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Capelin School Surface Area Index Incorporating the 1986 Aerial Survey in NAFO Div. 3L

by

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Introduction

The methodology and rationale for developing a relative abundance index based on aerial photographic measurements of capelin schools were discussed in previous manuscripts (Nakashima 1985, 1986). This brief report describes the results of the 1986 aerial photographic survey in NAFO Div. 3L and compares the trends of the school surface area index to other measures of trends in abundance.

Materials and Methods

The details of all aerial surveys for capelin that have been conducted in the Newfoundland Region are provided in Table 1. We attempted to provide comparable coverage of all four transects in 1986. These were the outside of Trinity Bay from the Horse Chops to Gooseberry Cove, the inside of Trinity Bay from Gooseberry Cove to Hopeall, the outside of Conception Bay from Caplin Cove to Harbour Grace Islands, and the inside of Conception Bay from Harbour Grace Islands to Portugal Cove (Fig. 1).

Optimal conditions for photography were in the morning when the sun angle was less than 25° and wind conditions were light. Afternoon photography was hampered by wind and land shadows along the coastline.

From each photograph the school surface area was measured with a compensating polar planimeter. The measurements were corrected for altitude and expressed in m². Each time a transect was surveyed, the mean and median school surface areas and the total school surface area along the transect were estimated.

A relative index for the year was estimated by summing the highest total school surface area observed on each of the four transects. This assumed that peak school surface area was indicative of inshore abundance for that year. The index derived for 1982-86 was compared to catch rates from capelin traps and purse seines (Nakashima and Harnum 1987) and to projections of mature biomass for acoustic surveys (Anon. 1982, 1983, 1984, 1985).

Results and Discussion

Coverage of the four transects in 1986 was very minimal due to consistently bad weather conditions during the survey period. We flew 13.4 hr which was considerably lower than previous surveys (Table 1). The outside transect of Trinity Bay was only partially surveyed on two days. On June 22, 26 schools were photographed between the Horse Chops and Bonaventure Head with a combined school surface area of 10,319 m². The mean school size was 397 ± 431 m² and the median size was 197 m². Later on June 28, we observed 14 schools in Southwest Arm having a total school surface area of 23,215 m². The mean school surface area was 1658 ± 4358 m² and the median size was 326 m². Neither estimate was presented in Table 2a since the table contained only those times when the entire transect was surveyed (Nakashima 1985). The inside transect of Trinity Bay was covered once on June 28 (Table 2b), the day the fixed gear capelin fishery was closed in this bay. The outside transect in Conception Bay was surveyed on June 19 (Table 2c) and partly covered on June 22 from south of Western Bay to Harbour Grace Islands. The latter survey measured 56 schools with a total surface area of 32,129 m². The mean school size was 529 ± 773 m² and median size was 203 m². The inside transect of Conception Bay was overflowed four times (Table 2d) and was the only one to have had multiple coverage in 1986.

The school surface area index was compared to two inshore catch rate indices and the mature biomass projections from acoustic surveys (Table 3). The purse seine catch (t)/day (C/D) per vessel has been added to this year's comparisons in support of the capelin trap catch (t)/day index (Nakashima and Harnum 1987). The total school surface area observed in 1986 was derived from the three surveyed transects (Tables 2b, c, d) and incorporated the 23,215 m² estimated for Southwest Arm on June 28 which was described earlier in the report:

Noting that the trap C/D may have been overestimated in 1985 due to a late opening of the season (Nakashima 1986), both catch rate indices followed a similar trend which corresponded to the one observed for mature biomass projections from acoustic surveys (Anon. 1982, 1983, 1984, 1985). However, the dramatic increase projected for 1986 from acoustic surveys was not apparent in either catch rate series. This may have been due to an overestimate in the projected inshore biomass or an underestimate from the catch rate indices. The trends in the school surface area index from 1982-85 were comparable to the other indices, however the 1986 estimate was negatively biased since coverage was incomplete for one transect and for two other transects there was only a single estimate. One aspect of the methodology was to have repeat coverage of each transect to be able to detect the period of peak abundance. It is likely that the single estimate on June 19 for the outside of Trinity Bay was close to the peak since a partial survey a few days later observed a much lower school surface area. The estimate of June 28 of the inside transect of Trinity Bay was after the peak since the trap fishery in that area had their highest landings June 18-20 and the fishery was closed on June 28. Also trap fishermen in this area experienced the highest catch rates in Div. 3L indicating that we would have observed substantially more schools had the survey been able to operate earlier.

The total surface area estimates by bay indicated that the 1986 Conception Bay estimate was higher than in 1985 while the Trinity Bay total was half the 1985 estimate. Annual comparisons by bay were:

	1982	1983	1984	1985	1986
Trinity	65360	217840	86660	244880	119110
Conception	157790	149430	129850	112390	164030

The effect of poor weather on this index underscores the need to maintain several indices of abundance since one index may not be measured reliably every year.

Acknowledgments

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References

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Table 1. Summary of aerial surveys conducted from 1982 to 1986.

Year	Aircraft	Camera	Lens (mm)	Filter	Film	Radar altimeter	Survey period	Altitude (m)	Flying hours
1982	Piper Aztec	RC 10	152	Anti-vignetting	Aerocolour Neg. 2445	No	June 18-July 5	152-160	
1983	Aero-Commander 500 B	RC 10	152	Anti-vignetting	Aerocolour Neg. 2445	Yes	June 19-July 9	457	21.8
1984	Cessna 310	RC 10	152	Anti-vignetting	Aerocolour Neg. 2445	Yes	June 17-July 7	457	38.5
1985	Aero-Commander 500 B	RC 10	152	Anti-vignetting	Aerocolour Neg. 2445	Yes	June 18-July 3	290-610	28.6
1986	Aero-Commander 500-B	RC 10	152	Anti-vignetting	Aerocolour Neg. 2445	Yes	June 19-July 5	381-579	13.4

Table 2a. Schooling data for the outside part of Trinity Bay from the Horse Chops to Gooseberry Cove, 1982-85.

Date	No. of schools	Total surface area (m ²)	School size (m ²)	
			Mean ± SD	Median
June 19, 1982	7	2963	423 ± 502	125
June 26, 1982	0	0		
July 3, 1982	1	522	522	522
June 23, 1983	7	11330	1619 ± 1315	1283
June 24, 1983	10	13671	1367 ± 1260	1088
June 25, 1983	7	11662	1666 ± 2151	725
June 29, 1983	8	2288	286 ± 228	195
June 30, 1983	13	18470	1420 ± 1613	1116
July 1, 1983	3	6417	2139 ± 2176	1172
June 18, 1984	9	3236	360 ± 423	223
June 19, 1984	8	3962	495 ± 703	279
June 25, 1984	22	30467	1385 ± 1959	502
June 26, 1984	38	37219	979 ± 1718	167
June 29, 1984	9	2790	310 ± 223	279
July 3, 1984	48	43412	904 ± 3010	223
July 6, 1984	34	16015	471 ± 485	167
June 21, 1985	0	0		
June 25, 1985	0	0		
June 29, 1985	18	15536	863 ± 983	316
July 1, 1985	32	48808	1525 ± 1622	893
July 2, 1985	24	49216	2051 ± 2965	949
July 3, 1985	9	2498	278 ± 183	270

Table 2b. Schooling data for the inside part of Trinity Bay from Gooseberry Cove to Hopeall, 1982-86.

Date	No. of schools	Total surface area (m ²)	School size (m ²)	
			Mean ± SD	Median
June 19, 1982	31	12724	411 ± 712	149
June 26, 1982	29	35607	1228 ± 2755	299
June 29, 1982	11	62397	5672 ± 8378	592
July 2, 1982	8	31365	3921 ± 9281	705
July 3, 1982	2	1920	960 ± 17	960
June 23, 1983	11	69583	6326 ± 6200	4241
June 24, 1983	26	39004	1500 ± 1880	753
June 25, 1983	30	174487	5816 ± 12759	781
June 29, 1983	35	152557	4359 ± 11139	781
June 30, 1983	46	199373	4334 ± 6927	558
July 1, 1983	25	189497	7580 ± 19791	2288
June 19, 1984	13	15624	1202 ± 1770	335
June 23, 1984	9	8314	924 ± 888	502
June 25, 1984	96	31526	328 ± 505	117
June 26, 1984	96	40510	422 ± 679	223
June 29, 1984	47	12053	256 ± 314	167
July 3, 1984	57	23827	418 ± 814	167
July 7, 1984	77	43245	562 ± 1124	223
June 21, 1985	13	7041	542 ± 706	270
June 25, 1985	35	22459	642 ± 1144	211
June 26, 1985	30	16540	551 ± 721	214
July 1, 1985	125	60245	482 ± 963	181
July 2, 1985	130	195659	1503 ± 6046 ^a	179
June 28, 1986	59	95898	1625 ± 4502	340

^a calculation excludes capelin in traps

Table 2c. Schooling data for the outside of Conception Bay from Caplin Cove to Harbour Grace Islands, 1982-86.

Date	No. of schools	Total surface area (m ²)	School size (m ²)	
			Mean ± SD	Median
June 29, 1982	10	6577	658 ± 366	642
July 2, 1982	2	1357	679 ± 554	679
June 23, 1983	34	51838	1374 ± 2266 ^a	530
June 24, 1983	16	10658	666 ± 823	447
June 25, 1983	4	4408	349 ± 184	279
July 1, 1983	5	5413	1083 ± 1884	112
June 18, 1984	1	391	391	
June 19, 1984	0	0		
June 25, 1984	49	63779	1294 ± 2874	391
June 26, 1984	67	65956	697 ± 1091 ^a	279
June 30, 1984	21	22320	818 ± 1509 ^a	223
July 3, 1984	4	1786	446 ± 599	195
June 20, 1985	0	0		
June 24, 1985	0	0		
June 27, 1985	30	8840	268 ± 378 ^a	120
June 28, 1985	125	50837	386 ± 800 ^a	132
June 29, 1985	22	19253	875 ± 1169	291
July 1, 1985	28	28036	991 ± 1616 ^a	264
July 2, 1985	66	69166	914 ± 2064 ^a	223
June 19, 1986	88	132455	1462 ± 2853 ^a	279

^a calculation excludes capelin in traps

Table 2d. Schooling data for the inside of Conception Bay from Harbour Grace Islands to Portugal Cove, 1982-86.

Date	No. of schools	Total surface area (m ²)	School size (m ²)	
			Mean ± SD	Median
June 26, 1982 AM	33	19408	571 ± 907 ^a	135
June 26, 1982 PM	20	36513	1826 ± 1914	2089
June 27, 1982	48	151214	3134 ± 6015 ^a	527
June 29, 1982	27	30275	1121 ± 1707	418
July 4, 1982	3	13042	4347 ± 4951	1409
July 5, 1982	7	5127	732 ± 582	592
June 23, 1983	53	97595	1787 ± 2754 ^a	558
June 24, 1983	30	56860	1819 ± 2965 ^a	558
June 25, 1983	29	79961	2677 ± 3725 ^a	781
June 30, 1983	7	8091	1156 ± 1181	558
July 1, 1983	1	2009	2009	
June 18, 1984	0	0		
June 23, 1984	8	17689	2085 ± 2556 ^a	949
June 25, 1984	70	63891	879 ± 1789 ^a	223
June 26, 1984	33	23603	703 ± 1708 ^a	223
June 30, 1984	29	16852	508 ± 467 ^a	335
July 3, 1984	18	9040	329 ± 254 ^a	223
July 5, 1984	0	0		
June 20, 1985	0	0		
June 24, 1985	2	1600	800 ± 834	800
June 26, 1985	17	10124	596 ± 1145	314
June 27, 1985	76	16552	214 ± 426 ^a	78
June 28, 1985	120	33858	274 ± 938 ^a	67
July 1, 1985	16	43228	2702 ± 5140	308
July 2, 1985	17	13436	676 ± 1872 ^a	191
June 19, 1986	39	31574	786 ± 1105 ^a	357
June 20, 1986	4	3515	698 ± 769 ^a	363
June 22, 1986	86	30930	343 ± 616 ^a	131
July 2, 1986	10	5019	502 ± 600	358

^a calculation excludes capelin in traps

Table 3. Comparison of three indices for estimating trends in relative spawning biomass. The catch/day index was based on capelin trap and purse seine data from logbook surveys (Nakashima and Harnum 1987), the mature biomass index originated from NAFO Scientific Council Reports (Anon. 1982-85), and the school surface area index came from this study.

Year	Catch (t)/day		Mature t biomass	School surface area (m ²)
	Purse seine	Trap		
1982	16.4	3.1	≥346,000	223,150
1983	18.8	3.4	658,000	367,270
1984	14.3	2.9	384,000	216,510
1985	16.4	4.6	596,000	357,270
1986	19.0	4.6	1,300,000	283,140

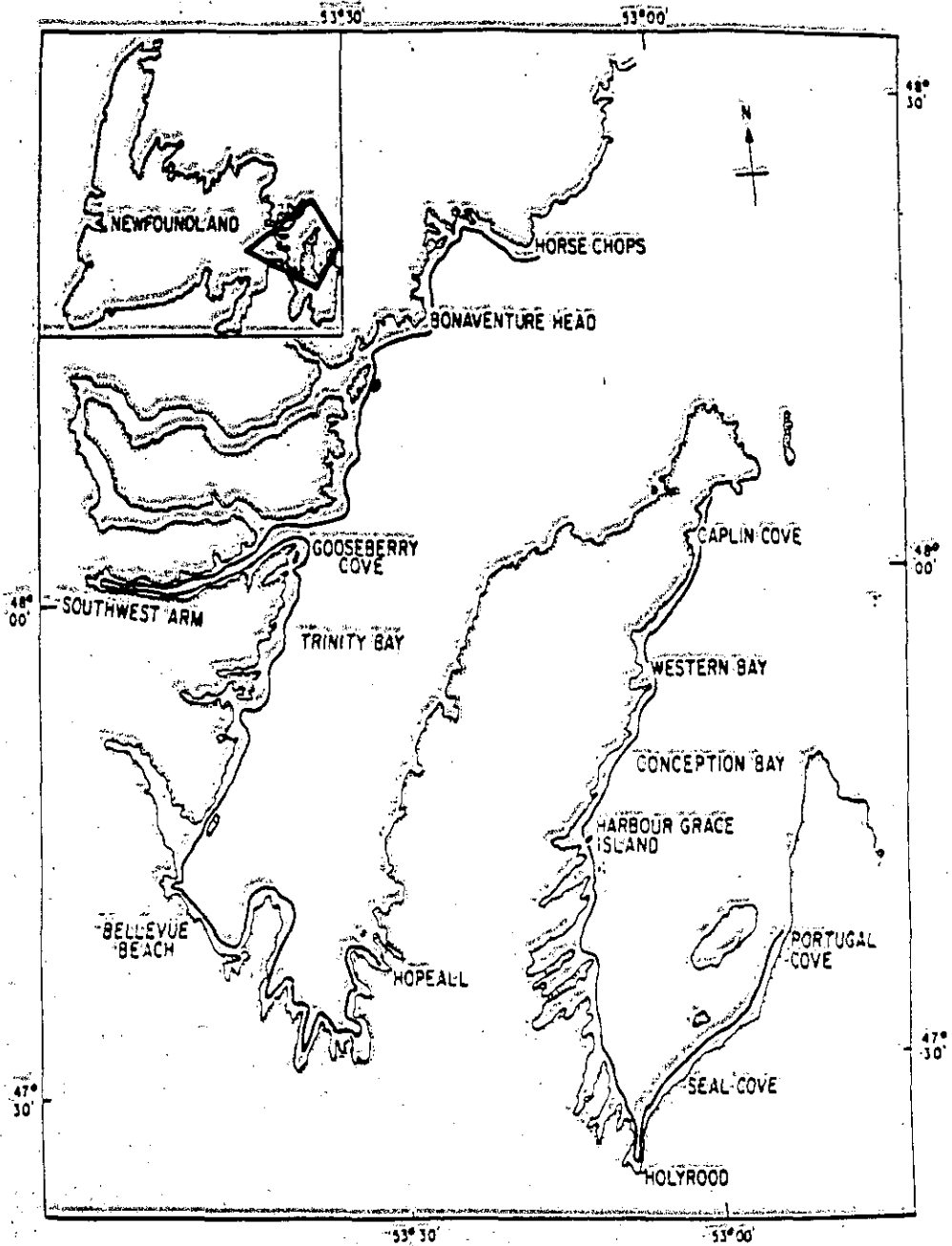


Fig. 1. Aerial survey track in Trinity and Conception Bays.