Biological update of the inshore cod stock in subdivision 4Vn (May-December) for 1982

by

S.J. Smith
Marine Fish Division
Bedford Institute of Oceanography
Department of Fisheries and Oceans
P.O. Box 1006
Dartmouth, N.S. B2Y 4A2

Abstract

Although nominal landings of cod in 4Vn (May-December) exceeded 12,000 t again this year the landings by the major gear - longliners-were 2,500 t less than the amount landed in 1981. The 1977 cohort which has appeared to be a strong year class in recent research surveys has now entered the fishery with the same apparent strength. Population indices estimated from research and commercial data indicate a drop in stock size but interpretation of the latter index is complicated by a decrease in the average weight and length of fish primarily in ages 6-8 years old. If this trend of decreasing size of fish continues, management advice may have to be changed to take this into account.

Résumé

Bien que les débarquements nominaux de morue de la subdiv. 4Vn (mai-décembre) aient de nouveau cette année dépassé 12 000 t, les débarquements du principal agrès - la palangre - ont été de 2 500 t inférieurs à ceux de 1981. La cohorte de 1977, qui avait semblé appartenir à une abondante classe d'âge dans les récents relevés par navires de recherche, a maintenant rallié le stock pêchable et semble tout aussi forte. Les indices de populations dérivés de données de recherche et commerciales indiquent une chute des effectifs de stock mais l'interprétation de ces dernières se complique du fait qu'il y eut déclin de la longueur et du poids moyens des poissons, surtout ceux d'âges 6-8. Si cette tendance vers une diminution de la taille se poursuit, il se peut que les conseils de gestion devront être modifiés pour en tenir compte.

Introduction

Nominal landings of cod in 4Vn (May-December) exceeded 12,000 t again this year. Landings for all major gears, with the exception of longliners showed increases with the largest increase being for the otter trawlers. This report summarizes the available information from both commercial and research sources for this cod stock.

Nominal Catch

Nominal landings by country (1965-1982) and by gear (1971-1982) are presented in Tables 1 (Figure 1) and 2 respectively. The Canadian catch is further broken down by tonnage class in Table 3 and by specific gear in Table 4. The most notable changes concern the landings by longliners, otter trawlers, and gillnets. The large gillnet landings according to information from statistics are due to unusually large by-catches of cod in the flatfish (mainly plaice) fishery. The longliner catch was down by approximately 2,500 t from 1981. There apears to be many factors which could explain this drop. The weather in 1982 was reported to be less favourable than in 1981, especially in the fall. Due to the early closure of the herring fishery in the area in 1982 there were problems in the availability of bait. Crab prices were very good last summer and may have diverted some of the inshore fleet from fishing cod. In addition fewer Newfoundland vessels participated in the fishery this year as compared to last.

The large increase for trawlers is directly related to the reallocation of 1,400 t from the 4Vn fixed gear (<65') quota effective December 1st to the mobile fleet >65' (700 t) and vessels >100' (700 t) in 4Vn. This reallocation to the mobile fleet was made in exchange for the transfer of 700 t from the offshore allocation in 4VsW to the closed inshore 4VsW fixed gear fishery in order to enable the inshore fishermen to operate on a by-catch limit of 1.5 t per trip. The impact of this transfer for 4Vn is obvious in Table 5b where more than half of the Canadian trawler catch for the year was landed in December.

Research Trawl Survey Information

From 1970 to 1981 the July research trawl survey was carried out by the A.T. Cameron. In 1982 the survey was carried out by the Lady Hammond.

Preliminary analyses of comparative fishing experiments between these two vessels have proven to be inconclusive and further study will be carried out (Koeller and Smith, 1983). The estimated population at age from the 1982 Lady Hammond survey is presented along with past estimated from the A.T. Cameron in Table 6. In 1980 and 1981 comparative surveys between these two vessels were done during the

summer cruise in this area and the estimated population at age for 1980, 1981, and 1982 from the Lady Hammond are presented in Table 7. Since no otoliths were collected on the Lady Hammond during the comparative cruises, age-length keys from the A.T. Cameron were used to convert lengths to ages. Given that we only have two points to compare and the magnitudes of the estimates differ there does appear to be agreement in the trend of catch/tow (Table 7) for the two vessels leading to the possibility that the decrease in 1982 was not solely due to the change in research vessel.

Plots of the percentage-at-age composition for both the research surveys and samples taken from the commercial catches of longliners in 4Vn from last years report (Smith and Charlton, 1982) are reproduced here (Figures 3a-3k) along with like plots for the Lady Hammond results for 1980-1982.

The age composition from the A.T. Cameron (Figure 3j) and from the Lady Hammond (Figure 4a) are virtually identical in pattern with small differences in the actual percentages. In 1981 (Figures 3k and 4b) both vessels picked up the same major year classes (1977, 1975), however the relative strengths were reversed. Comparing commercial and research age composition for 1982 (Figure 4c) indicates that the 1975 and 1974 year classes are still strong in the fishery and in addition that the long awaited 1977 year class is finally appearing in the commercial catch to a significant degree.

Catch Composition

Thirteen length and age samples were obtained from the longliner fishery in 1982 which was a substantial increase over the six samples collected in the previous year. The estimated numbers-at-age are presented in Table 8 and the percent composition is displayed in Figure 4c. From the average length-at-age and average weight-at-age information presented in Tables 9 and 10 respectively, there is evidence of a dramatic decrease in the size of fish landed for ages 6-9 over the previous year. The impact of such changes on the catch are evident when ages are grouped into the three categories in Table 11. It is apparent that catches of young fish (ages 1-4) and older fish (ages 9-16) in 1982 have decreased in both numbers and weight over the previous year. However for the second group (ages 5-8) which comprises the bulk of the catch in 1981 and 1982, approximately 415,000 more fish were landed in 1982 but the landed weight was 820 t less than the previous year. The large numbers of 5 year olds (1977 year class) landed may in part explain this difference in landed weight but the decrease in average weights for the 6-8 year olds (Table 10) could possibly mean that there has been a change in the growth rates for these cohorts. Therefore catches with respect to numbers in this group were higher in 1982 compared to 1981 the fish in ages 6-8 were substantially smaller in length and weight. If this trend of

decreasing growth rate for the 1974-1976 cohorts coupled with lower catches of fish in the older age classes continues, catches by weight in 1983 may exhibit the same pattern observed in 1982 despite the apparent strength of the 1977 year class.

Catch-per-unit-effort

The CPUE estimates for longliners (tonnage class 2) for the period 1968-1982 are presented in Table 12. Two series of estimates were calculated. The first labelled "Direct estimate" are simply the sum of the catches divided by the sum of the effort reported from fishing logs for each year. These figures differ from those presented last year (Smith and Charlton, 1982) due to the discovery and correction of an error in the computer programs used to process these data. The second series was estimated via the multiplicative model proposed in Gavaris (1980) in order to correct the seasonal trend exhibited in Figure 2. For both series the 1981 estimate was based on records from May to September since the fishery was restricted to boat quotas for the remainder of the year. The drop in CPUE from 1981 to 1982 exhibited in the two series may not be a valid indicator of a decrease in population size. Although there was a decrease in catch of older fish the trend in the CPUE indices is also confounded by the decrease in the size of the 6-8 year old fish which make up the bulk of the catch by number and weight.

Given that longliner gear has a discrete and determinable upper limit to the number of fish caught in any one set, then a population index based solely on weight landed can be misleading. Further information on the number of fish per line (hook success rate) would help in the interpretation of CPUE but such data are not available from the logbooks.

Discussion and Conclusions

For the last five years the bulk of the longliner catch has been made up on the 1973, 1974, and 1975 year classes. The 1977 year class has appeared to be extremely strong in the surveys but up until this year this strength was not reflected in the commercial catch. The same observation regarding this year class' strength in the surveys has been made for the adjoining areas of the Gulf.

The research and commercial population indices indicate a drop in population size but the former is based on three years of data from the Lady Hammond surveys and the latter is confounded by a dramatic change in the size of the fish primarily in the ages 6-8.

Although we have no conclusive evidence of a decrease in population size from these data, the decrease observed in the size

(especially weight) of fish in these age groups warrants concern. Since TAC's are expressed in terms of weight and not in numbers, adjustments may have to be made to the current level if this trend continues.

References

Gavaris, S. 1980. Use of a multiplicative model to estimate catch rate and effort from commercial data. Can. J. Fish. Aquat. Sci. 37: 2272-2275.

Koeller, P. and S.J. Smith. 1983. Preliminary analysis of A.T. Cameron - Lady Hammond comparative fishing experiments 1979-1981. In preparation.

Smith, S.J. and Charlton, B.A. 1982. An update of the status of the inshore cod stock in subdivision 4Vn (May-Dec.) for 1981. CAFSAC Res. Doc. 82/43. 20 p.

Table 1. Nominal cod catch (t) by countries in Division $4V_n$ (May - December).

	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
Canada	9136	9075	7292	6342	8373	8707	8469	6729	5245	4836	3363	5746	7786	5496	6301	9957	12480	12101
Spain	304	45	320	666	611	1141	2161	1171	241	852	89	-	-	-	-	-	-	-
Portugal	465	-	-	-	-	-	-	459	189	84	360	-	-	-	-	-	-	-
France	1679	210	-	44	85	34	1	745	-	-	-	211	135	53	73	102	101	152
Norway	-	-	-	-	-	-	-	-	-	142	186	-	-	-	-	-	-	-
Denmark	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
U.K.	-	-	-	-	-	-	-	-	-	61	-	-	-	-	-	-	-	-
F.R.G.	-	-	-	-	-	-	-	-	73	14	-	-	-	-	-	-	-	-
U.S.A.	-	-	-	-	-	5	-	-	-	-	-	-	-	-	-	-	-	-
Poland	-	-	-	-	71	7	-	-	-	-	-	-	-	-	-	-	-	-
Others	-	-	15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
USSR	415	543	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TOTALS	11999	9873	7627	7052	9140	9894	10631	9104	5748	5989	3998	5957	7921	5549	6374	10059	12581	12253
% Canadian	76	92	96	90	92	88	80	74	91	81	84	95	98	99	99	99	99	99
TAC	-	-	-	-	-	-	-	-	-	10000	10000	10000	3500	3500	3400	5000	*	**

* Initially set at 7500 t, increased in September to 9500 t.
** Initially set at 10500 t, increased November 1 to 14000 t.

Table 2. Nominal catch (t) of cod in Subdivision 4Vn (May - December) by gear type for all countries, 1971-82. (Note: numbers in brackets are percentages.)

Year	Otter Trawls	Seines	Gillnets	Longlines & Handlines	Miscellaneous	Total
1971	5304 (50)	106 (1)	41 (0)	4421 (42)	759 (7)	10631
1972	4418 (49)	121 (1)	248 (3)	3471 (38)	846 (9)	9104
1973	2099 (37)	143 (2)	649 (11)	2386 (42)	471 (8)	5748
1974	2842 (47)	139 (2)	751 (13)	2042 (34)	215 (4)	5989
1975	1851 (46)	100 (3)	604 (15)	1235 (31)	208 (5)	3998
1976	4375 (74)	83 (1)	314 (5)	930 (16)	255 (4)	5957
1977	4613 (58)	554 (7)	199 (3)	2400 (30)	155 (2)	7921
1978	1600 (29)	327 (6)	7 (0)	3501 (63)	114 (2)	5549
1979	624 (10)	278 (4)	5 (0)	5123 (80)	344 (6)	6374
1980	950 (9)	560 (6)	7 (0)	8242 (82)	300 (3)	10059
1981	1348 (11)	559 (4)	2 (0)	10579 (84)	93 (1)	12581
1982	2622 (21)	724 (6)	168 (1)	8647 (71)	92 (1)	12253

Table 3. Nominal catch (t) by Canada of cod in Subdivision 4Vn (May - December) by vessel size by gear. Percentage of gear total catch for each size class is in parentheses.

Tonnage Class (tons)	Otter Trawls	Seines	Gillnets	Longlines & Handlines	Miscellaneous	Total
1981						
0 - 49.9	316 (25)	487 (87)	2 (100)	10319 (98)	56 (60)	11180
50 - 149.9	390 (31)	72 (13)		236 (2)	37 (40)	735
150 - 499.9	406 (33)			24 (0)		430
500 - 999.9	135 (11)					135
TOTAL	1247	559	2	10579	93	12480
1982						
0 - 49.9	302 (12)	711 (98)	168 (100)	8156 (94)	15 (16)	9352
50 - 149.9	358 (15)	13 (2)		421 (5)	77 (84)	869
150 - 499.9	1061 (43)			70 (1)		1131
500 - 999.9	749 (30)					749
TOTAL	2470	724	168	8647	92	12101

Table 4. 4Vn (May - December) cod: Canadian nominal catch by gear.

Gear	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
Longlines	1730	1313	2190	2733	2393	3798	3895	2124	2455	3300	3229	3725	3185	1982	1332	689	620	1805	3035	4483	6422	9838	7287
Handlines	617	912	960	945	-	-	-	1398	960	848	495	696	286	404	568	360	310	595	466	640	1820	741	1360
Seines	78	229	108	88	910	154	134	207	184	107	83	106	121	143	269	100	83	554	327	278	560	559	724
Fixed Nets & Traps	385	41	29	388	-	1229	2030	44	163	6	99	2	4	-	-	-	-	-	9	4	8	13	5
Gillnets	-	199	373	110	-	209	130	139	110	115	75	41	248	649	751	604	314	199	7	5	7	2	168
Other	-	127	688	-	1135	-	-	1537	554	634	1054	770	390	282	1	208	255	155	105	340	292	80	87
TOTAL "INSHORE" (May-Dec)	2810	2821	4348	4264	4438	5390	6189	5449	4426	5010	5035	5340	4234	3460	2921	1961	1582	3308	3949	5750	9109	11233	9631
Otter Trawls (May-Dec)	1403	1096	3439	2981	4982	3737	2886	1843	1916	3363	3672	3129	2495	1785	1915	1402	4164	4478	1547	551	848	1247	2470
TOTAL (May-Dec)	4213	3917	7787	7245	9420	9127	9075	7292	6342	8373	8707	8469	6729	5245	4836	3363	5746	7786	5496	6301	9957	12480	12101

Table 5a. Nominal catch (t) for Canadian cod fishery in Subdivision 4Vn (May-December) by month and gear 1981.

Gear	May	June	July	Aug	Sept	Oct	Nov	Dec	TOTAL
Gillnets	-	1	-	1	-	-	-	-	2
Handlines	21	96	225	208	93	92	5	1	741
Longlines	2286	1224	1072	1291	1324	1426	747	468	9838
Traps	2	4	7	-	-	-	-	-	13
Miscellaneous	2	-	-	10	11	11	-	-	34
UNKNOWN	-	-	4	-	-	1	-	4	9
Side OT	116	83	34	58	53	42	19	132	537
Stern OT	160	30	83	10	19	22	4	382	710
Pair Seine	7	1	-	-	-	-	-	-	8
Purse Seine	-	-	2	-	-	-	-	-	2
Danish Seine	159	49	45	16	15	13	155	81	533
Scottish Seine	16	-	-	-	-	-	-	-	16
Shrimp Trawl	9	6	12	6	1	-	3	-	37
TOTAL	2778	1494	1484	1600	1516	1607	933	1068	12480
FRANCE	82	19	-	-	-	-	-	-	101
TOTAL	2860	1513	1484	1600	1516	1607	933	1068	12581

Table 5b. Nominal catch (t) for Canadian cod fishery in Subdivision 4Vn (May-December) by month and gear 1982.

Gear	May	June	July	Aug	Sept	Oct	Nov	Dec	TOTAL
Gillnets	28	64	46	-	-	-	11	19	168
Handlines	1	21	164	513	363	254	37	7	1360
Longlines	1114	1097	782	791	1017	786	790	910	7287
Traps	-	2	3	-	-	-	-	-	5
Miscellaneous	-	-	1	3	-	-	-	-	4
Side OT	41	86	152	3	9	1	0	196	488
Stern OT	104	149	86	22	48	154	231	1188	1982
Danish Seine	337	199	60	6	13	18	48	39	720
Scottish Seine	3	1	-	-	-	-	-	-	4
Shrimp Trawl	20	44	8	5	-	-	-	-	77
Scallop Drag	6	-	-	-	-	-	-	-	6
TOTAL	1654	1663	1302	1343	1450	1213	1117	2359	12101
FRANCE	-	152	-	-	-	-	-	-	152
TOTAL	1654	1815	1302	1343	1450	1213	1117	2359	12253

Table 6. Division 4Vn (May - December) cod: research vessel population abundance indices (numbers-at-age x 10^{-3}) (strata 40-42). 1970-1981 survey carried out by A.T. Cameron. In 1982 the Lady Hammond was used. (3 year median smooth used)

Age	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
1	-	-	-	-	-	-	-	-	-	-	-	111	-
2	2120	391	174	-	-	204	2164	43	222	435	627	1455	721
3	591	14146	95	970	203	2142	751	2377	3048	262	3509	5642	495
4	1595	3368	784	1529	455	2863	494	1400	6442	1717	1325	12170	1644
5	3637	8846	100	7073	931	1550	643	968	1850	837	7866	4010	2911
6	3490	5390	538	870	1071	271	517	685	1462	197	5471	8492	2169
7	1502	3554	491	995	133	334	243	279	509	572	1719	3835	2634
8	864	1198	130	1028	168	192	597	64	392	186	387	421	972
9	280	657	89	154	87	71	549	93	147	98	149	309	377
10	-	180	85	49	74	109	469	48	145	49	123	286	127
11	96	-	62	-	36	-	81	64	-	-	123	81	29
12	46	-	-	-	-	38	78	85	-	55	-	52	66
13+	43	187	125	-	-	-	156	73	37	149	-	105	0
UK	70	135	125	72	-	55	-	23	42	-	-	58	27
TOTAL	14334	38052	2798	12740	3158	7829	6742	6202	14296	4557	21299	37027	12172
4+	11553	23380	2404	11698	2955	5428	3827	3759	10984	3860	17163	29819	10956
4+ (smoothed)	11553	11553	11553	5428	3827	3827	3827	3827	3860	10984	17163	28329	
5+	9958	20012	1620	10169	2500	2565	3333	2359	4542	2143	15838	17649	9312
5+ (smoothed)	9958	9958	9958	2565	2565	2565	2565	2565	3333	4542	15838	17649	
6+	6321	11166	1520	3096	1569	1015	2690	1391	2692	1306	7972	13639	6401
6+ (smoothed)	6321	6321	3096	1569	1569	1569	1569	1569	2690	2692	7972	13639	
7+	2831	5776	982	2226	498	744	2173	706	1230	1109	2501	5147	4332
7+ (smoothed)	2831	2831	2226	982	744	744	744	1109	1230	1230	2501	2501	

Table 7. Division 4Vn (May-Dec) cod: Research vessel abundance indices (numbers-at-age x 10^{-3}) from Lady Hammond[1] summer cruises (1980-1982) (strata 40-42).

Age[2]	1980	1981	1982
1	0	0	0
2	238	784	721
3	2987	1426	495
4	1393	5379	1644
5	6164	3174	2911
6	4837	7444	2169
7	2297	4039	2634
8	906	456	972
9	202	518	377
10	110	387	127
11	110	27	29
12	0	0	66
13+	0	68	0
UK	71	174	27
TOTAL	19,315	23,876	12,172
Catch/tow (LH):	67.82	83.83	42.73
Catch/tow (ATC):	63.84	110.98	-

[1]Number corrected for net width of 34 ft.

[2]For 1980 and 1981 Age-Length Key from A.T. Cameron Comparative surveys.

Table 8. 4Vn (May - December) inshore cod: catch-at-age by longlines (thousands of fish).

Ages	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	1	-	-	-	-	-	1	-
3	5	5	2	3	10	-	7	15	44	-	-	35	-	-	85	27
4	122	96	42	62	43	676	133	179	177	-	-	277	17	8	221	198
5	336	393	240	322	236	39	437	181	127	5	-	265	208	105	310	633
6	266	382	346	314	492	604	87	184	73	10	-	197	480	532	409	523
7	67	102	370	181	600	444	193	54	36	25	-	120	305	747	672	694
8	112	122	184	208	63	209	230	66	17	27	-	76	185	386	529	485
9	24	68	41	56	152	2	51	82	13	17	-	49	91	219	267	203
10	23	10	55	40	48	21	17	26	11	15	-	54	17	127	151	91
11	33	12	24	82	14	50	9	-	4	10	-	20	39	32	57	53
12	11	10	24	21	7	2	5	4	-	10	-	18	8	8	52	24
13	4	10	17	17	28	1	6	1	-	-	-	13	4	8	53	10
14	3	2	8	11	1	-	1	1	1	-	-	3	4	-	5	9
15	1	1	2	1	7	1	-	1	-	-	-	8	-	-	8	2
16	2	-	1	-	5	1	2	1	-	10	-	4	-	-	18	22

Table 9. 4Vn (May - December) inshore cod: average length-at-age from longline samples (cm).

Age	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
1	-	-	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	31.00	-	-	-	-	-	28.00	-
3	40.00	37.00	-	34.72	37.31	38.25	-	-	38.90	-	43.00	37.67	39.03
4	43.43	43.25	43.97	42.26	44.01	44.55	-	-	46.94	46.68	51.43	45.90	46.39
5	48.55	47.82	46.00	49.74	51.10	51.24	58.00	-	52.76	55.58	60.85	52.78	53.18
6	55.80	53.17	56.41	56.94	56.26	57.26	64.00	-	60.77	63.90	64.23	61.81	58.67
7	60.33	58.91	55.44	57.22	65.40	62.04	68.20	-	69.57	72.75	70.37	68.20	62.71
8	67.79	77.04	59.38	60.44	62.58	59.23	76.00	-	75.53	72.94	80.66	78.42	70.38
9	76.31	71.65	100.00	65.83	63.50	68.66	76.86	-	80.25	78.37	89.69	83.95	78.68
10	74.53	81.59	89.03	81.97	67.17	71.79	87.00	-	81.81	88.13	94.00	89.29	89.77
11	79.49	87.47	70.67	84.64	94.00	75.74	86.50	-	86.82	90.77	97.00	95.16	93.71
12	94.99	96.47	100.00	80.53	75.18	92.23	92.50	-	86.31	97.38	100.00	102.27	98.35
13	97.24	78.98	118.00	90.09	106.00	106.00	-	-	94.06	100.92	-	100.55	104.77
14	100.44	113.17	-	103.00	103.23	97.97	-	-	98.56	88.00	-	100.00	102.56
15	109.00	108.56	106.00	112.00	106.70	-	-	-	97.91	-	-	103.54	108.56
16	-	104.42	118.00	91.00	84.47	97.00	100.00	-	114.86	-	-	110.65	111.19

Table 10, 4Vn (May-Dec) inshore cod: mean weight-at-age for longline catch (kg).

AGES	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	0.28	-	-	-	-	-	0.21	-
3	0.44	0.54	0.46	0.60	0.48	-	0.40	0.49	0.53	-	-	0.56	-	-	0.50	0.55
4	0.96	0.87	0.94	0.79	0.77	0.82	0.72	0.81	0.84	-	-	0.99	0.93	0.73	0.90	0.89
5	1.49	1.38	1.26	1.09	1.04	0.91	1.17	1.28	1.29	1.82	-	1.40	1.63	1.22	1.35	1.33
6	2.03	2.00	1.86	1.67	1.45	1.72	1.75	1.72	1.79	2.46	-	2.14	2.54	2.03	2.15	1.76
7	2.45	2.87	2.38	2.14	2.01	1.66	1.78	2.65	2.29	3.08	-	3.27	3.78	2.49	2.94	2.14
8	2.93	2.38	3.14	3.11	4.33	2.10	2.14	2.40	2.00	4.18	-	4.14	3.92	3.14	4.28	3.03
9	4.51	3.29	4.44	4.38	3.60	9.29	2.79	2.50	3.18	4.23	-	4.97	4.99	4.55	5.21	4.17
10	4.07	4.97	4.19	4.39	5.24	6.91	5.33	3.14	3.50	6.19	-	5.27	6.95	6.21	6.23	5.97
11	4.10	6.70	4.67	5.15	6.29	3.46	5.98	7.72	4.41	6.07	-	6.27	7.78	6.99	7.75	6.90
12	5.13	5.97	4.63	8.07	8.55	9.29	5.68	4.15	7.72	7.50	-	6.45	9.78	7.65	9.29	7.76
13	7.44	4.58	6.696	8.79	4.84	15.23	7.24	11.06	11.06	-	-	7.98	10.72	8.36	8.80	9.29
14	7.04	7.55	8.01	9.49	13.45	-	10.15	10.26	8.79	-	-	8.93	6.88	-	8.53	8.66
15	13.42	11.06	9.39	12.02	12.03	11.06	13.03	11.37	-	-	-	9.16	-	-	9.45	10.25
16	3.55	-	9.37	-	10.71	15.23	7.01	6.08	8.48	9.39	-	14.09	-	-	11.59	11.03

Table 11. A comparison of numbers and weight landed by longliners (by age groups) for 4Vn cod 1981 and 1982.

Age Groups	1981		1982	
	No.s (000's)	Landings (t)	No.s (000's)	Landings (t)
1-4	307	241.61	225	191.07
5-8	1,920	5,537.65	2,335	4,717.08
9-16	611	4,058.74	414	2,378.85
TOTAL	2,838	9,838	2,974	7,287

Table 12. Longliner catch of cod and associated catch-per-unit-effort 1968-1982, 4Vn (May - December).

Year	Longliner Catch (t)	Proportion of catch for which effort reported	CPUE (t/1000 hks) (1) Direct Estimate	CPUE (t/1000 hks) (2) Multiplicative Model
1968	2455	0.066	0.452	0.556
1969	3300	0.097	0.646	0.619
1970	3229	0.130	0.625	0.698
1971	3725	0.071	0.507	0.529
1972	3185	0.138	0.440	0.539
1973	1982	0.192	0.338	0.419
1974	1332	0.217	0.325	0.285
1975	689	0.028	0.232	0.248
1976	620	0.011*	0.084	0.084
1977	1805	0.027	0.499	0.491
1978	3035	0.141	0.442	0.483
1979	4483	0.169	0.545	0.609
1980	6422	0.111	0.504	0.656
1981	9838	0.028	0.666**	0.736**
1982	7287	0.077	0.408	0.464

* based on one log record
** calculated for records from May to September only (see text)

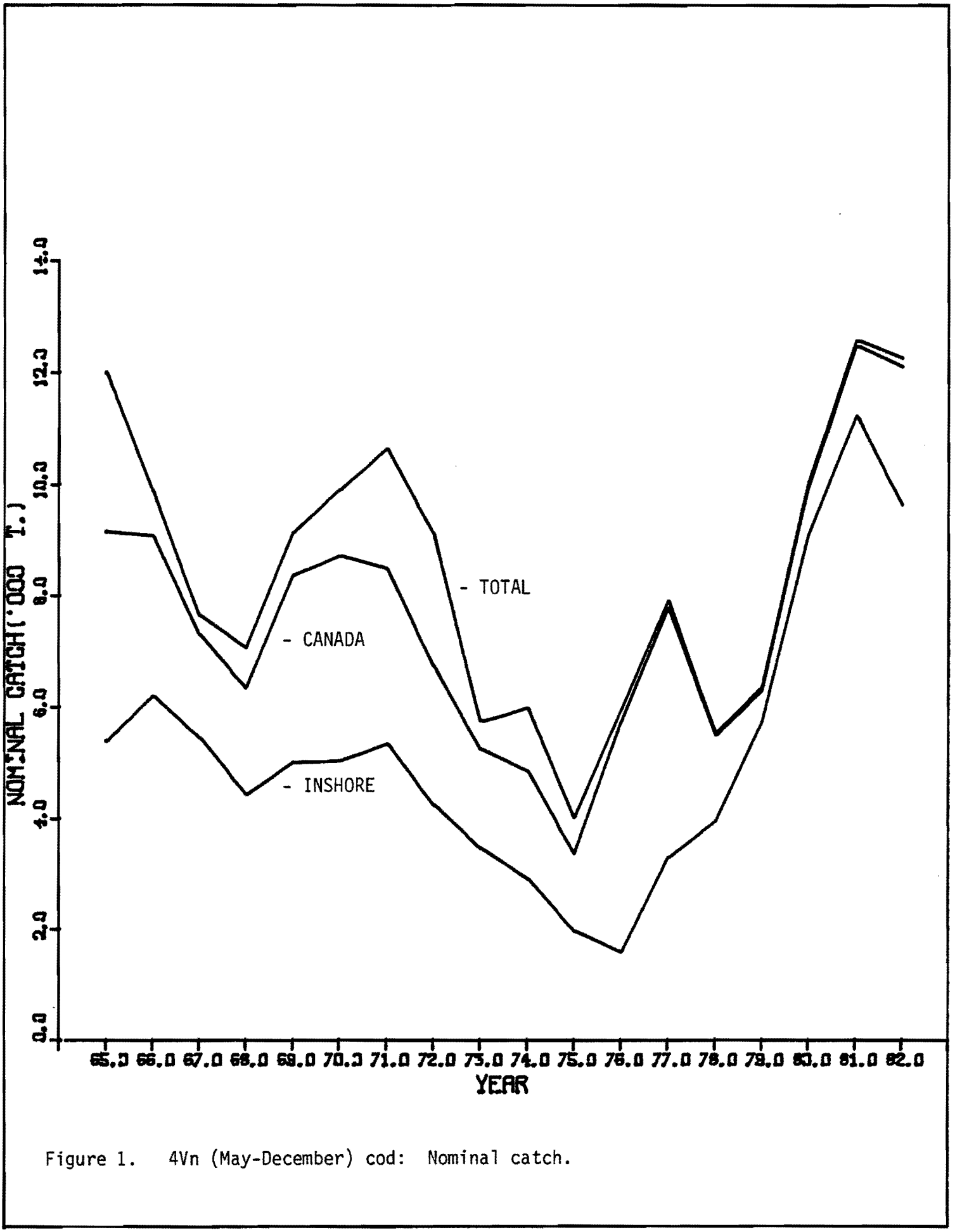

Figure 1. 4Vn (May-December) cod: Nominal catch.

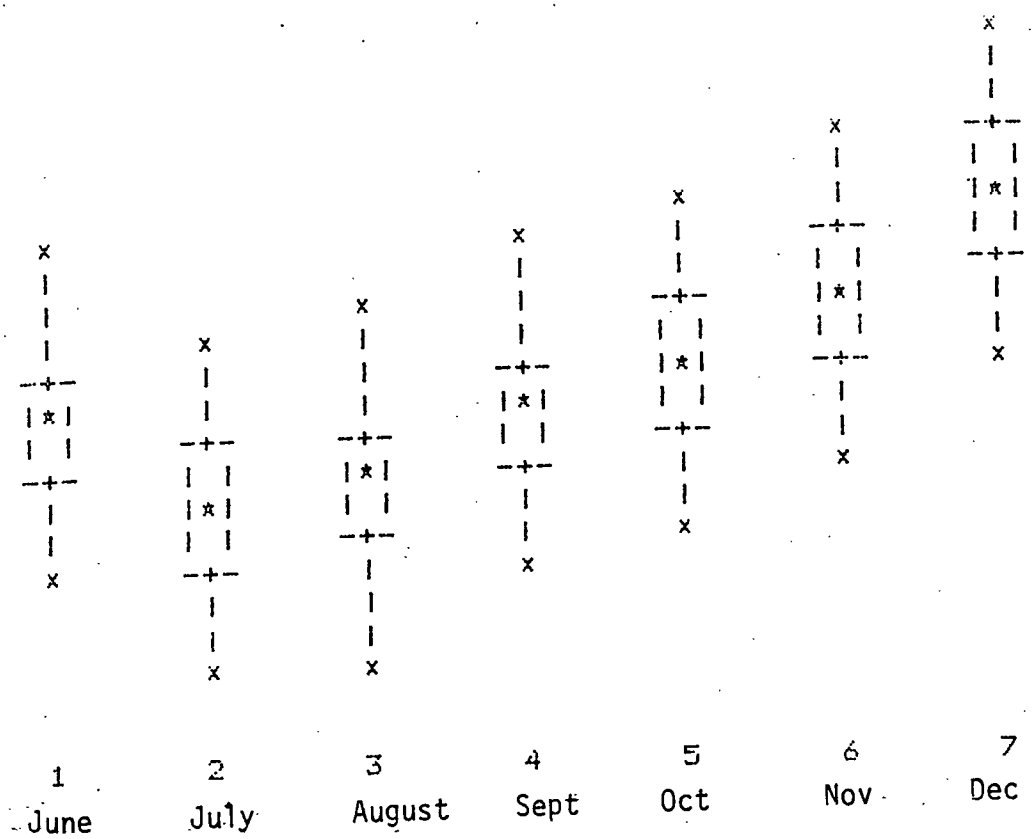

Figure 2. Box and whisker plots of seasonal component from multiplicative model for CPUE. Asteriks indicate coefficient value, crosses indicate upper lower bounds for 95% confidence interval.

Figure 3a. Comparing Age Composition from Research Surveys and Longliners 1970 Cod 4Vn (May-Dec).

—— Research, - - - - Longlines

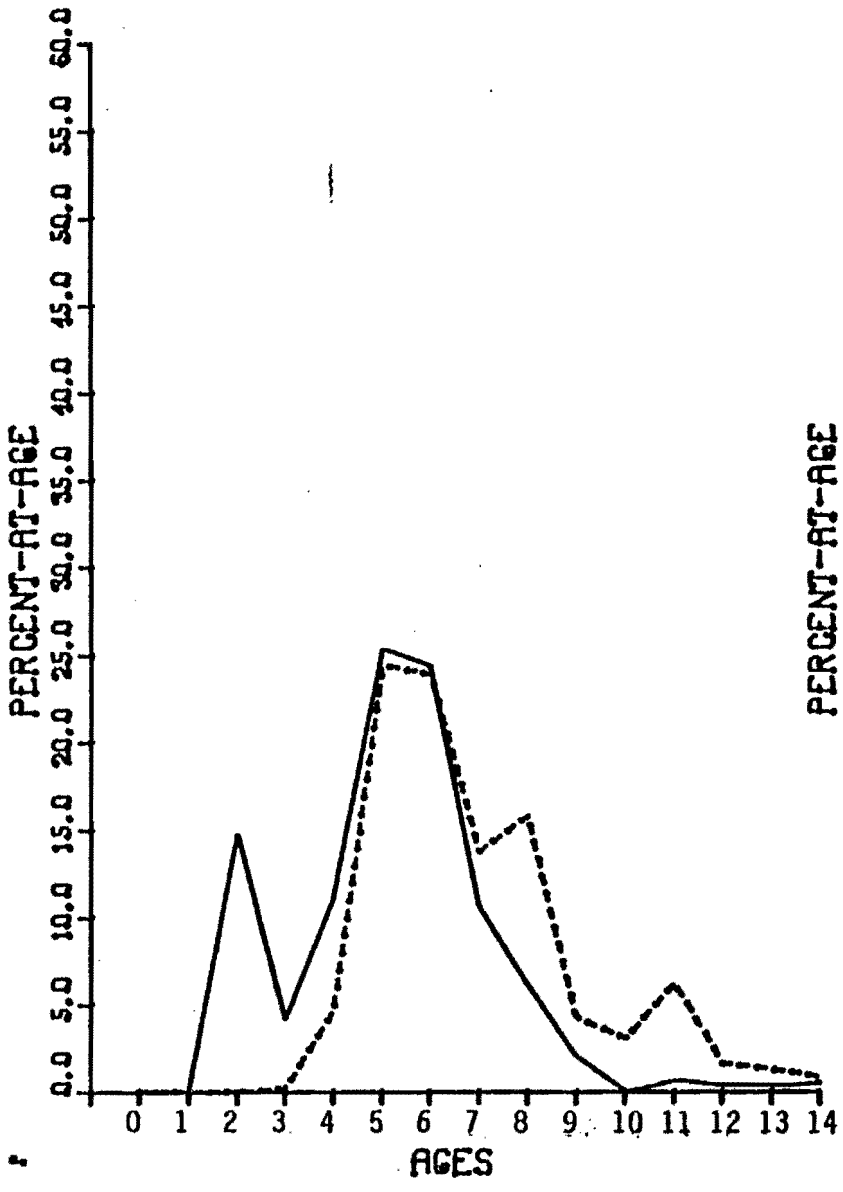

Figure 3b. Comparing Age Composition from Research Surveys and Longliners 1971 Cod 4Vn (May-Dec).

—— Research, - - - - Longlines

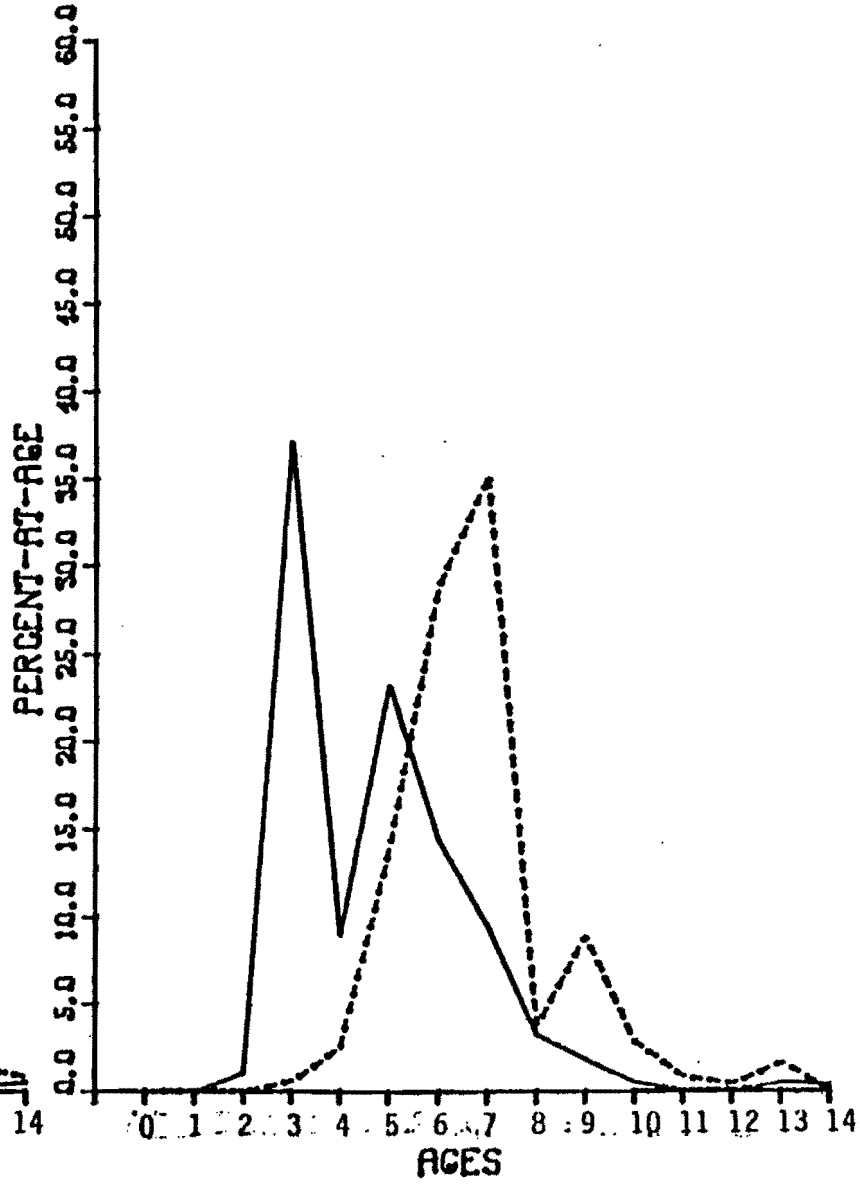

Fig. 3c. Comparing age composition from Research Surveys and longliners 1972 (Cod 4Vn, M-D).

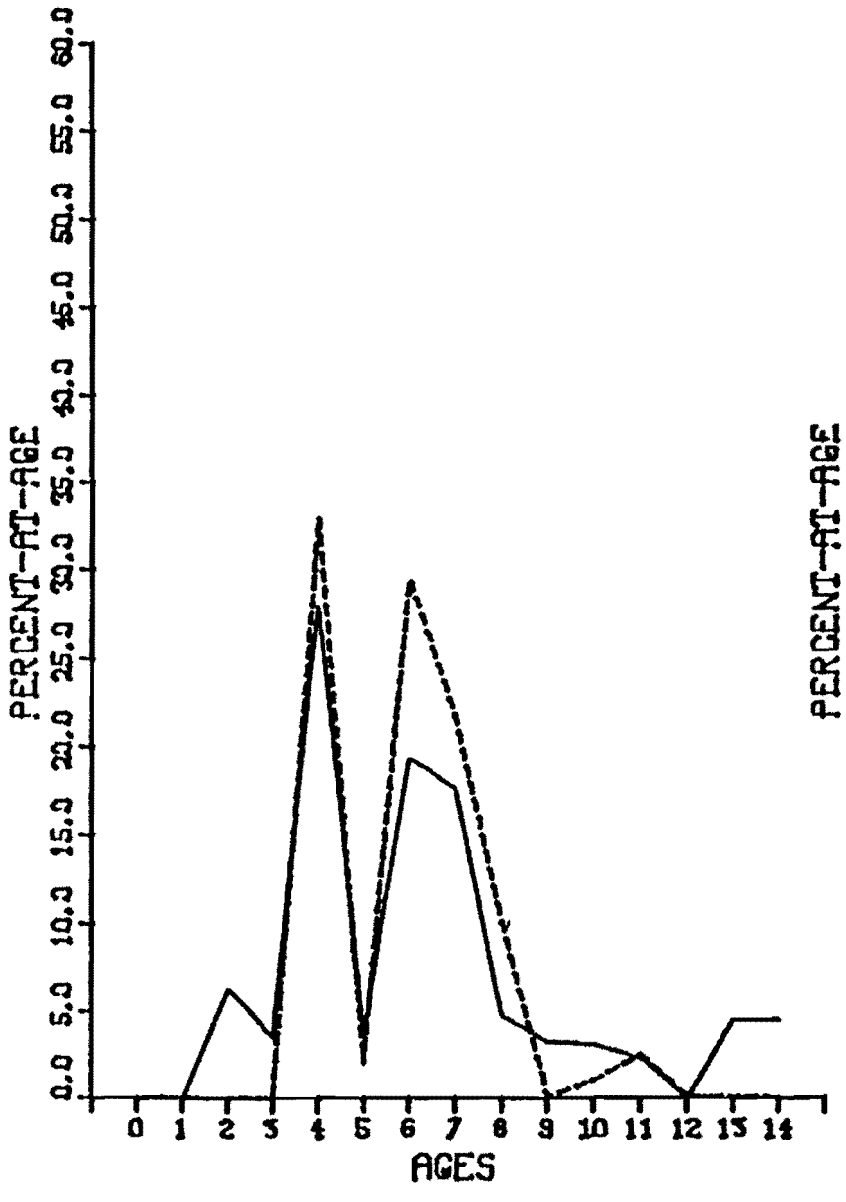

Fig. 3d. Comparing age composition from Research Surveys and longliners 1973 (Cod 4Vn, M-D).

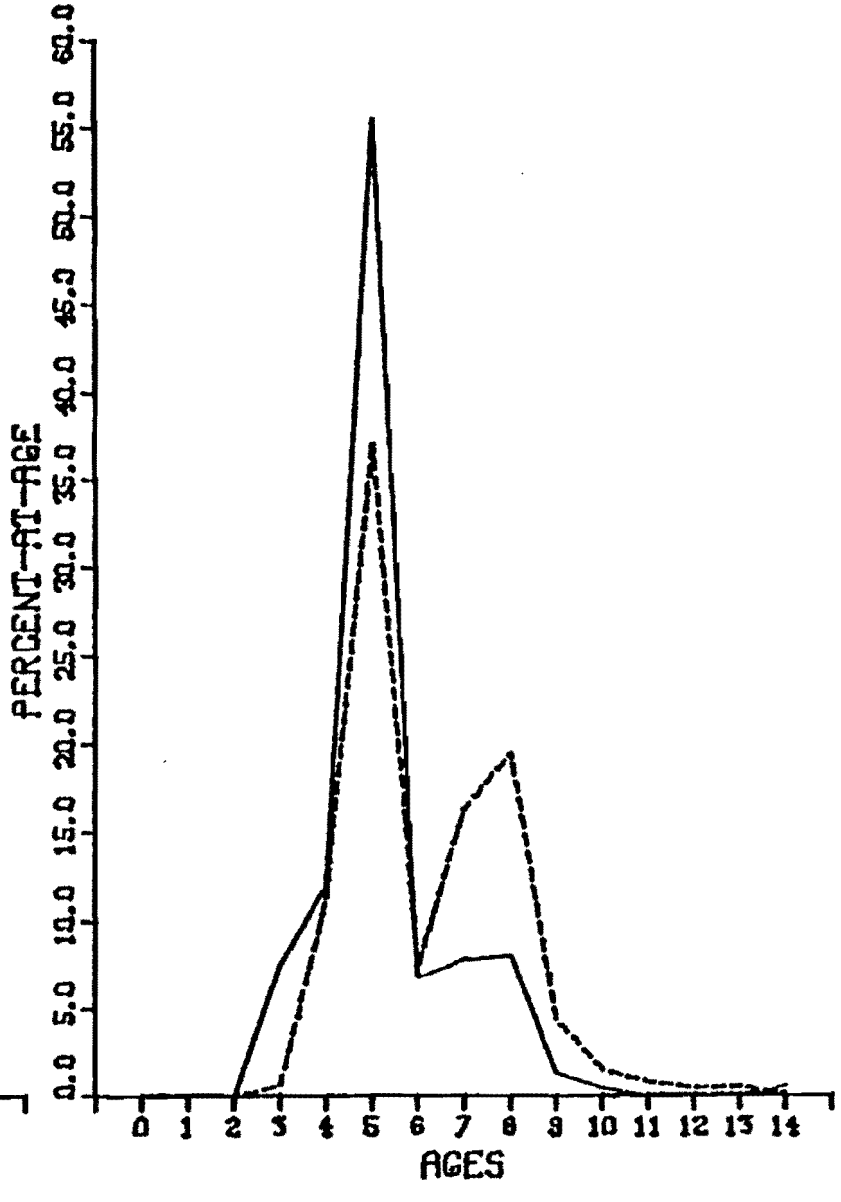

Figure 3e. Comparing Age Composition from Research Surveys and Longliners 1974 (Cod 4Vn, May-Dec.)

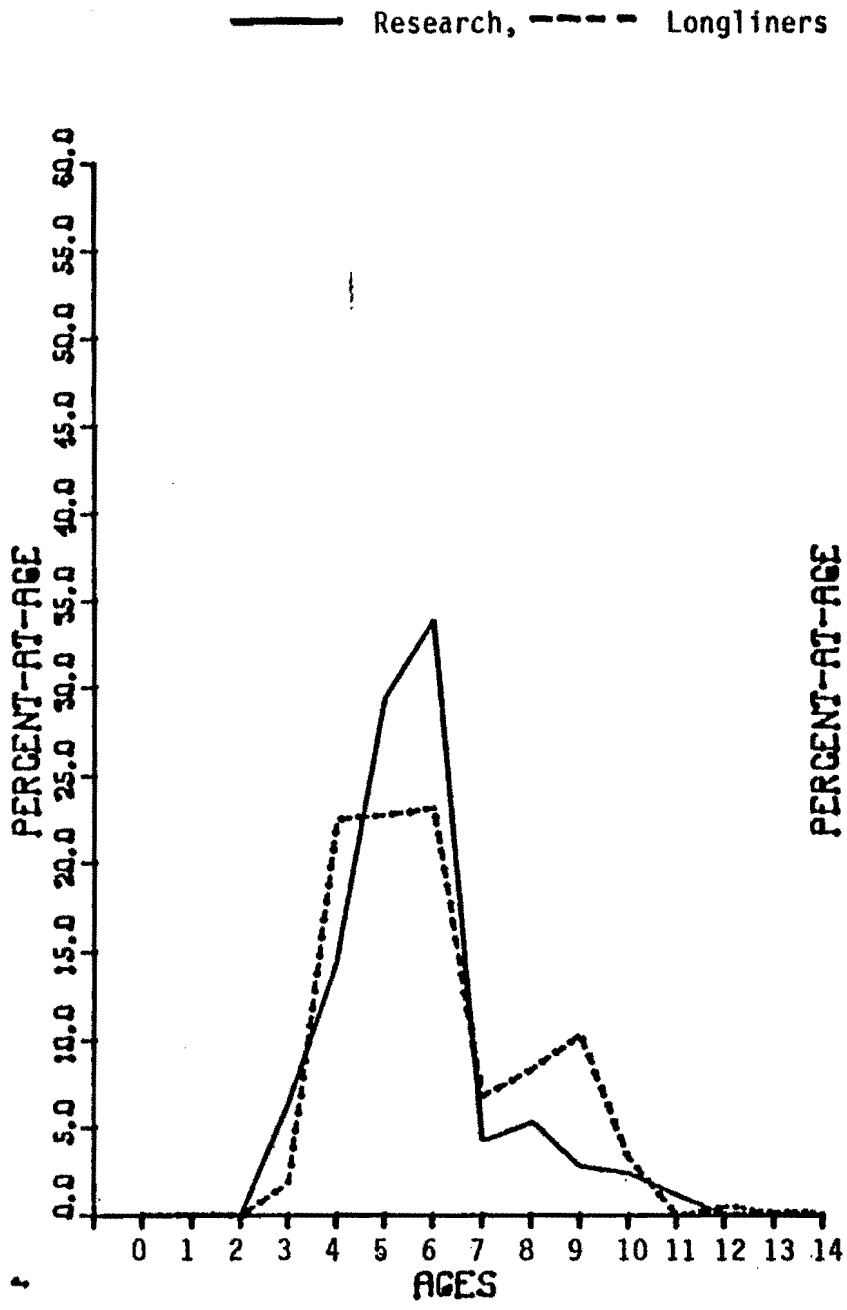

Figure 3f. Comparing Age Composition from Research Surveys and Longliners 1975 (Cod 4Vn, May-Dec.)

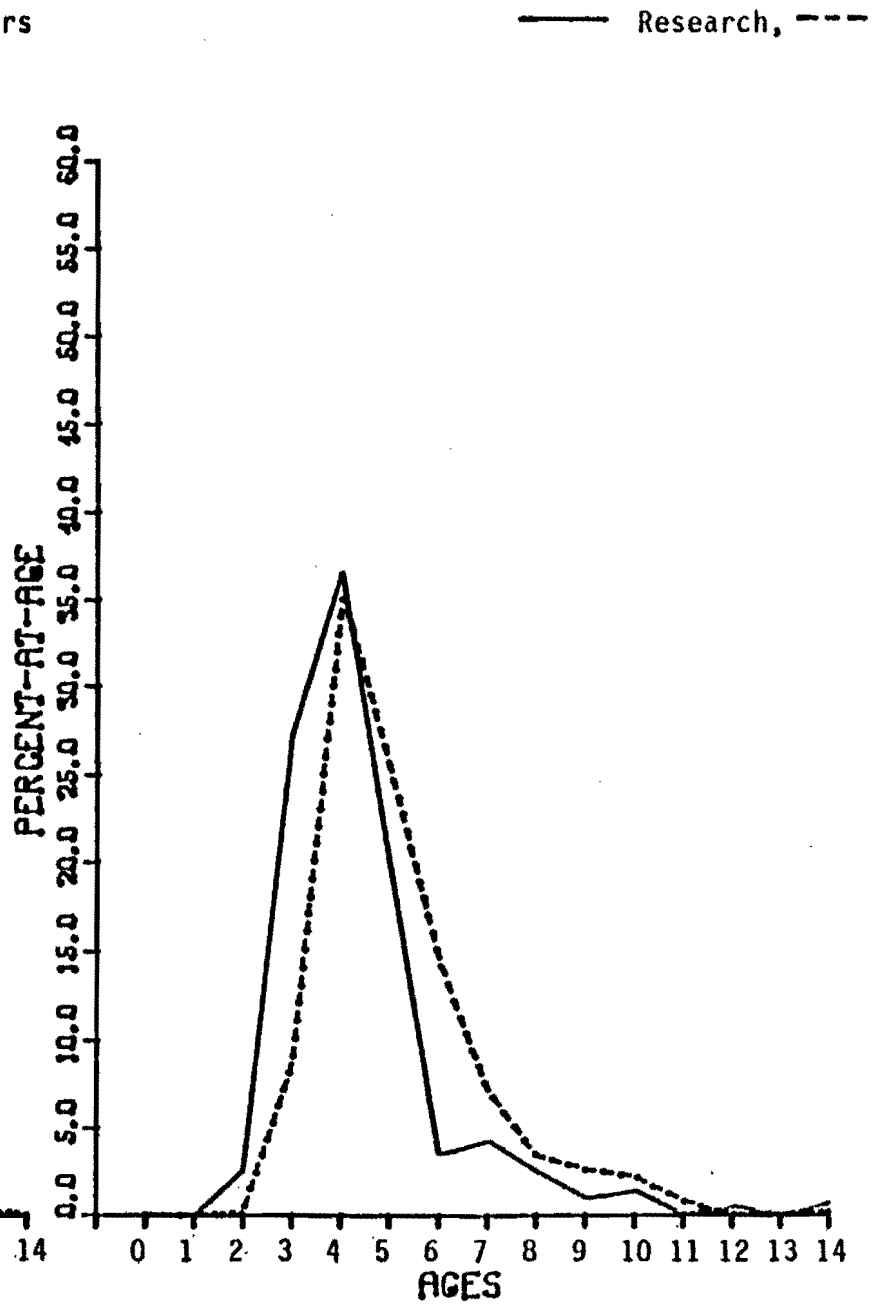

Fig. 3g. Comparing age composition from Research Surveys and longliners 1976 (Cod 4Vn, M-D).

——— Research, - - - - Longliners

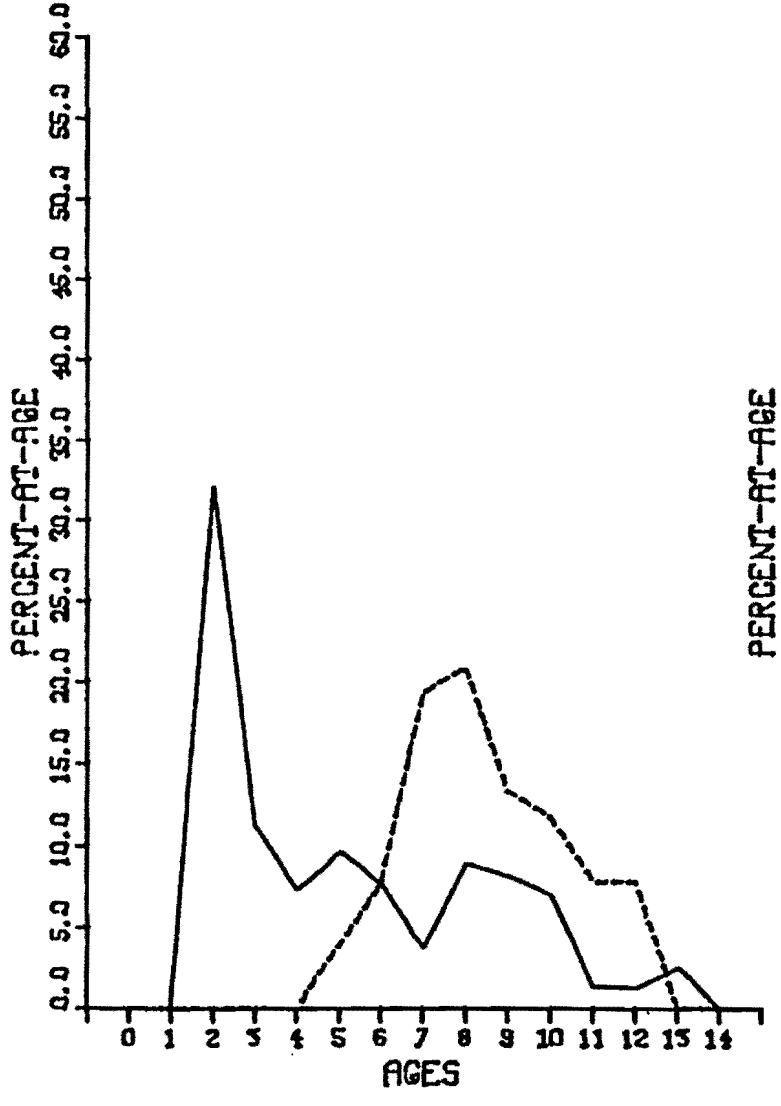

Fig. 3h. Comparing age composition from Research Surveys and longliners 1978 (Cod 4Vn, M-D).

——— Research, - - - - Longliners

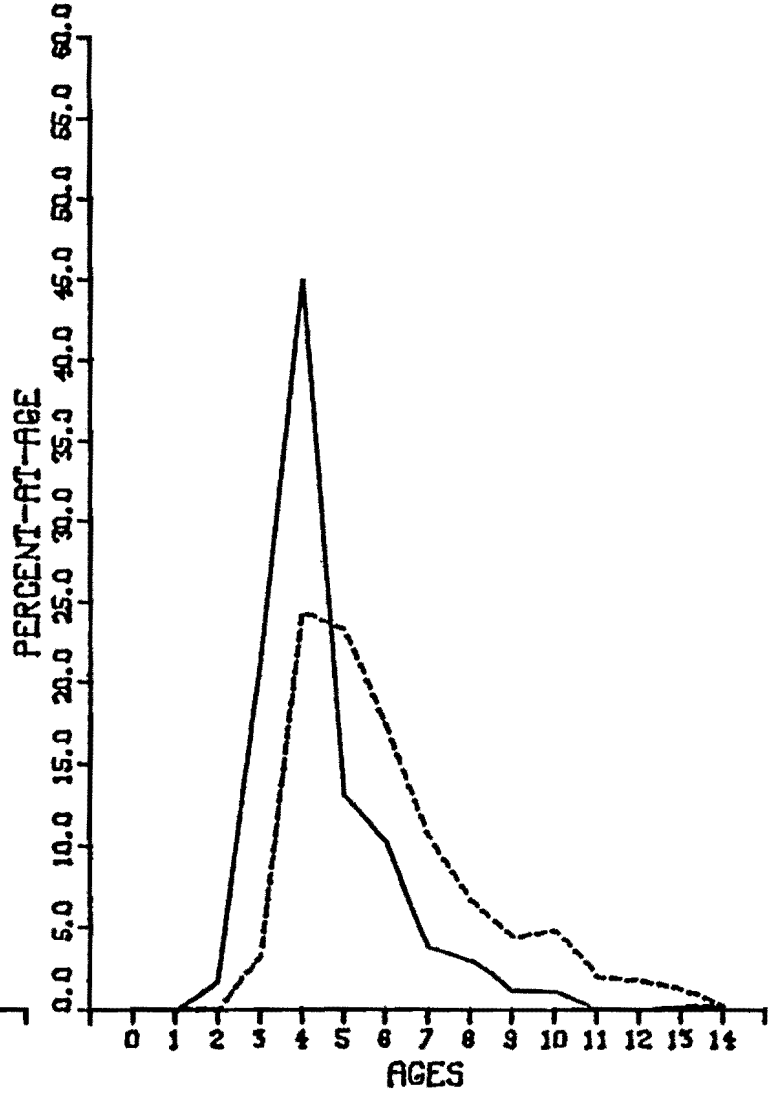

Fig. 3i. Comparing age composition from Research Surveys and longliners 1979 (Cod 4Vn, M-D).

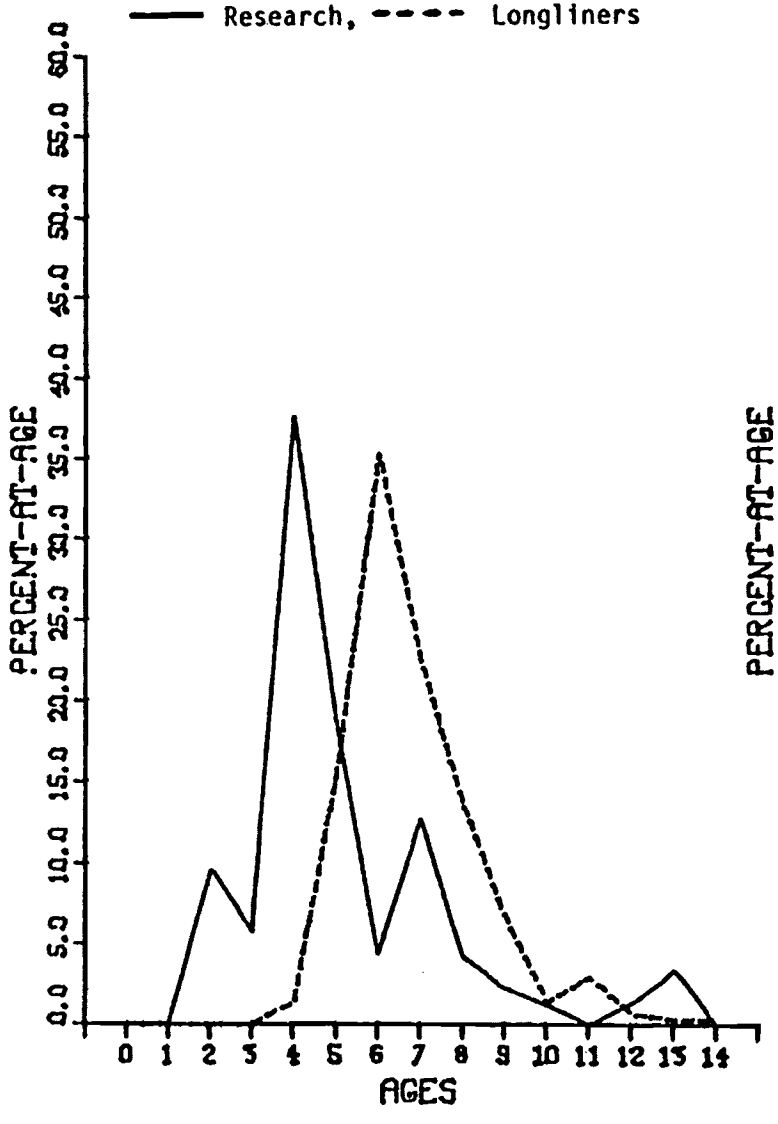

Fig. 3j. Comparing age composition from Research Surveys and longliners 1980 (Cod 4Vn, M-D).

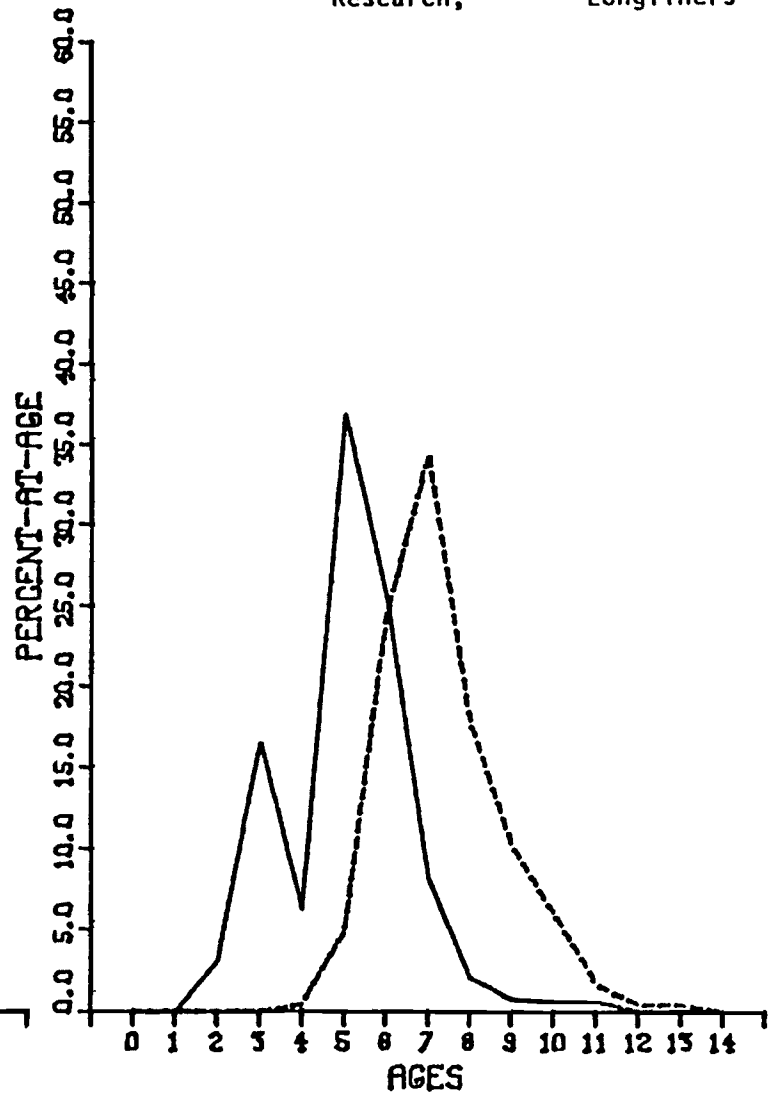

Fig. 3k. Comparing age composition from Research Surveys and longliners 1981 (Cod 4Vn, M-D).

——— Research, - - - - Longliners

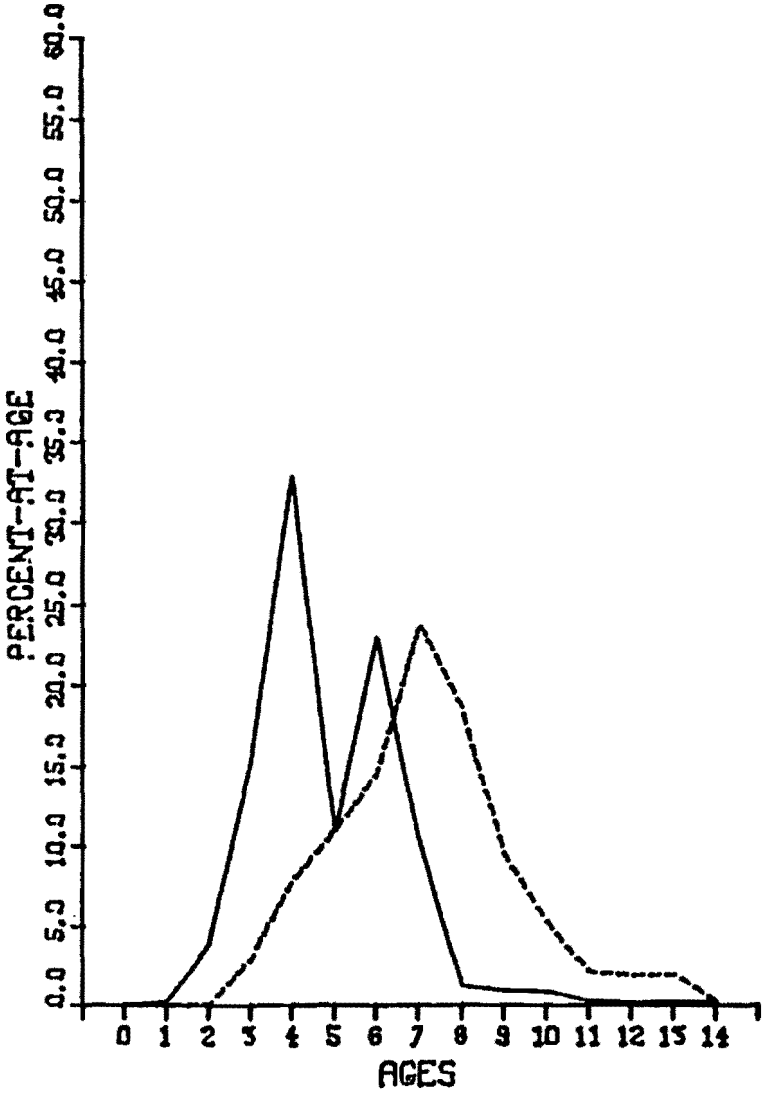

Figure 4a. Comparison of age composition from research surveys and longliners 1980 (Lady Hammond).

——— Research
-------- Longliners

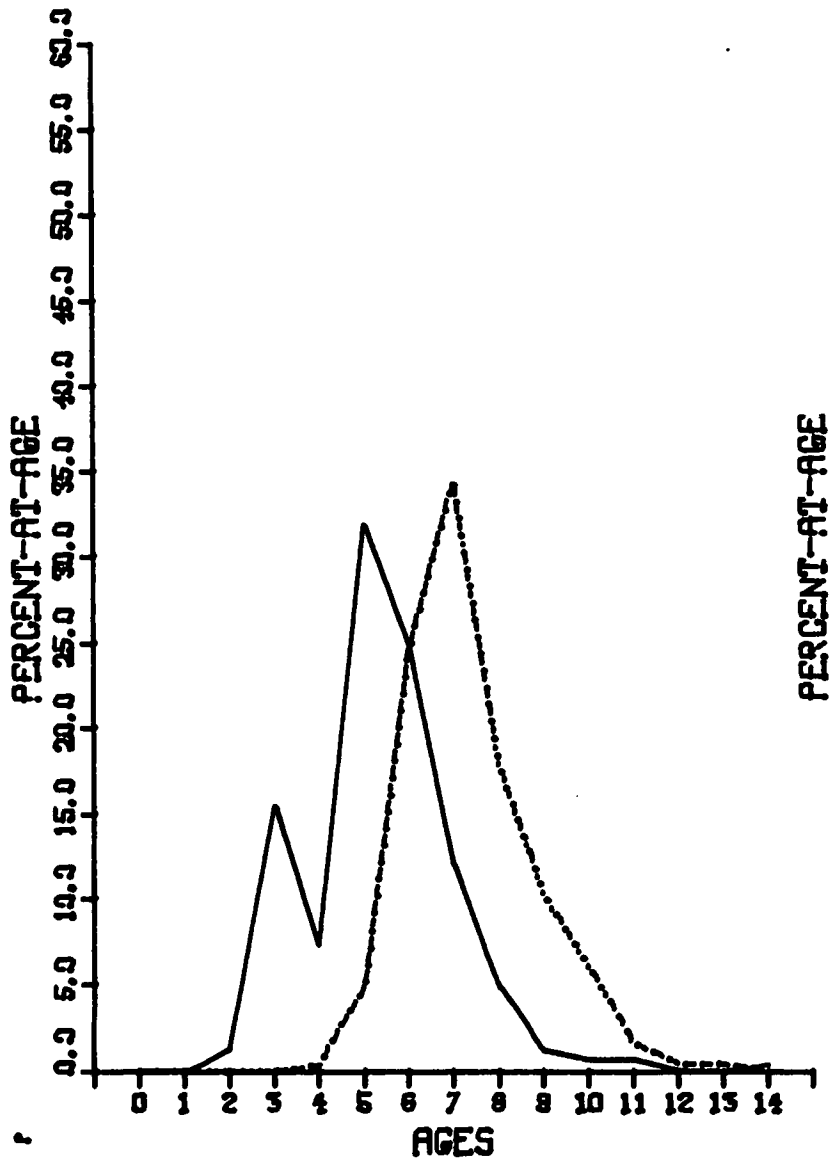

Figure 4b. Comparison of age composition from research surveys and longliners 1981 (Lady Hammond).

——— Research
-------- Longliners

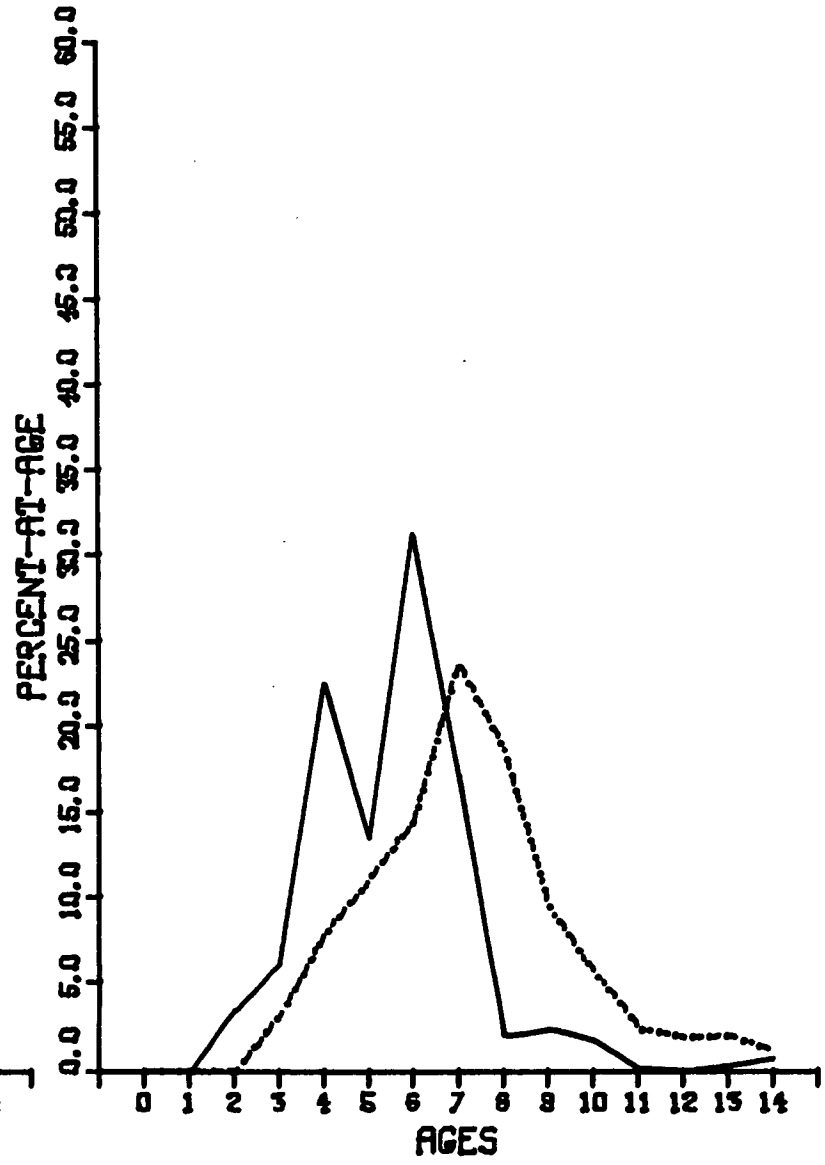

Figure 4c. Comparison of age composition from research surveys and longliners 1982 (Lady Hammond).

———— Research
-------- Longliners