	2	1
21453	8735	1	7	84	460	2	1
2838	904	1	8	84	460	2	1
8400	3702	1	5	85	460	2	1
26230	10541	1	6	85	460	2	1
15956	13623	1	7	85	460	2	1
5751	2069	1	8	85	460	2	1
435	184	2	7	77	460	1	1
50	41	2	7	77	460	2	1
771	712	2	8	77	460	1	1
16	72	2	8	77	460	2	1
18	16	2	8	77	470	1	1
225	128	2	9	77	460	1	1
527	408	2	4	78	460	1	1
1233	776	2	5	78	460	1	1
17	17	2	5	78	470	1	1
16	19	2	5	78	470	2	1
1375	493	2	6	78	450	1	1
2136	1557	2	6	78	460	1	1
116	63	2	6	78	460	2	1
72	40	2	6	78	470	1	1
774	310	2	7	78	450	1	1
2745	1645	2	7	78	460	1	1
47	32	2	7	78	470	1	1
74	29	2	8	78	450	1	1
3195	1316	2	8	78	460	1	1
110	102	2	9	78	460	1	1
1510	690	2	5	79	460	1	1
1684	847	2	5	79	460	2	1
105	81	2	5	79	470	1	1
11	15	2	5	79	470	2	1
3174	1604	2	6	79	460	1	1
2097	1188	2	6	79	460	2	1
41	46	2	6	79	470	1	1
83	87	2	6	79	470	2	1
2239	899	2	7	79	460	1	1
1017	455	2	7	79	460	2	1
392	259	2	8	79	460	2	1
9423	2240	2	5	86	460	2	1
11905	3292	2	6	86	460	2	1
5531	1803	2	7	86	460	2	1
63	16	2	6	86	470	2	1
1049	175	2	7	86	470	2	1
2300	638	1	5	82	460	2	2
3437	1491	1	6	82	460	2	2
5469	2542	1	7	82	460	2	2
1565	515	1	4	83	460	2	2

Table 4. (continued)

Catch	Effort	Source	Month	Year	Area	Regime	Country
3003	2124	1	5	83	460	2	2
2564	2640	1	6	83	460	2	2
286	150	1	7	83	460	2	2
2614	724	1	4	84	460	2	2
6254	2364	1	5	84	460	2	2
5415	2351	1	6	84	460	2	2
213	192	1	7	84	460	2	2
2889	863	1	4	85	460	2	2
6098	3035	1	5	85	460	2	2
7014	2797	1	6	85	460	2	2
1682	831	1	7	85	460	2	2
869	744	2	8	86	460	2	2
2682	489	2	4	86	460	2	2
2482	850	2	5	86	460	2	2
950	503	2	6	86	460	2	2
342	353	2	9	86	460	2	2
5216	742	2	4	87	460	2	2
9411	1658	2	5	87	460	2	2
4641	2407	2	6	87	460	2	2
237	121	2	7	87	460	2	2
3173	597	2	5	87	460	2	1
15895	6758	2	6	87	460	2	1
18291	7438	2	7	87	460	2	1
24	11	2	7	87	470	2	1
247	139	2	8	87	470	2	1
20663	4789	2	4	88	460	2	1
782	274	2	4	88	460	2	2
18870	6050	2	5	88	460	2	1
2279	1079	2	5	88	460	2	2
12328	5864	2	6	88	460	2	1
4184	2384	2	6	88	460	2	2
3254	976	2	6	88	470	2	1
93	56	2	6	88	470	2	2
1233	1462	2	7	88	460	2	1
1796	973	2	7	88	460	2	2
650	60	2	3	89	460	2	1
30044	5110	2	4	89	460	2	1
19098	5255	2	5	89	460	2	1
9749	4245	2	6	89	460	2	1
4667	1552	2	7	89	460	2	1
4347	823	2	4	89	460	2	2
6844	2207	2	5	89	460	2	2
2999	1536	2	6	89	460	2	2
457	244	2	7	89	460	2	2
182	39	2	4	89	470	2	1
171	35	2	5	89	470	2	1
6128	1683	2	6	89	470	2	1

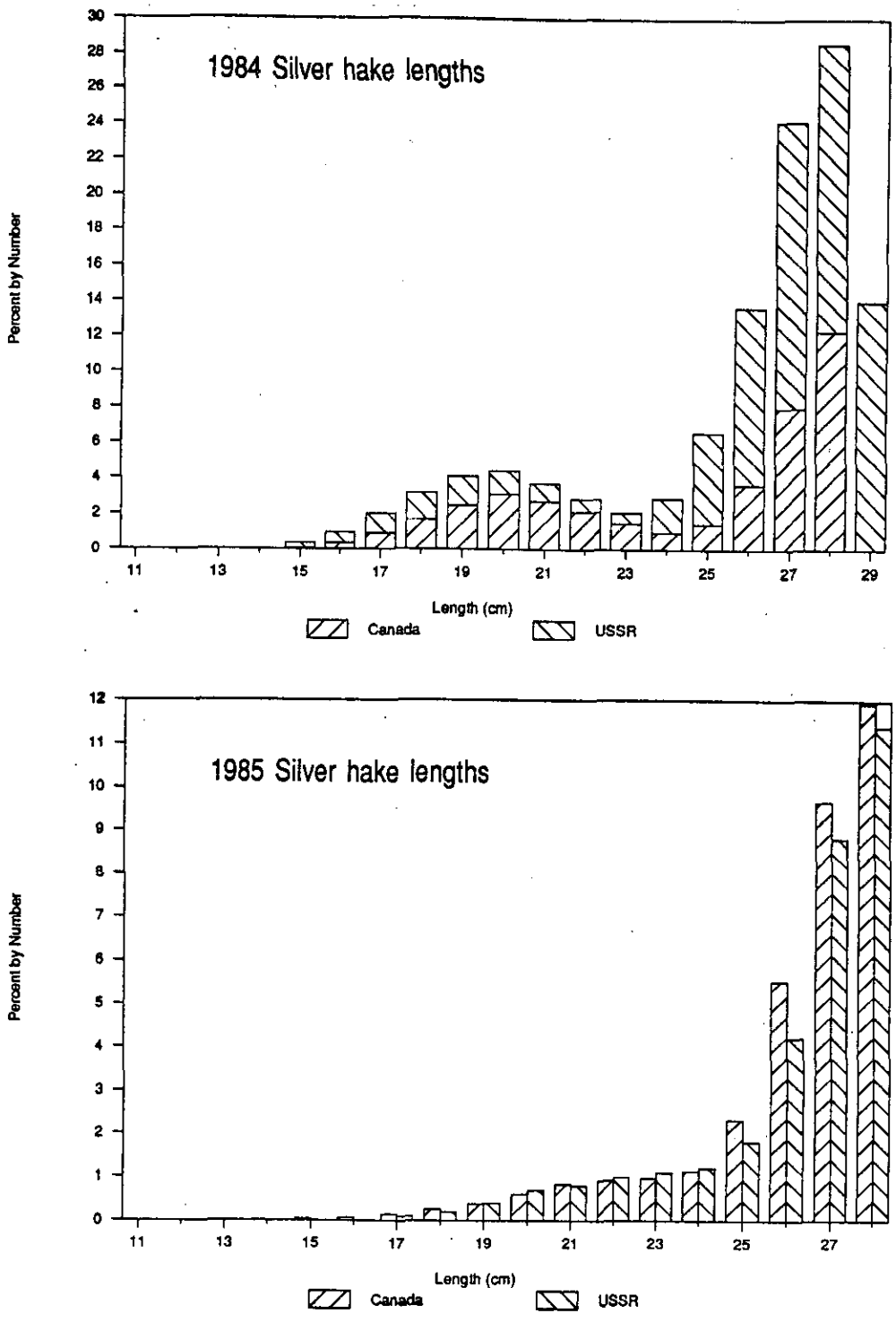


Fig. 1. Comparison of Canadian and USSR silver hake length data given as percent by number for lengths below 28 cm.

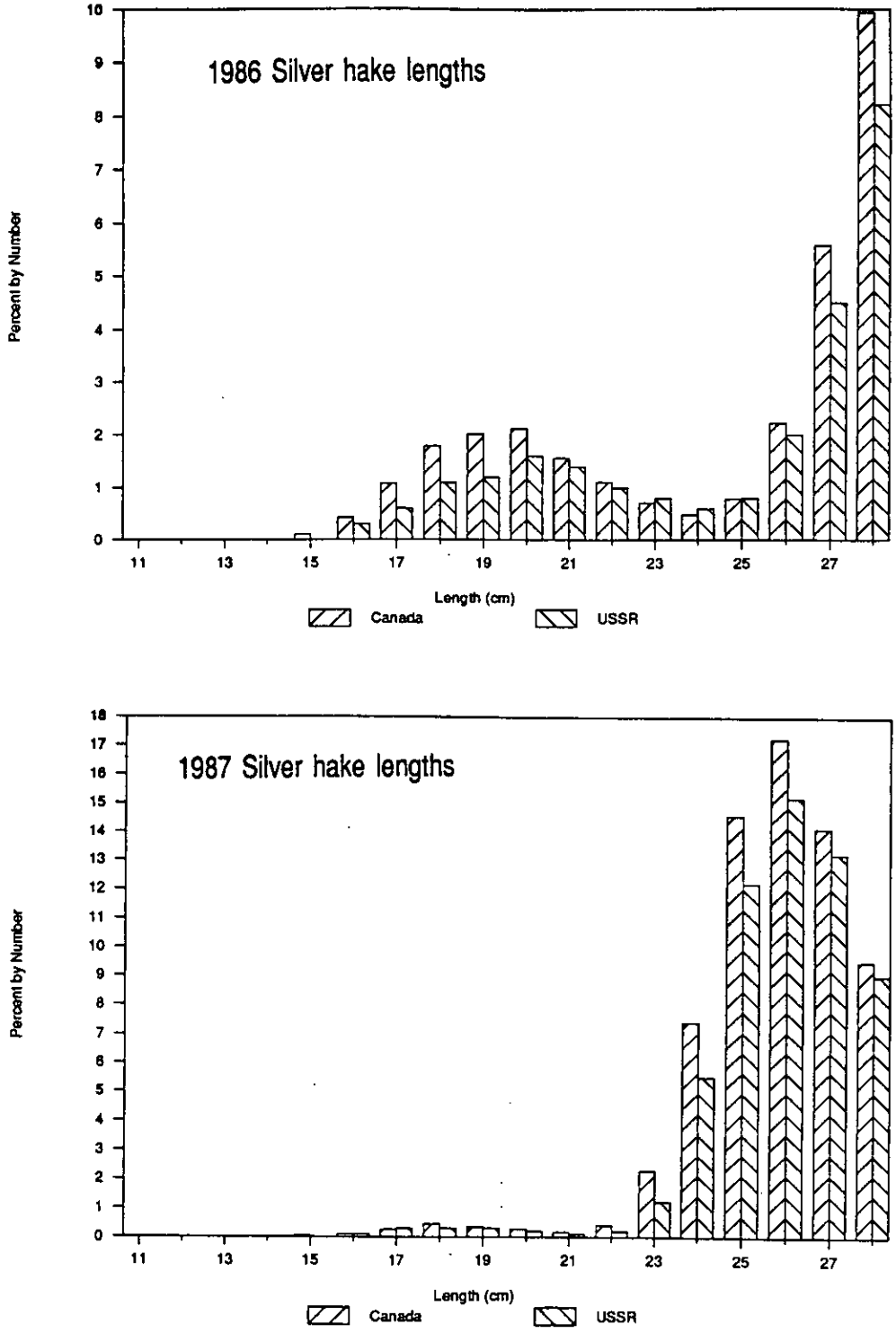
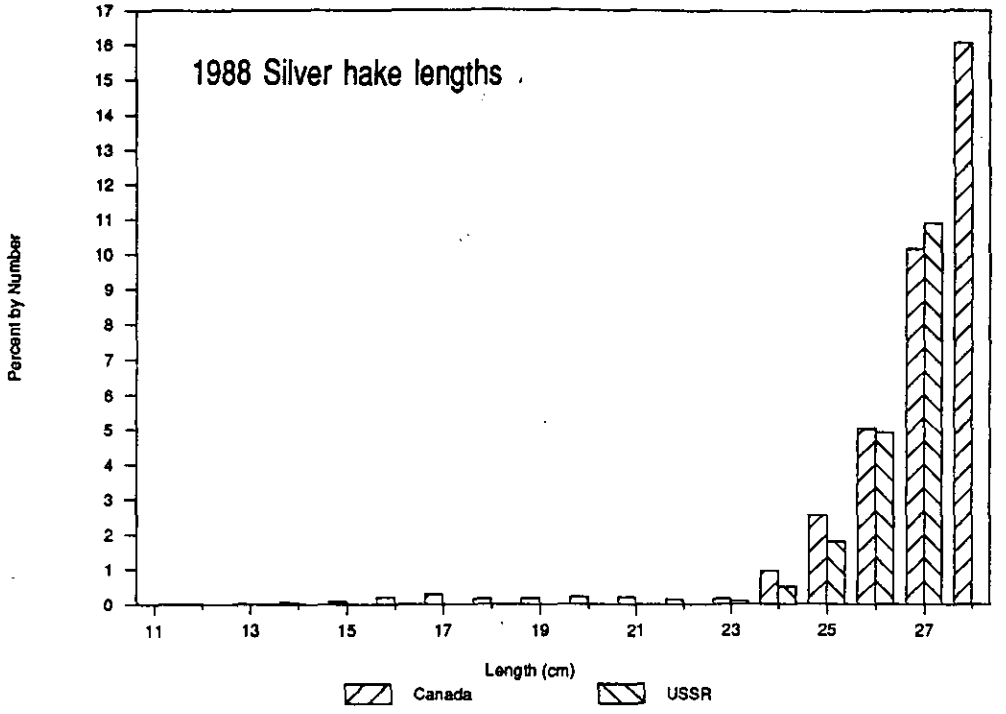


Fig. 1. (Continued)



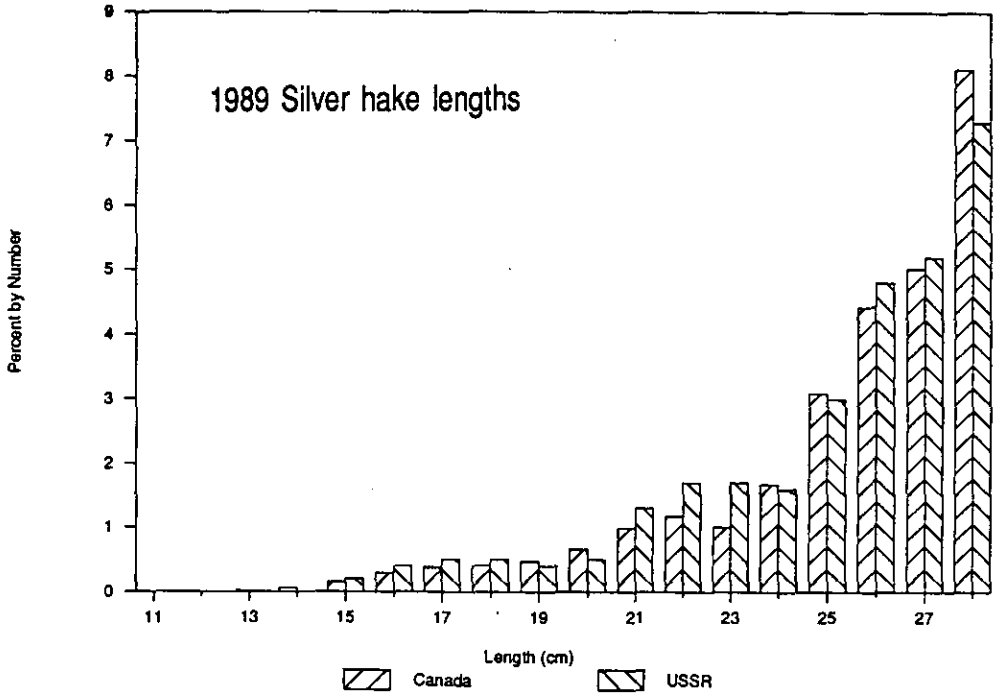


Fig. 1. (Continued)

APPENDIX I

List of Participants

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APPENDIX II

AGENDA

The Scientific Council recommended at its June 1989 meeting that a workshop be held on "silver hake assessment data and analysis" and that the workshop should be held in early 1990.

The workshop was scheduled for 8-12 January 1990, at the Greenland Fisheries Research Institute, Tagensvej 135, 1, DK-2200, Copenhagen, Denmark, with Hans Lassen (STACFIS Chairman) as Chairman.

The objective of the workshop would be to review data available for silver hake assessment, resolve the apparent discrepancies and establish an agreed database.

Six topics were identified:

a) Sampling for Length and Ageing Material

Discrepancies between length frequencies collected by several countries have been noted. Therefore sampling methods for all countries should be reviewed (e. g. sample size, randomization scheme, equipment used and measurements taken).

b) Ageing Methods

Results of the otolith exchange programs between Canada and USSR were reported in June 1989, and a bias was still apparent in the data. The workshop should therefore attempt to resolve those problems.

c) Methods Used in the Construction of Yearly Catch Compositions

Procedures for aggregating age and length data should be reviewed, particularly stratification schemes. The database at present only went back to 1977. While data for the 1962-76 period were available, they had not been analyzed yet.

d) Research Vessel Survey Data

Stratification schemes, sampling and raising procedures should be reviewed. The ageing and length measurement problems referred to above would also influence the survey results.

e) Commercial Catch Rate Data Series

There was a break in the nature of the data series so two periods needed to be addressed: 1970-85 and 1986-89.

f) Assessment Methods

The methods which were currently employed to assess silver hake should be reviewed and new methods should be evaluated before they were used in assessments.

Output of the Workshop

For items a-e listed above, the agreed database and how it was constructed should be fully documented. Further, effects on the assessment as a consequence of any changes in the database should be documented.

For item f, validation of the methods should be sought.

Standard methods of sampling, stratification, length measurement etc. should be established wherever possible.