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Comparative Fishing for Silver Hake on the Scotian Shelf using 90 mm and 60 mm Codends

by

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Introduction

Experimental fishing using 60 mm and 90 mm mesh size codends was carried out by two Soviet fishing vessels on the Scotian Shelf in July, 1980. The purpose of the experiment was to gain information on the relative catch rates and size selection of the two gears. A Canadian fisheries observer was aboard each vessel while the experiment was carried out.

Methods

Experimental fishing, using a 90 mm codend was conducted by the Soviet vessel BMRT-345 "Ametist" in July 1980. A similar vessel, BMRT-398 "Pulbovo" was designated to fish simultaneously with a 60 mm codend alongside the "Ametist". Each vessel carried both a Canadian and Soviet observer. The vessels completed a total of thirty-one tows in this comparison.

All experimental sets by both vessels were limited to daylight hours, between 1015 and 2230 GMT, and were generally of one hour duration (net on bottom). The vessels always carried out the comparative work slightly removed from the major concentration of vessels and remained within a mile of each other while towing. Although the experiment was limited to NAFO division 4W in the area inside (seaward of) the small mesh gear line, two quite widely separated areas were covered during the survey. From July 8 to July 21, the "Ametist" and the "Pulbovo" completed eight sets in the southwestern corner of 4W along the parallels $42^{o}51'$ - $42^{o}52'$ N between the meridians $62^{o}40'$ W and $63^{o}00'$W (area 1, figure 1). A single set was made at position $43^{o}00'$, $62^{o}00$ on the afternoon of July 21. All remaining sets were made in the northeast corner of the small mesh line between $43^{o}21'$ - $43^{o}33'$ N and $60^{o}06'$ - $60^{o}40'$W (area 2, figure 1). Fishing depths ranged from 130 m to 155 m in area 1 and from 113 m to 210 m in area 2. Both vessels fished similar depth contours.

Estimates of catch weight and species composition were obtained from the Canadian observer and the Canadian fishing log which was completed by the captain. Random samples of silver hake were taken from as many sets as possible by length analysis. Sample weights were recorded in kg and lengths to the nearest cm.

The removals at length of silver hake were calculated separately by sex. Individual length frequencies were weighted by the ratio of hake catch to hake sample weight. The weighted length frequencies were summed for a particular gear. The resultant was then multiplied by the factor

$$\frac{C_t}{C_s}$$

where C_t = the total hake catch

C_s = the catch of sets sampled

Catch rates of silver hake and the variance of the estimater were calculated using the 'jackknife' method described by Smith, 1980.

Results

The set by set information on silver hake catch and total catch for 60 mm and 90 mm gears is given in tables 1 and 2 respectively. There was good agreement between catch estimate of the observer and the captain on the 60 mm vessel. However there is not as good agreement in estimates on the 90 mm vessel. Also neither of the data sets presented here agree with the data set presented by Bidenko, et. al. (1981) for the same experiment. The estimates of the Canadian Observer were used in this analysis.

Catch rates of silver hake were calculated separately for area 1, area 2 and both areas combined (table 3). The differences between catch rates with 60 mm and 90 mm gear were tested for significance with a "t" test. None of the comparisons produced a significant difference due to the overall high variance in the set by set observations. However, the trend in catch rates indicated that in area 1 the 2 gears had equal catch rates but in area 2 the 60 mm gear had a slightly higher catch rate.

The calculated removals at length for both gears in area 1, area 2 and combined are given in table 4 for males and table 5 for females. The length frequencies are presented graphically in figures 2 - 7. It can be seen that more smaller fish were caught in area 2 than in area 1. This could explain the lower catch rate of 90 mm gear in area 2.

The selectivity of the gears is shown by the length frequency plots in figure 2 - 7. The 60 mm gear clearly caught more fish between lengths 16 to 30 cm than the 90 mm gear. However, the decending limits of the curves indicate equal catches at length greater than 32 cm.

The age composition of the catches by both gears in shown in table 6. For males the 90 mm gear reduced catch at age 1 by 97%, at age 2 by 74%, and at age 3 by 30%. For females the 90 mm gear reduced catch at age 1 by 98%, at age 2 by 80% and at age 3 by 49%. From age 4 on catches by both gears were relatively equal.

The data presented here suggests a possible selectivity difference between the two gear types. However the data set is too small to make conclusive statements. It was suggested that the relative catch rates of the two gears were affected by the size composition of the schools being prosecuted. Also the experiment was conducted only in daylight hours in an area removed from the main concentration of the fleet.

REFERENCES

Smith, S. J. 1980. Comparison of two methods of estimating the variance of the estimate of catch per unit effort. Can. J. Fish. Aquat. Sci., 37:2346-2351.

Bidenko, G. E., V. A. Rikhter and V. F. Turok. 1981. Results of experimental fishing for silver hake on the Scotian Shelf in July 1980. NAFO SCR Doc. 81/VI/62, Serial No. N346.

Table 1. Set by set estimates of catch and effort from the Canadian observer and the Captain's log for 60 mm gear.

Date	Tow Duration	Area	Catch(kg) Silver Hake Observer	Silver Hake Logbook	Total Observer	Total Logbook
18-07-80	1.33	1	1600	1800	2000	2140
"	1.00	1	1500	1400	4500	4550
"	1.00	1	3000	3000	3500	3600
"	1.00	1	4800	4800	5000	5100
"	1.25	1	1730	1850	2000	1971
19-07-80	1.00	1	172	110	250	172
21-07-80	1.00	1	150	110	200	150
"	1.00	1	0	0	50	110
"	1.50	X	155	160	200	205
22-07-80	1.00	2	770	800	1000	1040
"	1.00	2	690	720	1000	1091
"	1.00	2	1482	1500	5000	5130
23-07-80	1.00	2	888	900	3000	3085
"	1.00	2	1455	1349	5000	5090
"	1.00	2	5382	5500	6000	6180
"	1.00	2	1500	1500	2500	2500
24-07-80	1.00	2	3876	3830	4000	3955
"	1.00	2	1392	1300	3500	3540
"	1.00	2	1534	1450	2000	1835
"	1.00	2	1870	1840	2000	1988
"	1.00	2	480	500	1000	1030
26-07-80	1.00	2	828	820	1000	1015
"	1.00	2	175	185	300	294
"	1.00	2	200	211	300	304
27-07-80	1.00	2	579	600	1500	1438
"	1.00	2	2697	1850	4500	4555
"	1.00	2	588	600	1500	1516
"	1.00	2	870	990	1200	1260
"	1.00	2	310	380	500	457
28-07-80	2.42	2	4695	4740	5000	4992
"	1.00	2	278	330	1000	993
Total			45646	45125	70500	71286

Table 2. Set by set estimates of catch and effort from the Canadian Observer and the Captain's log for 90 mm gear.

Date	Tow Duration	Area	Catch(kg) Silver Hake Observer	Silver Hake Logbook	Total Observer	Total Logbook
18-07-80	1.42	1	1500	3000	1620	3680
"	1.00	1	2400	4000	4000	4830
"	1.00	1	2100	2000	3100	7258
"	1.00	1	5800	1728	6050	2248
"	1.08	1	300	4000	340	5020
19-07-80	1.00	1	200	1084	270	1484
21-07-80	1.00	1	40	50	147	60
"	1.00	1	0	50	60	57
"	1.50	X	0	33	53	33
22-07-80	1.08	2	25	57	85	127
"	0.83	2	60	50	6575	200
"	1.00	2	10	50	75	50
23-07-80	1.00	2	10	200	320	760
"	1.00	2	1300	300	1420	958
"	1.00	2	1200	100	9200	615
"	1.00	2	25	145	4025	685
24-07-80	1.00	2	30	100	51	100
"	1.00	2	10	40	68	40
"	1.00	2	4000	4000	4135	5010
"	1.00	2	10	40	15	72
"	1.00	2	10	1000	10	1065
26-07-80	1.00	2	15	38	96	61
"	1.00	2	15	50	76	100
"	1.00	2	20	50	51	100
27-07-80	1.00	2	400	29	625	29
"	1.00	2	350	0	470	20
"	1.00	2	50	0	255	20
"	1.33	2	0	0	223	50
"	1.00	2	250	1000	725	1895
28-07-80	1.17	2	210	0	600	116
"	1.00	2	8000	6000	8110	6252
Total			28340	29194	52850	42995

Table 3. Estimates of catch rates and standard error of 60 mm and 90 mm gear.

AREA	60 mm kg/hr	60 mm Std. Error	90 mm Kg/hr	90 mm Std. Error	t
1	1290	499	1221	592	.089
2	1393	259	713	388	1.458
Total	1364	231	873	321	1.242

TABLE 4 : REMOVALS AT LENGTH OF MALES

	60 MM			90 MM		
LENGTH	AREA 1	AREA 2	TOTAL	AREA 1	AREA 2	TOTAL
16	0	48	48	0	0	0
17	0	102	102	0	0	0
18	0	397	397	0	0	0
19	0	1037	1037	0	0	0
20	0	1532	1532	0	43	43
21	0	3921	3921	0	93	93
22	0	3525	3525	0	298	298
23	163	2145	2308	0	298	298
24	285	2647	2932	117	215	332
25	733	5400	6132	0	325	325
26	2198	6280	8478	553	662	1215
27	1669	7861	9529	779	1918	2697
28	1995	6830	8824	1009	1824	2833
29	1180	5499	6679	2164	3517	5681
30	1465	7413	8878	3724	2253	5977
31	1343	8161	9504	3840	3711	7550
32	1099	4345	5444	3314	4162	7476
33	611	3263	3874	2713	2444	5156
34	488	1373	1862	1026	444	1470
35	163	427	590	324	801	1126
36	0	228	228	167	707	875
37	0	18	18	96	153	249
38	0	78	78	0	19	19
39	0	0	0	0	0	0
40	0	0	0	7	0	7
41	0	0	0	0	0	0
42	0	0	0	0	0	0
43	0	0	0	0	0	0
44	0	0	0	0	0	0
45	0	0	0	0	0	0
46	0	0	0	0	0	0
47	0	0	0	0	0	0
48	0	0	0	0	0	0
49	0	0	0	0	0	0
50	0	0	0	0	0	0
51	0	0	0	0	0	0
52	0	0	0	0	0	0
53	0	0	0	0	0	0
54	0	0	0	0	0	0

TABLE 5: REMOVALS AT LENGTH OF FEMALES

	60 MM			90MM		
LENGTH	AREA 1	AREA 2	TOTAL	AREA 1	AREA 2	TOTAL
16	0	48	48	0	0	0
17	0	132	132	0	0	0
18	0	616	616	0	0	0
19	0	1007	1007	0	0	0
20	0	1475	1475	0	43	43
21	0	2329	2329	0	128	128
22	0	1935	1935	0	128	128
23	0	1857	1857	0	213	213
24	0	562	562	60	256	316
25	163	1412	1575	0	190	190
26	285	1932	2217	133	153	286
27	611	4273	4883	186	138	324
28	773	7109	7883	403	439	842
29	1384	9715	11098	251	1582	1833
30	1832	9624	11456	669	3038	3707
31	5943	9877	15820	2746	4129	6875
32	7083	10751	17834	2334	4153	6487
33	8182	8963	17145	6787	6854	13641
34	6920	10219	17139	6126	7383	13508
35	3745	6178	9923	5469	6214	11684
36	1995	2605	4600	2644	4001	6645
37	1343	1436	2780	1651	2951	4602
38	163	1109	1272	619	873	1492
39	285	288	573	375	843	1218
40	0	246	246	0	676	676
41	163	273	436	160	15	174
42	163	39	202	36	320	356
43	163	18	181	165	427	591
44	163	0	163	7	582	589
45	0	177	177	0	174	174
46	0	36	36	36	153	188
47	0	0	0	71	12	84
48	0	0	0	60	2	62
49	0	66	66	0	155	155
50	0	18	18	36	0	36
51	0	0	0	0	10	10
52	0	0	0	1	0	1
53	0	0	0	0	0	0
54	0	12	12	0	0	0

Table 6. Age composition by sex of catches with 60 mm gear and 90 mm gear.

Age	Male		Female	
	60 mm	90 mm	60 mm	90 mm
1	5087	157	4064	86
2	44985	11560	38861	7704
3	20649	14543	56123	27674
4	8808	10090	19377	20931
5	4750	4436	15747	15793
6	1335	2031	2776	3371
7	221	749	487	1166
8	9	124	165	403
9	-	-	56	18
10	-	-	18	36
11	-	-	33	78
Total	85844	43692	137707	77260
	.3840	.3612	.6160	.6388

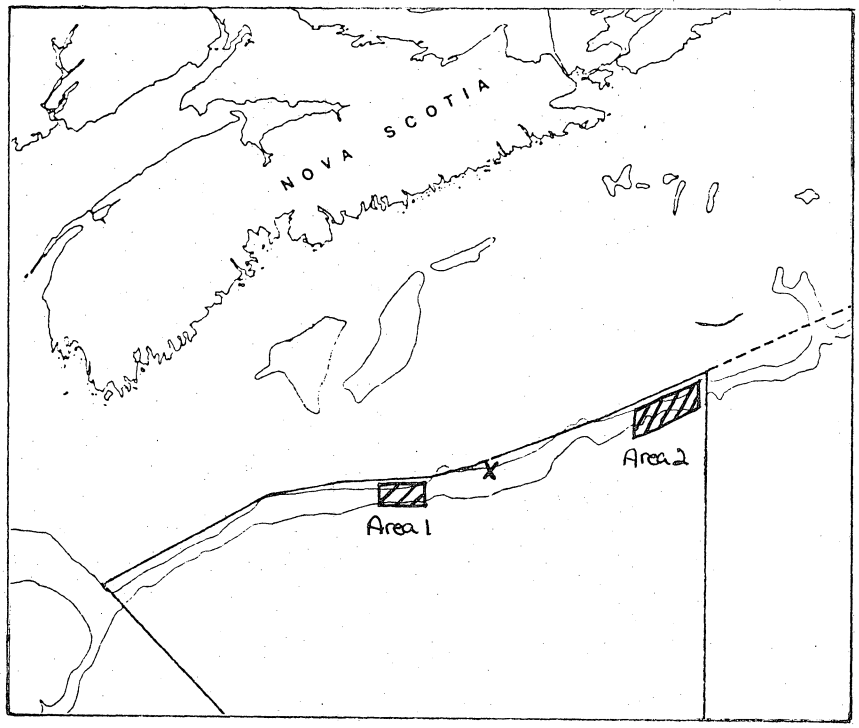

Figure 1. Areas fished in comparitive fishing study.

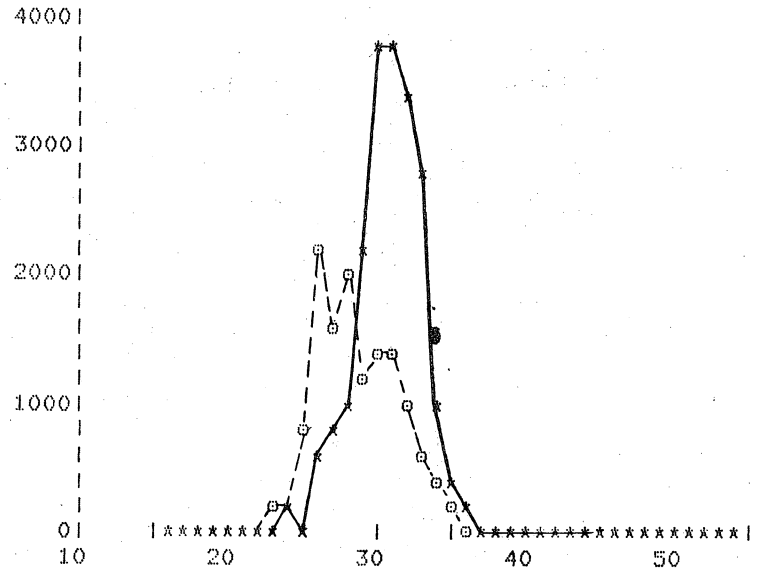

Figure 2. Male catch-at-length for 60 mm and 90 mm gear in area 1.

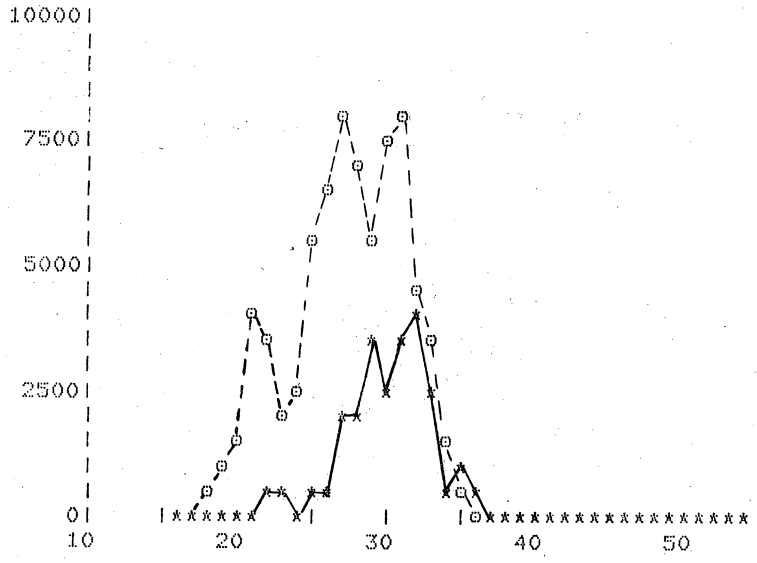

Figure 3. Male catch-at-length for 60 mm and 90 mm gear in area 2.

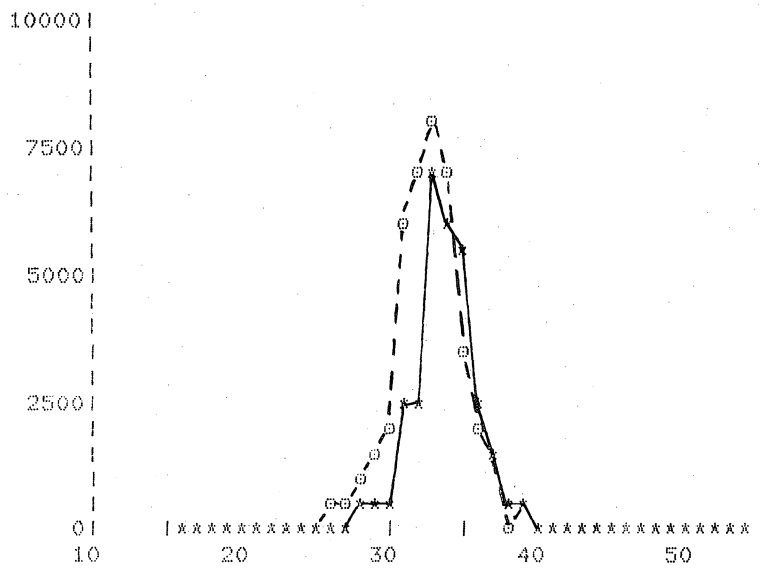

Figure 4. Female catch-at-length for 60 mm and 90 mm gear in area 1.

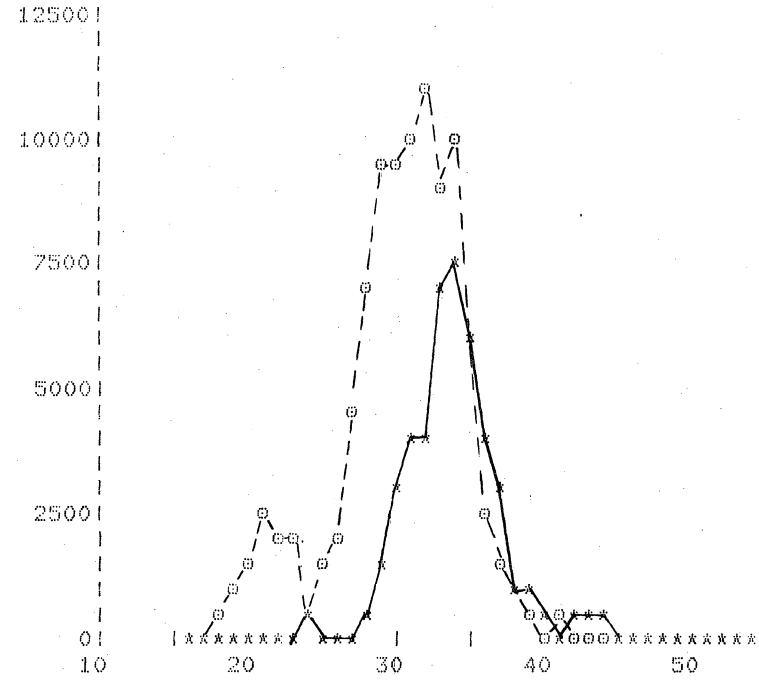

Figure 5. Female catch at length for 60 mm and 90 mm gear in area 2.

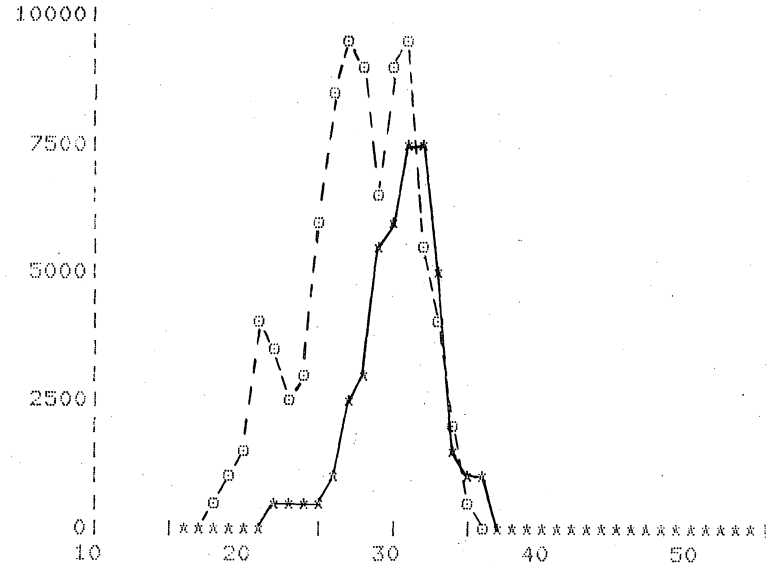

Figure 6. Male catch-at-length for 60 mm and 90 mm gear in both areas combined.

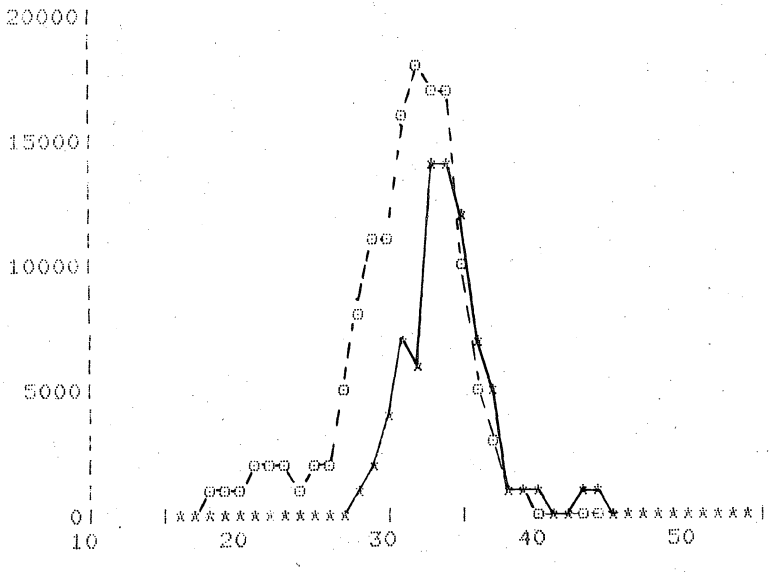

Figure 7. Female catch-at-length for 60 mm and 90 mm gear in both areas combined.