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The Inshore Capelin Fishery in NAFO Division 3L in 1991

by

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Abstract

Data collected during the inshore capelin fishery in 1991 in NAFO Div. 3L were presented. Provisional inshore landings of 21,407 t in 1991 were less than half the 1990 landings. Purse seiners and trap fishermen in all areas of Div. 3L failed to land their quotas. The fishery in Div. 3L opened on June 5, however, the main fishery occurred in late July and early August. Discarding was higher than reported in 1989 and in 1990. Low percentage of females was the dominant reason for discarding the catch from traps and for purse seines it was the presence of 'redfeed' in the fish, small females, and low percentages of females in the catch. Catch rates in 1991 were the third highest estimate for capelin traps and the third lowest for purse seines in their respective series. Fishing time for traps was higher than in 1990. The catch was dominated by the 1988 year-class as three-year-olds comprising 49% of the total catch in numbers. Trends in catch rate-at-age for ages 3 and 4 combined for traps and purse seines were comparable.

Introduction

Capelin landings of 21,407 t in NAFO Div. 3L were one of the lowest reported for the inshore fishery since 1980 (Table 1). In 1991 the opening dates for each area (Fig. 1) were not based on a monitoring programme as had been the case in 1990. The capelin fishery for fixed gear and purse seines was opened on June 5 for all areas in Div. 3L. The TAC for the Div. 3L inshore fishery in 1991 was 56,100 t based on a market-related TAC for roe-bearing females.

The data presented here describe catch and effort from research logbook records collected by inshore fishermen and age composition of the catch based on biological samples from the commercial fishery.

Materials and Methods

Research logbooks were mailed to 26 purse seine and 103 fixed gear fishermen who fished in NAFO Div. 3L. Fishermen completed 8 purse seine and 39 fixed gear logbooks (Table 2), the lowest number since the research logbook survey began in 1981. The proportion of fixed gear fishermen who did not fish capelin in 1991 increased from 1990 (Table 2).

Biological samples were collected from the commercial capelin fishery on the basis of two random samples per statistical section (Fig. 1) per gear type per week. From each sample, 200 fish were measured for length, sex, and maturity stage (LSM). A stratified sample of 2 fish per sex per 1/2 cm length group was collected from each LSM sample for otoliths. The otoliths were used for age determinations by an experienced reader.

Effort data for capelin traps were examined based on the fishing strategy employed. In 1991 24 fishermen who filled out logbooks fished one trap and 12 others fished two traps. Of the 12 fishermen who fished more than one trap, six reported separate catch and effort data for each trap fished and six did not. We developed an adjustment factor by combining the data for all six fishermen who kept separate records for each trap fished. Fishing effort for the remaining six fishermen was estimated by doubling the reported number of fishing hauls and multiplying by 0.94 and by doubling the number of fishing days. In 1991 most fishermen who set two traps tended to leave both traps fishing the same number of days which differed from 1989 and 1990 (Nakashima and Harnum 1991).

In 1991 trap fishing commenced at least six weeks later than the opening date of June 5 due to the later arrival of mature capelin on spawning beaches (Nakashima and Slaney 1992). Most trap fishermen did not set out their traps until mid-July. Fishing days prior to mid-July were not considered in this analysis unless capelin were being caught. Consequently six fishermen fished part of the time between July 22 and August 9 and one from July 14 to July 17 in Bonavista Bay, 17 fishermen fished part of the time between July 19 and August 3 in Trinity Bay, and ten fishermen fished part of the time between July 18 and August 2 in Conception Bay. In addition one fisherman fished from July 2 to July 5 and another from July 9 to July 31 in Conception Bay. Fishermen from St. Mary's Bay and the Southern Shore who usually keep research logbook records did not fish capelin in 1991.

Results

Discards

Discarding rates in 1991 were 53% of landings for purse seines (Table 3) and 104% of landings for traps (Table 4) which were significantly higher than the 38% and 32% respectively reported for the 1990 fishery (Nakashima and Harnum 1991). Capelin caught but not landed for sale were considered as discards in this analysis with no distinction between those released alive and those dumped (i.e. dead capelin). Capelin given to other fishermen were included in the estimates of discarding (Tables 3 and 4) but were excluded in assigning proportional weight to the reasons for discarding (Tables 5 and 11).

In 1991 the principle reason for discarding capelin varied among areas (Table 5). A low percentage of females in the catch (76%) was the main reason given for discarding the catch from traps in Conception Bay. Similar to 1988-90 (Nakashima and Harnum 1989, 1990, 1991), most of the discards from traps in Trinity Bay were males picked from the catch to increase the percentage of females in the landed catch. The presence of small females was also an important reason for discarding. In Bonavista Bay, the redfeed level in capelin caught in traps represented 63% of the discards. For purse seiners in St. Mary's Bay and Conception Bay discarding was related to small females in the catch. Discards from purse seine sets in Bonavista Bay and Trinity Bay were predominantly due to 'redfeed' content followed by small females in the catch.

Catch/effort

Detailed records from logbooks collected from seven purse seiners (Tables 3 and 7) and from 48 capelin traps (Tables 4 and 8) were analyzed to calculate catch/effort indices. Fishing effort of traps in 1991 was higher than estimated in 1990, whereas effort by purse seiners was less than in 1990. The average number of days fished and average number of hauls per trap in 1991 were comparable to estimates derived in 1989 (Table 6). Purse seiners in Div. 3L fished 9.4 days per vessel and averaged 12.9 sets (Table 7). The average number of sets in 1991 was reduced from the 1990 average of 17.7 sets per vessel (Nakashima and Harnum 1991).

Catch rates for purse seiners and capelin trap fishermen varied among areas (Tables 7 and 8). The lowest purse seine catches/day (C/D) occurred in St. Mary's Bay followed by Trinity Bay and Conception Bay and the highest rates were estimated for Bonavista Bay (Table 7). The high C/D in Bonavista Bay continues the pattern observed in 1989 and 1990 (Nakashima and Harnum 1990, 1991). Landings/day (L/D) varied from 9.5 to 11.7 t/day in St. Mary's Bay, Trinity Bay, and Conception Bay while Bonavista Bay had the lowest estimate of 6.9 t/day (Table 7). The highest landings/set (L/S) and catch/set (C/S) were from Trinity Bay. The average C/D for a purse seine vessel in NAFO Div. 3L in 1991 was 16.2 t. The C/S in the four areas fished ranged from 9.2 t to 13.0 t and averaged 11.9 t per set for all 8 purse seine vessels.

All three catch rates for traps in 1991 (Table 8) were lower than reported in 1990 (Nakashima and Harnum 1991). The C/D of 4.7 t in Bonavista Bay was the lowest one in 1991. The second lowest was from Conception Bay and the highest from Trinity Bay. The C/H varied between 2.1 and 5.1 t for the three areas. In 1991 the average C/D for capelin traps was 7.3 t and the average C/H was 4.1 t. The L/D of 3.6 t was half the C/D and reflects the disparity between the two measures, especially in years when discards are high.

By-catch

The total reported by-catch of cod was 22.3 t for 48 traps fished in 1991 which represented 1.5% of reported logbook landings of capelin (Table 4). There

was a significant increase from 1990 in Trinity Bay and a decline from 1990 in Conception Bay. Fishermen reported the presence of tomcods in several hauls but did not provide estimates by weight. Consequently the bycatch of 1.5% is considered a minimum estimate for 1991. Herring by-catch in traps was negligible (Table 4).

Age Composition

The age composition of the commercial catch was estimated from 30 biological samples based on 16 purse seine, 10 capelin trap, and 4 beach seine samples (Table 9). Mean number of otoliths read per sample ranged from 41.5 to 43.0 (Table 9) which was much higher than the 28.5 to 34.2 averages for 1990 (Nakashima and Harnum 1991).

Age compositions by sex and with sexes combined of the inshore catch from 1979 to 1991 are given in Table 10. In 1991, the 1988 year-class as three-year-olds represented 49% of the total catch in numbers (Table 10). The 1987 year-class as four-year-olds at 31% was also strong. The 1986 year-class as five-year-olds constituted 4% of the catch. The 1989 year-class as two-year-olds comprised 16% of the catch. Due to difficulties in ageing otoliths collected in 1991, the proportion of age 2's in the catch should be considered a maximum and age 3's a minimum.

The age composition of the Div. 3L catch in 1991 was comparable to that of the Div. 3K catch (Nakashima and Harnum 1992) except that the 1987 year-class in Div. 3K was relatively stronger than observed in Div. 3L.

Discussion

Discarding was considerably higher in 1991 than reported in 1988-90 for both traps and purse seines. When discarding was reported for traps in 1991, the major reasons were low percentage of females in the catch (48%) followed by small females (15%) and problems in selling the catch or boat quotas (13%) (Table 11). The major reasons for discarding were different than those reported in 1989 and 1990 for traps. The presence of 'redfeed' in females (29%), small females (28%), and a low percentage of females in the catch (23%) were equally important as the major reasons for discarding fish reported by purse seiners (Table 11). Spent females were also important contributors to discarding by purse seiners in 1991 (Table 11).

Four catch rate indices were estimated for capelin traps and for purse seines based on logbook data (Tables 12 and 13). Catch/day (C/D) is the preferred index because it combines both landings and discards to estimate catch. If the discards were in the same proportion to landings in all years then landings could be utilized in place of the catch. However, the level of discarding varies among years. We assumed that C/S and C/H more likely reflect school size and may not necessarily indicate changes in mature biomass. The average C/D for capelin traps in 1991 was 7.3 t which was less than the 1990 estimate and the third highest estimate in the series (Table 12). The average C/D for purse seiners was 16.2 t in 1991 which was one of the lowest rates in the purse seine series (Table 13). The trap index indicated that capelin spawning biomass in Div. 3L in 1991 was one of the highest observed since 1981 while the purse seine index suggested that the mature biomass available to purse seiners was one of the lowest in the series (Fig. 2). Of concern is the unknown effect of less fishermen fishing than in previous years, especially considering that no effort data were available from St. Mary's Bay and the Southern Shore.

Both purse seine and trap catch-at-age analyses indicated that the same weak and strong year-classes were observed for both gear types. Total effort (Table 14) was estimated using the official landings (Table 1) and catch rates derived from research logbooks (Tables 12, 13). Catch rates-at-age (Table 16) were estimated using the effort data and the numbers-at-age (Table 15). To determine year-class strengths in the catch I assumed that a year-class would best be represented by summing the catch rate-at-age for 3- and 4-year-olds (Table 17, Fig. 3). Finally standardized catch rates-at-age for ages 3 and 4 combined indicate that both inshore gears, especially since the 1983 year-class, show comparable trends for year-class strength. Trap catch rates-at-age for ages 3 and 4 combined for Div. 3L (this study) and Div. 3K (Nakashima and Harnum 1992) are similar except in 1991 (Fig. 5).

Fishing in 1991 was influenced largely by the late arrival of the spawning population. Evidence supporting late spawning was based on observations during the aerial survey (Nakashima 1992), egg surveys on spawning beaches (Nakashima and Slaney 1992), comments by fishermen in research logbooks, and unpublished

data from spawning beach surveys. Purse seiners had difficulty in finding capelin. Similar to 1985 (Nakashima and Harnum 1986) purse seiners noted that capelin appeared close to land near the spawning beaches before they had an opportunity to make sets. Trap fishermen noted difficulties in selling the catch due to low percentage of females and small females. Biological samples had more small fish (Table 9) than in 1990 and the range of otoliths per sample was similar to 1985, another year when arrival and spawning of capelin was later than anticipated (Nakashima and Harnum 1986). Of consequence is the significantly reduced total effort as a result of fishermen not participating in the capelin fishery in 1991. Trap landings in St. Mary's Bay and on the Southern Shore and purse seine landings in St. Mary's Bay were negligible in 1991. Fixed gear fishermen from St. Mary's Bay and the Southern Shore reported capelin were scarce in their areas. Those fishermen from Conception Bay, Trinity Bay, and Bonavista Bay who did participate generally did not report that abundance was substantially reduced. Rather low landings and a poor fishery were the result of late spawning, strong market demand for large females, and low prices.

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Table 1. Inshore capelin landings (t) by fishing gear (vessels <21 m in length) by area (Bonavista Bay = BB, Trinity Bay = TB, Conception Bay = CB, Southern Shore = SS, St. Mary's and Trepassey Bays = SMB) in Div. 3L. The mobile fleet was issued ringnet licences until 1982 and purse seine licences from 1983 to the present.

Year	Area	Ringnet and purse seine (<21 m)	Beach seine	Capelin trap	Total
1980	BB	1388	205	124	1717
	TB	2541	603	1612	4756
	CB	3226	457	3591	7274
	SS	-	80	239	319
	SMB	284	-	95	379
	3L	7439	1345	5661	14445

Table 1. Continued.

Year	Area	Ringnet and purse seine (<21 m)	Beach seine	Capelin trap	Total
1981	BB	3714	89	62	3865
	TB	6006	1006	2267	9279
	CB	4670	202	5537	10409
	SS	-	14	51	65
	SMB	820	3	-	823
	3L	15210	1314	7917	24441
1982	BB	3429	169	133	3731
	TB	7687	463	2445	10595
	CB	5511	174	5944	11629
	SS	9	33	314	356
	SMB	1056	58	9	1123
	3L	17692	897	8845	27434
1983	BB	2580	96	527	3203
	TB	3801	603	4445	8849
	CB	6349	166	5500	12015
	SS	-	3	3	6
	SMB	983	6	12	1001
	3L	13713	874	10487	25074
1984	BB	3805	49	2037	5891
	TB	4928	799	5531	11258
	CB	6628	89	6806	13523
	SS	-	17	672	689
	SMB	1714	28	159	1901
	3L	17075	982	15205	33262
1985	BB	2286	115	1593	3994
	TB	1624	545	6816	8985
	CB	3649	211	6804	10664
	SS	33	9	348	390
	SMB	1284	12	121	1417
	3L	8876	892	15682	25450
1986*	BB	3323	199	3197	6719
	TB	4005	648	12142	16795
	CB	7454	133	9589	17176
	SS	37	52	1362	1451
	SMB	5685	34	337	6056
	3L	20504	1066	26627	48197
1987*	BB	2140	76	2139	4355
	TB	1644	193	6780	8617
	CB	1317	120	3084	4521
	SS	106	32	633	771
	SMB	712	0	0	712
	3L	5919	421	12536	18976
1988*	BB	3664	157	3960	7781
	TB	4275	164	15417	19856
	CB	7064	210	10586	17860
	SS	220	33	3194	3447
	SMB	3636	228	605	4469
	3L	18859	792	33762	53413
1989*	BB	2704	111	4426	7241
	TB	4822	172	14845	19839
	CB	8662	75	8579	17316
	SS	207	11	3048	3266
	SMB	3327	1	643	3971
	3L	19722	370	31541	51633
1990*	BB	3171	90	5619	8880
	TB	4408	108	11731	16247
	CB	6852	41	11373	18266
	SS	31	45	2897	2973
	SMB	610	0	1016	1626
	3L	15072	284	32636	47992
1991*	BB	3075	70	3173	6318
	TB	3912	154	6428	10494
	CB	1747	25	2743	4515
	SS	0	7	0	7
	SMB	69	1	3	73
	3L	8803	257	12347	21407

* provisional

Table 2. Responses from a logbook survey conducted in Div. 3L, 1981-91.

Year	No. contacted	No. logbooks returned	Did not fish capelin	Logbooks not returned
Purse seine				
1981	70 (7)*	37 (44)	11	22
1982	91 (7)*	54 (61)	10	27
1983	75 (9)*	37 (46)	7	31
1984	63 (3)*	39 (42)	3	21
1985	45 (3)*	30 (33)	2	13
1986	36 (7)*	27 (34)	0	9
1987	37	23	4	10
1988	34 (7)*	26 (33)	3	5
1989	34 (9)*	27 (36)	2	5
1990	28 (5)*	18 (23)	1	9
1991	26	8	8	10
Fixed gear				
1981	119	74	13	32
1982	136	81	36	19
1983	131	66	38	27
1984	142	91	20	31
1985	93	61	8	24
1986	87	56	5	26
1987	93	62	14	17
1988	95	70	8	17
1989	96	82	2	12
1990	113	76	11	26
1991	103	39	28	36

* fishermen who reside in Div. 3K but fished in Div. 3L. These are added to the 'No. logbooks returned' column in parentheses.

Table 3. Total purse seine landings (t) compiled from logbooks in 1991.

Area	Landings by logbook	Discards by logbook*	No. of fishermen
Bonavista Bay	61.7	130.6	1
Trinity Bay	373.0	122.5	3
Conception Bay	216.7	97.5	2
St. Mary's Bay	47.6	20.0	1
Div. 3L	699.0	370.6	7

* includes capelin given to other fishermen

Table 4. Total capelin trap landings (t) compiled from logbooks in 1991.

Area	Landings by logbook	Discards by logbook*	By-catch		No. of fishermen	No. of traps
			Cod	Herring		
Bonavista Bay	336.9	125.3	2.7	0	7	10
Trinity Bay	800.1	733.2	11.6	+	17	21
Conception Bay	367.5	706.5	8.0	0	12	17
Div. 3L	1504.5	1565.0	22.3	+	36	48

* includes capelin given to other fishermen

Table 5. Percent contribution by weight of reasons for discarding capelin in 1991. (This excludes capelin given to other fishermen.)

Area	Redfeed	Low % females	Small females	Females picked out	Females spawned out	No market/ quota filled	Misc.	Not given
Traps								
Bonavista Bay	63	-	11	-	-	26	-	-
Trinity Bay	-	7	28	30	-	17	18	-
Conception Bay	5	76	9	1	+	8	1	+
Purse Seine								
Bonavista Bay	77	-	14	-	-	-	9	-
Trinity Bay	-	54	12	-	24	10	-	-
Conception Bay	-	30	47	-	23	-	-	-
St. Mary's Bay	-	-	100	-	-	-	-	-

Table 6. Average fishing days (D) and average number of trap hauls (H) per capelin trap per area in Div. 3L from 1981-91. (Number of traps given in parentheses.)

Year	Measure of effort	Areas in Div. 3L				
		Bonavista	Trinity	Conception	Southern Shore	St. Mary's
1981	D	-	10.4 (15)	16.8 (21)	13.6 (5)	-
	H	-	12.1	21.1	11.8	
1982	D	-	14.6 (23)	24.2 (48)	13.0 (10)	-
	H	-	18.0	30.3	12.5	-
1983	D	14.0 (1)	17.2 (25)	19.8 (40)	-	-
	H	12.0	21.9	21.3	-	-
1984	D	13.7 (7)	19.5 (36)	18.2 (31)	19.0 (8)	19.0 (1)
	H	26.0	30.9	26.4	22.4	47.0
1985	D	11.4 (16)	13.3 (23)	16.8 (24)	10.5 (8)	-
	H	19.8	18.4	23.8	9.4	-
1986	D	11.8 (14)	15.3 (33)	24.9 (22)	17.7 (6)	6.3 (2)
	H	17.7	24.4	28.8	20.8	2.5
1987	D	6.3 (15)	7.7 (31)	7.3 (25)	5.0 (7)	-
	H	13.9	14.3	11.2	6.9	-
1988	D	9.0 (16)	11.6 (44)	12.6 (34)	8.8 (10)	11.1 (1)
	H	16.4	22.5	17.0	14.7	17.0
1989	D	8.2 (24)	8.1 (40)	7.0 (43)	7.6 (10)	2.7 (2)
	H	17.3	16.2	12.2	9.7	8.0
1990	D	4.8 (26)	4.8 (35)	8.3 (45)	4.1 (10)	6.8 (3)
	H	8.8	11.1	11.9	6.6	10.7
1991	D	9.9 (10)	7.8 (21)	9.4 (17)	-	-
	H	21.8	15.0	12.3	-	-

Table 7. Catch/effort data for purse seiners from the 1991 logbook survey.

Area	No. days fished	No. sets made	Landings per logbook (t)	Landings and discards per logbook (t)	No. of purse seiners
Bonavista Bay	9	21	6.9/day 2.9/set	21.4/day 9.2/set	1
Trinity Bay	32	38	11.7/day 9.8/set	15.5/day 13.0/set	3
Conception Bay	20	25	10.8/day 8.6/set	15.7/day 12.6/set	2
St. Mary's Bay	5	6	9.5/day 7.9/set	13.5/day 11.3/set	1
Div. 3L	66	90	10.6/day 7.8/set	16.2/day 11.9/set	7

Table 8. Catch/effort data for capelin traps from the 1991 logbook survey.

Area	No. days fished	No. hauls made	Landings per logbook (t)	Landings and discards per logbook (t)	No. of traps
Bonavista Bay	98.7	218	3.4/day 1.5/haul	4.7/day 2.1/haul	10
Trinity Bay	162.8	315	4.9/day 2.5/haul	9.4/day 4.9/haul	21
Conception Bay	159.3	209	2.3/day 1.8/haul	6.7/day 5.1/haul	17
Div. 3L	420.8	742	3.6/day 2.0/haul	7.3/day 4.1/haul	48

Table 9. Summary of the commerical samples collected from the inshore capelin fishery in 1991 in Div. 3L.

Gear type	No. of LSM/stratified samples	No. of otoliths aged	Mean number of otoliths aged per sample ± SD
Purse seine	16	581	41.5 ± 4.4
Capelin trap	10	917	41.7 ± 5.7
Beach seine	4	172	43.0 ± 4.8
TOTAL	30	1670	

Table 10. Age compositions (%) from the inshore commercial capelin fishery in Div. 3L, 1979-91.

	Age				
	2	3	4	5	6
Males					
1979	-	47.6	36.3	15.1	0.9
1980	-	39.0	57.8	2.9	0.3
1981	-	28.3	40.2	29.7	1.9
1982	+	90.4	8.9	0.7	+
1983	2.3	62.9	34.0	0.9	-
1984	0.4	37.5	61.5	0.7	-
1985	5.8	66.3	26.4	1.5	0.1
1986	0.3	56.0	43.1	0.5	-
1987	0.3	12.7	85.4	1.6	-
1988	5.3	72.4	19.6	2.7	+
1989	0.4	79.3	20.3	-	-
1990	0.7	37.0	61.9	0.4	-
1991	12.8	43.2	42.1	1.7	0.2
Females					
1979	0.8	59.1	25.4	11.3	3.4
1980	0.3	41.1	58.3	0.2	0.1
1981	+	38.7	31.4	28.9	1.1
1982	1.6	77.7	12.7	6.3	1.7
1983	6.4	59.1	32.1	2.3	0.2
1984	2.8	41.5	47.1	8.3	0.3
1985	16.7	58.0	16.0	8.7	0.6
1986	0.2	66.1	28.9	3.7	1.1
1987	6.6	21.7	63.6	7.7	0.3
1988	14.2	50.8	11.5	21.4	1.4
1989	1.5	72.5	21.8	1.9	2.3
1990	2.2	47.5	47.4	2.8	0.1
1991	17.1	52.7	24.3	5.9	-
Sexes combined					
1979	0.2	50.3	33.8	14.2	1.5
1980	0.2	40.4	58.1	1.1	0.2
1981	-	34.6	34.7	29.2	1.4
1982	0.7	84.6	10.6	3.3	0.8
1983	4.6	60.7	32.9	1.7	0.1
1984	1.7	39.6	53.7	4.8	0.2
1985	12.4	61.3	20.2	5.8	0.4
1986	0.3	62.3	34.2	2.5	0.7
1987	4.0	18.0	72.5	5.2	0.2
1988	11.3	59.0	14.6	14.3	0.8
1989	1.0	75.4	21.2	1.1	1.3
1990	1.6	43.2	53.4	1.8	+
1991	15.5	49.1	31.0	4.4	+

Table 11. Percent contribution to weight of reasons for discarding capelin in Div. 3L, 1981-91. (This analysis excludes capelin given to other fishermen.)

Area	Redfeed	Low % females	Small females	Females picked out	Females spawned out	No market/ quota filled	Misc.	Not given
Traps								
1981	13	43	1	10	+	22	3	8
1982	4	57	+	19	1	4	13	2
1983	17	37	+	3	+	18	13	12
1984	1	31	-	35	6	15	11	1
1985	30	26	4	5	3	22	4	5
1986	45	28	+	10	+	5	10	2
1987	59	22	1	+	2	9	7	+
1988	4	27	6	28	6	8	17	5
1989	12	36	2	12	1	30	7	+
1990	13	31	1	13	5	27	10	+
1991	9	48	15	9	+	13	6	+
Purse seine								
1981	32	35	14	8*	+	8	+	3
1982	45	41	3	-	+	+	10	1
1983	70	17	1	-	+	5	3	4
1984	18	78	+	-	+	3	2	-
1985	61	15	9	1	3	4	5	2
1986	52	35	1	+	1	3	8	1
1987	73	4	2	-	1	2	11	7
1988	58	21	5	-	8	5	3	-
1989	43	37	+	-	-	6	10	4
1990	41	20	16	-	2	16	5	+
1991	29	23	28	-	13	3	4	-

* use of separators at sea

Table 12. Catch/effort of capelin traps in Div. 3L utilizing research logbook data.

Year	L = Logbook landings (t)		C = Logbook landings and discards (t)	
	L/day	L/haul	C/day	C/haul
1981	2.2	1.9	2.9	2.5
1982	2.7	2.2	3.1	2.5
1983	2.4	2.1	3.4	3.0
1984	2.6	1.7	2.9	1.9
1985	2.9	2.0	4.6	3.2
1986	3.2	2.4	4.6	3.4
1987	5.1	2.9	8.8	5.0
1988	5.3	2.9	6.2	3.4
1989	5.4	2.9	6.7	3.6
1990	6.5	3.8	8.6	5.0
1991	3.6	2.0	7.3	4.1

Table 13. Catch/effort of purse seines in Div. 3L utilizing research logbook data.

Year	L = Logbook landings (t)		C = Logbook landings and discards (t)	
	L/day	L/set	C/day	C/set
1981	6.9	3.4	9.4	5.3
1982	13.5	6.7	16.4	8.1
1983	10.4	5.4	18.8	9.7
1984	12.3	6.2	14.3	7.2
1985	10.5	5.5	16.4	8.6
1986	14.4	8.6	19.0	11.4
1987	13.4	9.0	18.1	12.1
1988	18.1	8.9	20.7	10.2
1989	20.1	9.0	24.3	10.9
1990	15.5	8.1	21.4	11.2
1991	10.6	7.8	16.2	11.9

Table 14. Capelin landings (t), catch rates (t/day), and effort (days fished) for purse seines (PS) and traps (T) in NAFO Div. 3L, 1981-91.

Year	Gear	Landings	Catch rate	Effort
1981	PS	15210	9.4	1618
	T	7917	2.9	2730
1982	PS	17692	16.4	1079
	T	8845	3.1	2853
1983	PS	13713	18.8	729
	T	10487	3.4	3084
1984	PS	17075	14.3	1194
	T	15205	2.9	5243
1985	PS	8876	16.4	541
	T	15682	4.6	3409
1986	PS	20504	19.0	1079
	T	26627	4.6	5788
1987	PS	5919	18.1	327
	T	12536	8.8	1425
1988	PS	18859	20.7	911
	T	33762	6.2	5445
1989	PS	19722	24.3	812
	T	31541	6.7	4708
1990	PS	15072	21.4	704
	T	32636	8.6	3795
1991	PS	8803	16.2	543
	T	12347	7.3	1691

Table 15. Catch at age (numbers x 10^{-3}) for mature capelin by purse seines and traps in NAFO Div. 3L, 1981-91.

	Year	Ages 2	3	4	5	6
Purse seine	1981	0	198444	198587	180638	7945
	1982	3274	424871	64520	19326	5270
	1983	13174	287491	150157	6609	286
	1984	4852	185439	296573	26973	738
	1985	47940	213053	71552	25177	1568
	1986	1172	488272	233688	17926	4705
	1987	6590	35667	130961	8815	95
	1988	56311	346446	94472	109655	6850
	1989	3697	466125	149678	6740	6699
	1990	11090	239597	269759	8578	440
	1991	24318	179068	131300	20631	0
Trap	1981	0	106596	100848	74584	4178
	1982	2154	252868	21565	7321	1493
	1983	15952	204722	116720	3430	89
	1984	11991	214639	252096	22153	888
	1985	71940	369247	118585	30125	1932
	1986	3028	518636	316910	22235	6142
	1987	16185	64969	270517	19953	945
	1988	139876	664876	155906	135412	7520
	1989	14173	787595	202973	11150	15346
	1990	14520	460657	594169	21100	137
	1991	120156	276447	158772	20383	636

Table 16. Catch rates at age (t/day) for mature capelin from purse seines and traps in NAFO Div. 3L, 1981-91.

	Year	Ages 2	3	4	5	6
Purse seine	1981	0	122.6	122.7	111.6	4.9
	1982	3.0	393.8	59.8	17.9	4.9
	1983	18.1	39.4	206.0	9.1	0.4
	1984	4.1	155.3	248.4	22.6	0.6
	1985	88.6	393.6	132.3	46.5	2.9
	1986	1.1	452.5	216.6	16.6	4.4
	1987	20.2	109.1	400.5	27.0	0.3
	1988	61.8	380.3	103.7	120.4	7.5
	1989	4.6	574.0	184.3	8.3	8.3
	1990	15.8	340.3	383.2	12.2	0.6
	1991	44.8	329.8	241.8	38.0	0
Trap	1981	0	39.0	36.9	27.3	1.5
	1982	0.8	88.6	7.6	2.6	0.5
	1983	5.2	66.4	37.8	1.1	0
	1984	2.3	40.9	48.1	4.2	0.2
	1985	21.1	108.3	34.8	8.8	0.6
	1986	0.5	89.6	54.7	3.8	1.1
	1987	11.4	45.6	189.8	14.0	0.7
	1988	25.7	122.1	28.6	24.9	1.4
	1989	3.0	167.3	43.1	2.4	3.3
	1990	3.8	121.4	156.6	5.6	0
	1991	71.1	163.5	93.9	12.1	0.4

Table 17. Catch rate at age (t/day) for ages 3 and 4 mature capelin combined for NAFO Div. 3L year-classes 1978-87.

Year-class	Purse seine (C/D)	Trap (C/D)
1978	182.4	46.6
1979	599.8	126.4
1980	642.4	104.2
1981	287.6	75.7
1982	610.4	16.3
1983	853.0	279.4
1984	398.0	74.2
1985	484.0	165.2
1986	957.2	323.9
1987	582.1	215.3

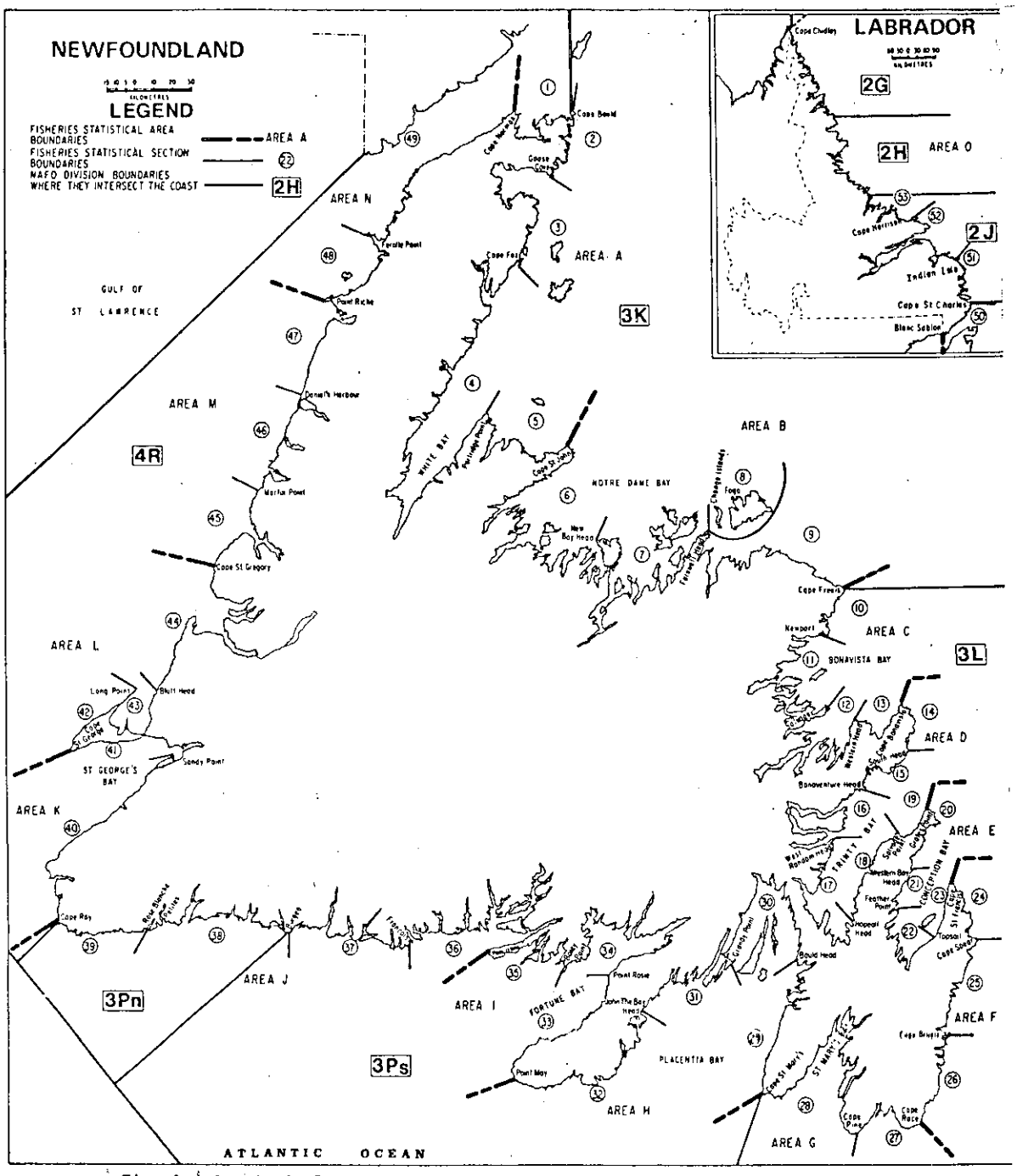

Fig. 1. Statistical areas (C = Bonavista Bay; D = Trinity Bay; E = Conception Bay; F = Southern Shore; G = Trepassey and St. Mary's Bay) and sections (numeric) in NAFO Div. 3L along the coast of Newfoundland.

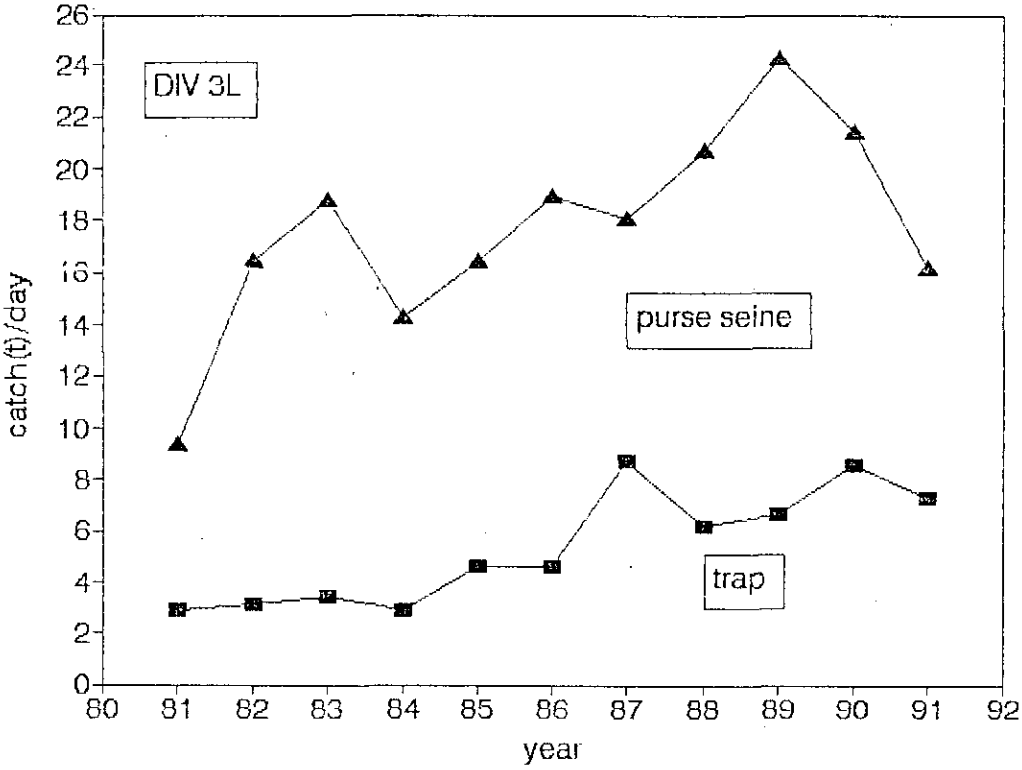

Fig. 2. Catch rates (t/d) for purse seines and capelin traps in NAFO Div. 3L.

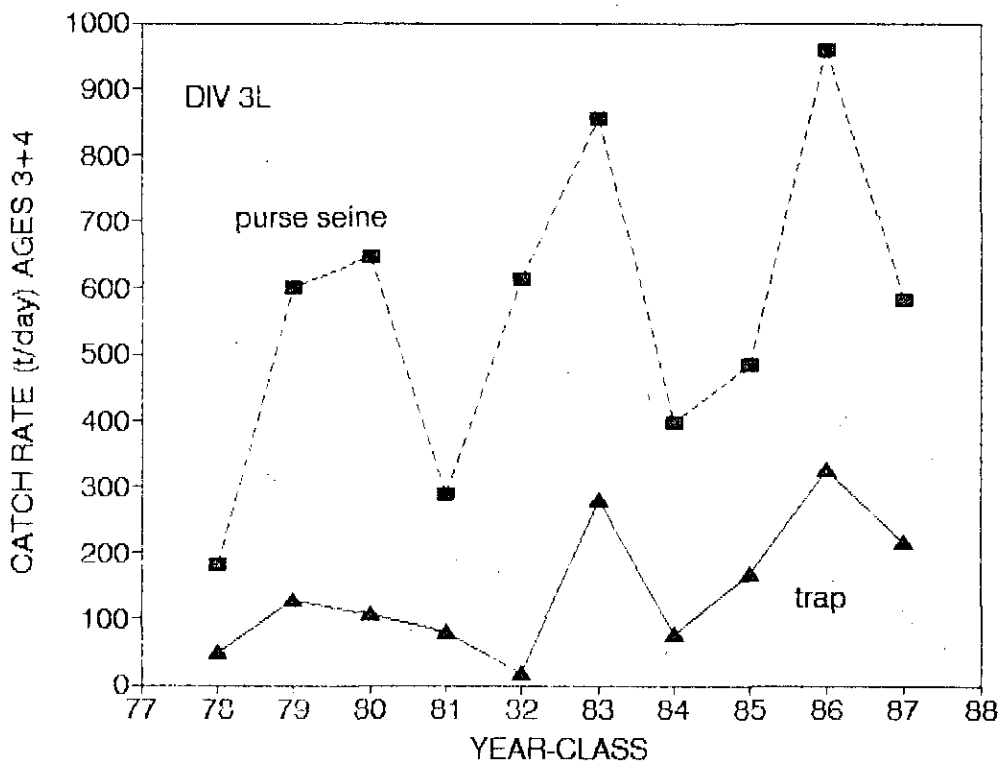

Fig. 3. Catch rates at ages 3 and 4 combined for purse seines and traps in NAFO Div. 3L.

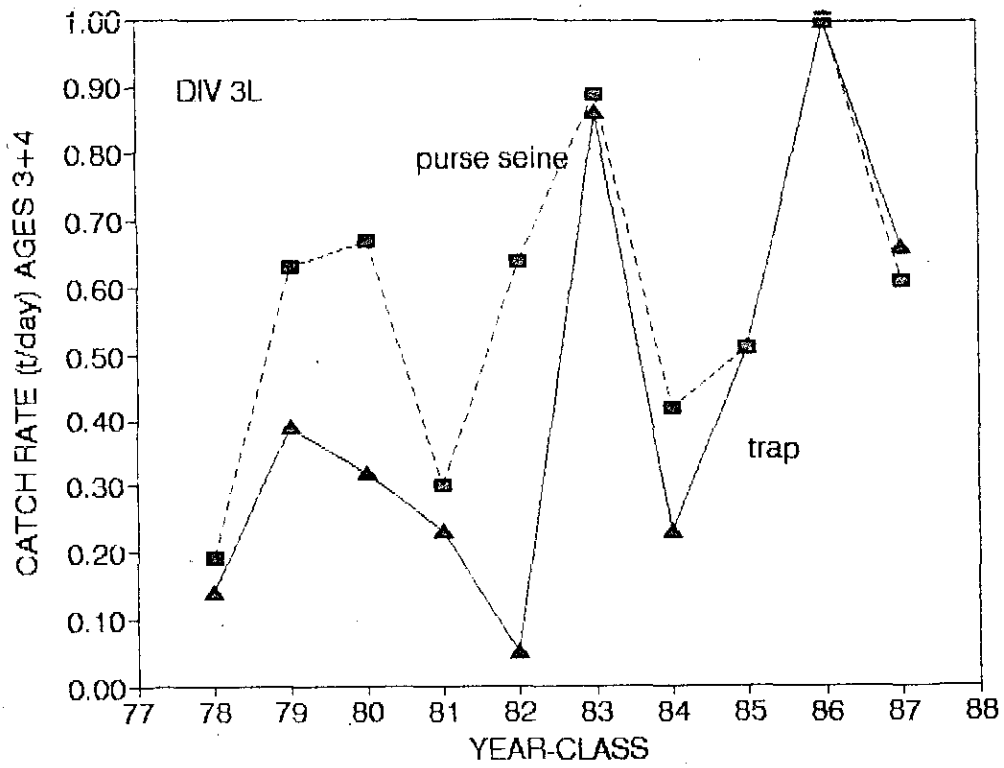

Fig. 4. Standardized catch rates at ages 3 and 4 combined for purse seines and traps in NAFO Div. 3L.

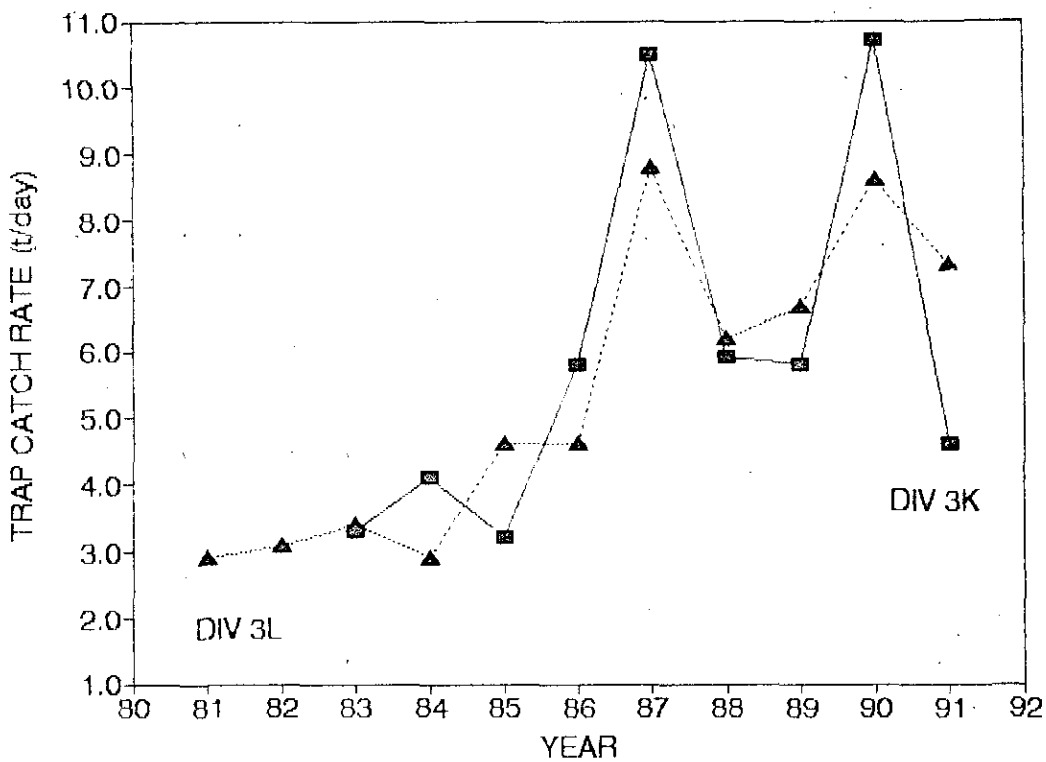

Fig. 5. Comparison of trap catch rates for Div. 3L and Div. 3K.