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Cod in Divisions 2J+3KL - Information Relative to the Portion of the Stock beyond the Canadian 200-Mile Fishery Zone

by

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Introduction

This document was prepared to provide a response to the Fisheries commission for the following request:

> "The Fisheries Commission with the concurrence of the coastal state requests that the Scientific council continue to provide information, if available, on the stock separation in Div. 2J+3KL and the proportion of the biomass of the cod stock in Div. 3L in the Regulatory Area and a projection if possible of the proportion likely to be available in the Regulatory Area in future years. Information is also requested on the age composition of that portion of the stock occurring in the Regulatory Area".

During past Scientific Council meetings data on stock separation has been presented (Lear, 1985, 1986a, 1986b, 1986c) and discussed in some detail. The general conclusion from these discussions was that it is advisable to assess Div. 2J+3KL cod as one stock complex as had been the practice in the past (NAFO Scientific Council reports, 1986). Currently, there are no new analyses available on this subject, however, analyses of the structure of the 2J+3KL stock as well the potential for assessing the entire management unit in smaller areas is ongoing. The rest of this document updates data from research vessel surveys that had been previously presented at Scientific Council meetings.

Results and Discussion

Survey coverage

The area of NAFO Div. 3L in depth to 400 fathoms is 42265 square nautical miles, of which about 3700 or 9% occurs in the Regulatory Area (Table 1, Fig. 1). All areas within this depth zone in both Div. 2J and 3K are on the shoreward side of the Canadian 200 mile fishery zone. The total area in Div. 2J3KL to 400 fathoms is about 106,000 square nautical miles (Table 2), therefore, the area to this depth in the Regulatory Area in Div. 2J3KL is about 3.5% of the total.

Stratified-random research vessel surveys have been conducted in Div. 2J, 3K, and 3L during autumn since 1977, 1978, and 1981 respectively. Stratified-random surveys have also been conducted in Div. 3L during spring since 1971 (excluding 1983-84) and during winter in 1985 and 1986. Surveys during spring for the 1971-76 period were incomplete with regard to strata coverage and have been excluded from analysis for this document. The RV A. T. CAMERON was used to conduct Div. 3L surveys for the 1971-72 period while the sister ships RV WILFRED TEMPLEMAN and RV ALFRED NEEDLER have been used since that time. Surveys in Div. 2J and 3K have been conducted by the RV GADUS ATLANTICA.

Biomass estimates

The information on the proportion of cod biomass occurring in Div. 3L in the Regulatory Area has been presented previously (Baird 1987, Baird and Bishop, 1989, Baird and Bowering, 1986, Wells et al. 1988). Information has been updated and included in the present document.

For spring surveys conducted during the 1977-89 period the percentage of cod biomass in the Regulatory Area of the total 3L biomass ranged from 0.4 to 6.1% (Table 3). The percentage during 1989 is about 1.5%.

Results of autumn surveys conducted during 1981-89 indicate that the proportion of the total 3L biomass occurring in the Regulatory Area at that time of year ranged from 0.5 to 7.7% while the proportion during 1989 was 3.4% (Table 4). No new information is available from winter surveys and the results of two surveys conducted during 1985 and 1986 are given in Table 5.

Surveys conducted during autumn (1981-89) in all three divisions (2J, 3K, and 3L) indicate that only a small portion of the entire 2J3KL cod biomass occurs in the Regulatory Area at that time of year (Table 6). The average proportion for the time period examined is less than 1%. The average divisional biomass during autumn is given in Table 7. If these divisional proportions are similar at other times of the year, then on average throughout the year less than 5% of the entire 2J3KL cod stock occurs in the Regulatory Area.

Age compositions

Age compositions from research vessel surveys conducted in Div. 3L during spring and autumn during 1989 were included with data presented last year (Baird and Bishop 1989) and are presented as percentages inside and outside the 200 mile zone in Tables 8-9 and Fig. 2-3. Results from winter surveys that were presented last year are again given in Table 10 and Fig. 4.

Results for the 1989 RV data are similar to those reported last year. When a small proportion of the 3L biomass occurs in the Regulatory Area (spring and autumn), cod in that area are proportionately smaller than the area inside 200 miles. During winter when the largest proportion of 3L cod biomass occurs in the Regulatory Area age compositions are similar.

Age compositions for the entire 2J3KL cod biomass estimated from RV surveys are presented in Tables 11 and 12. Age compositions for the entire management unit are similar to those which occur in Div. 3L inside the 200 mile fishing zone.

References

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Baird, J. W., and W. R. Bowering. 1986. Biomass estimates for cod and Greenland halibut beyond the Canadian 200 mile economic zone in NAFO Div. 2J+3KL. NAFO SCR Doc. 86/51. Ser. No. N1168, 6 p.

Lear, W. H. 1986a. A further discussion of the stock complex of Atlantic cod (Gadus morhua) in NAFO Div. 2J, 3K, and 3L. NAFO SCR Doc. 86/118, Ser. No. N1245, 18 p.

Lear, W. H., 1986b. Results of tagging on winter concentrations of cod in NAFO Div. 2J, 3K, and 3L during 1978-83. NAFO SCR Doc. 86/124, Ser. No. N1253, 8 p.

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Lear, W. H. 1985. Migration and intermingling of cod in relation to the Canadian 200 mile limit around the nose (NAFO Div. 3L) and the tail (NAFO Div. 3N) of the Grand Bank, NAFO SCR Doc. 85/40. Ser. No. N990 (14 p.).

Wells, R., J. W. Baird, and C. A. Bishop. 1988. The proportion of cod biomass in the Regulatory Area of Div. 3L in relation to the whole of Div. 3L. NAFO SCR Doc. 88/95. Ser. No. N1547, 15 p.

Table 1. Proportion of area (square nautical miles) outside the 200 mile fishery zone in NAFO Div. 3L by depth range.

Depth (fm)	Depth (m)	Area total	Area outside	% Outside
31-50	56-91	8,552.	0	0
51-100	92-183	17,452	933	5
101-150	184-274	6,918	791	11
151-200	275-366	3,855	768	20
201-300	367-549	1,142	636	56
301-400	550-732	804	554	69
Unstratified shoreward		3,542	0	0
Total		42,265	3,682	9

Table 2. Area in square nautical miles in Div. 2J, 3K, and 3L.

Division	Survey area (mi^2) (0-750 m)	Percentage
2J	27,633	26
3K	36,545	34
3L	42,265	40
Total	106,443	100

Table 3. Estimates of cod biomass outside the 200 mile fishery zone in Division 3L by strata and depth zone from surveys conducted in the spring over the period 1977-89. The number of successful sets is in parenthesis.

Strata	Depth zone (fath)	% Area outside 200 mi. zone	ATC 262 (102) 1977	ATC 276 (94) 1978	ATC 290 (141) 1979	ATC 304-305 (115) 1980	ATC 317-318 (77) 1981	ATC 329 (103) 1982	WT 28-30 (221) 1985	WT 48 (211) 1986	WT 59-60 (181) 1987	WT 70-71 (154) 1988	WT 83 (194) 1989
385	51-100	5	21	4	56	314	21	0	104	21	53	107	154
390	"	55	278	437	1,169	1,539	275	119	144	223	277	0	109
389	101-150	62	833	659	681	4,292	296	1,031	3,825	558	401	429	382
391	"	100	634	356	1,048	2,064	1,212	95	429	826	201	41	95
387	151-200	37	45	68	170	95	90	871	7,952	2,425	72	192	927
388	"	99	1,169	179	346	107	188	1,308	343	1,556	10	177	121
392	"	100	30	66	189	0	128	256	2,237	435	3	98	57
729	201-300	100							35				
731	"	100							36				
733	"	50			not surveyed				158	not surveyed			
730	301-400	100			beyond 200 fathoms				0	beyond 200 fathoms			
732	"	100							0				
734	"	67							0				
Biomass outside 200 miles			3,010	1,769	3,659	8,411	2,210	3,680	15,263	6,044	1,017	1,044	2,845
Total 3L biomass			70,877	78,118	129,116	139,030	218,214	140,578	267,515	239,857	257,564	259,080	193,713
Outside 200 miles			4.3	2.3	2.8	6.1	1.0	2.6	5.7	2.5	0.4	0.4	1.5

Table 4. Estimates of cod biomass outside the 200 mile fishery zone in Division 3L by strata and depth zone from surveys conducted during autumn for 1981-89. The number of successful sets is in parenthesis.

Strata	Depth zone (fath)	% Area outside 200 mi. zone	ATC 323-325 (96) 1981	ATC 333-334 (120) 1982	WT 7-9 (125) 1983	WT 16-18 (208) 1984	WT 37-39 (231) 1985	AN 72 (142) 1986	WT 65 (165) 1987	WT 78 (189) 1988	WT 87 (195) 1989
385	51-100	5	2	2	51	94	5	55	48	16	3
390	"	55	5	32	469	622	5	19	152	112	59
389	101-150	62	-	2,125	-	1,697	1,563	1,068	1,074	436	1,246
391	"	100	-	487	159	79	325	370	70	6	23
387	151-200	37	494	3,410	-	2,762	1,501	7,483	1,014	477	176
388	"	99	-	456	-	610	1,892	-	114	362	1,348
392	"	100	-	220	109	68	106	11	8	41	22
729	201-300	100	-	-	-	59	0	0	-	-	-
731	"	100	-	-	-	49	146	-	-	-	-
733	"	50	-	-	-	483	150	-	-	-	-
730	301-400	100	-	-	-	0	0	-	-	-	-
732	"	100	-	-	-	0	0	-	-	-	-
734	"	67	-	-	-	0	0	-	-	-	-
Biomass outside 200 miles			501	6,732	788	6,523	5,693	9,006	2,480	1,450	2,877
Total 3L biomass			109,706	87,997	131,267	191,701	165,417	190,731	151,936	139,726	84,320
% Outside 200 miles			0.5	7.7	0.6	3.4	3.4	4.7	1.6	1.0	3.4

Table 5. Estimates of cod biomass outside the 200 mile fishery zone in Division 3L by strata and depth zone from surveys conducted during winter for 1985-86. The number of successful sets is in parenthesis.

Strata	Depth zone (fath.)	% Area outside 200 mi. zone	WT 22-24 (182) 1985	WT 42-44 (206) 1986
385	51-100	5	566	21
390	"	55	2,941	21
389	101-150	62	22,223	1,055
391	"	100	2,710	92
387	151-200	37	20,034	8,592
388	"	99	21,940	2,133
392	"	100	2,182	902
729	201-300	100	0	178
731	"	100	546	-
733	"	50	2,629	728
730	301-400	100	0	-
732	"	100	0	-
734	"	67	20	-
Biomass outside 200 miles			75,800	13,722
Total 3L biomass			318,563	51,164
% Outside 200 miles			23.8	26.8

Table 6. Cod biomass distribution in NAFO Division 2J3KL derived from fall surveys in relation to the 200 mile fishery zone from Canadian research vessel surveys.

	1981	1982	1983	1984	1985	1986	1987	1988	1989	Average
Biomass outside 200 mi.	501	6,732	788	6,523	5,693	9,006	2,480	1,450	2,877	
Total 2J3KL	528,300	447,800	607,800	554,100	387,400	952,200	450,000	468,800	449,000	
% Outside	0.1	1.5	0.1	1.2	1.5	0.9	0.6	0.3	0.6	0.8

Table 7. Biomass estimates (000 t) of cod from autumn research vessel surveys in NAFO Divisions 2J, 3K, and 3L.

Division	1981	1982	1983	1984	1985	1986	1987	1988	1989	
2J	228.8	216.5	267.1	181.7	136.7	404.6	174.8	252.9	145.5	
3K	185.4	142.2	183.7	181.9	86.0	356.4	123.3	75.4	219.2	
3L	114.5	89.1	157.0	190.5	164.7	191.2	151.9	139.7	84.3	
Total	528.7	447.8	607.8	554.1	387.4	952.2	450.0	468.0	449.0	
Percentage										Average
2J	43	48	44	33	35	43	39	54	32	41
3K	35	32	30	33	22	37	27	16	49	31
3L	22	20	26	34	43	20	34	30	19	28
Total	100	100	100	100	100	100	100	100	100	100

Table 8. Percent age compositions Division 3L inside and outside the 200 mile limit as derived from the 1986-89 spring RV surveys.

	1986 WT 48		1987 WT 59-60		1988 WT 70-71		1989 WT 83	
Age	Inside	Outside	Inside	Outside	Inside	Outside	Inside	Outside
1	-	-	-	-	-	-	-	-
2	-	1	1	6	-	5	1	2
3	6	19	5	40	10	57	10	39
4	24	42	11	30	9	20	20	43
5	26	20	29	13	15	5	9	6
6	19	10	27	5	33	6	9	2
7	9	4	14	3	16	3	23	2
8	7	3	5	1	8	2	17	2
9	2	1	4	1	3	1	5	2
10	1	-	1	1	2	1	2	1
11	2	1	1	-	1	-	2	1
12	1	-	1	1	1	-	-	-

Table 9. Percent age compositions for Division 3L inside and outside the 200 mile limit as derived from the 1986-89 fall RV surveys.

Age	1986 AN 72		1987 WT 65		1988 WT 78		1989 WT 87	
	Inside	Outside	Inside	Outside	Inside	Outside	Inside	Outside
1	-	-	-	17	-	4	-	1
2	3	4	7	62	5	37	3	20
3	6	4	6	18	16	36	22	40
4	27	20	13	2	8	6	21	15
5	23	23	31	3	18	2	11	3
6	24	26	23	1	22	2	15	2
7	7	8	11	1	16	3	15	3
8	6	6	4	1	8	3	6	2
9	2	3	3	2	4	2	4	4
10	1	1	-	-	2	1	1	3
11	1	2	-	1	-	1	-	2
12	1	1	1	1	-	1	-	1

Table 10. Percent age compositions from Division 3L inside and outside the 200 mile limit as derived from the 1985-86 winter RV surveys.

Age	1985 WT 22-24		1986 WT 42-44	
	Inside	Outside	Inside	Outside
1	-	-	-	-
2	1	-	1	-
3	10	13	8	8
4	17	25	35	38
5	30	27	31	28
6	18	14	17	17
7	14	11	4	4
8	5	5	2	3
9	2	2	-	1
10	1	2	-	-
11	1	1	-	-
12	-	-	-	-

Table 11. Mean number of cod per tow of cod in Div. 2J3KL estimated from research vessel surveys conducted by Canada (1981-89).

	1981	1982	1983	1984	1985	1986	1987	1988	1989
2	1.62	2.53	6.15	5.58	1.10	1.85	1.56	2.15	7.27
3	5.27	5.92	12.42	10.81	7.27	4.77	2.04	3.94	7.97
4	2.82	6.04	10.76	15.26	12.35	20.69	4.03	3.21	7.25
5	3.35	3.93	11.07	11.37	10.02	31.29	13.23	5.32	5.38
6	9.92	2.85	3.94	9.62	7.28	21.28	11.61	10.66	5.87
7	8.99	5.93	2.48	2.31	4.24	10.14	4.38	10.23	7.54
8	3.72	5.42	5.42	1.38	0.92	5.26	2.67	2.60	4.44
9	0.75	2.62	3.00	2.10	0.78	1.37	1.38	1.56	1.42
10	0.24	0.58	1.44	1.31	0.67	0.58	0.34	0.80	0.83
11	0.10	0.17	0.37	0.54	0.41	0.68	0.17	0.15	0.36
12	0.11	0.09	0.14	0.28	0.15	0.42	0.19	0.11	0.14
13	0.11	0.07	0.13	0.12	0.06	0.19	0.13	0.08	0.08
2+	36.98	36.14	57.32	60.68	45.25	98.52	41.74	40.82	48.55
3+	35.36	33.62	51.17	44.10	44.15	96.67	40.18	38.67	41.28
4+	30.10	27.70	38.75	44.29	36.87	91.91	38.14	34.73	33.31
5+	27.27	21.66	27.99	29.03	24.52	71.21	34.11	31.52	26.06
6+	23.93	17.73	16.92	17.66	14.51	39.92	20.88	26.20	20.68
7+	14.01	14.88	12.97	8.03	7.23	18.64	9.27	15.54	14.81

Table 12. Percent age composition of cod in Div. 2J3KL derived from research vessel surveys conducted by Canada (1981-89).

	1981	1982	1983	1984	1985	1986	1987	1988	1989
2	0.04	0.07	0.11	0.09	0.02	0.02	0.04	0.05	0.15
3	0.14	0.16	0.22	0.18	0.16	0.05	0.05	0.10	0.16
4	0.08	0.17	0.19	0.25	0.27	0.21	0.10	0.08	0.15
5	0.09	0.11	0.19	0.19	0.22	0.32	0.32	0.13	0.11
6	0.27	0.08	0.07	0.16	0.16	0.22	0.28	0.26	0.12
7	0.24	0.16	0.04	0.04	0.09	0.10	0.10	0.25	0.16
8	0.10	0.15	0.09	0.02	0.02	0.05	0.06	0.06	0.09
9	0.02	0.07	0.05	0.03	0.02	0.01	0.03	0.04	0.03
10	0.01	0.02	0.03	0.02	0.01	0.01	0.01	0.02	0.02
11	0.00	0.00	0.01	0.01	0.01	0.01	0.00	0.00	0.01
12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

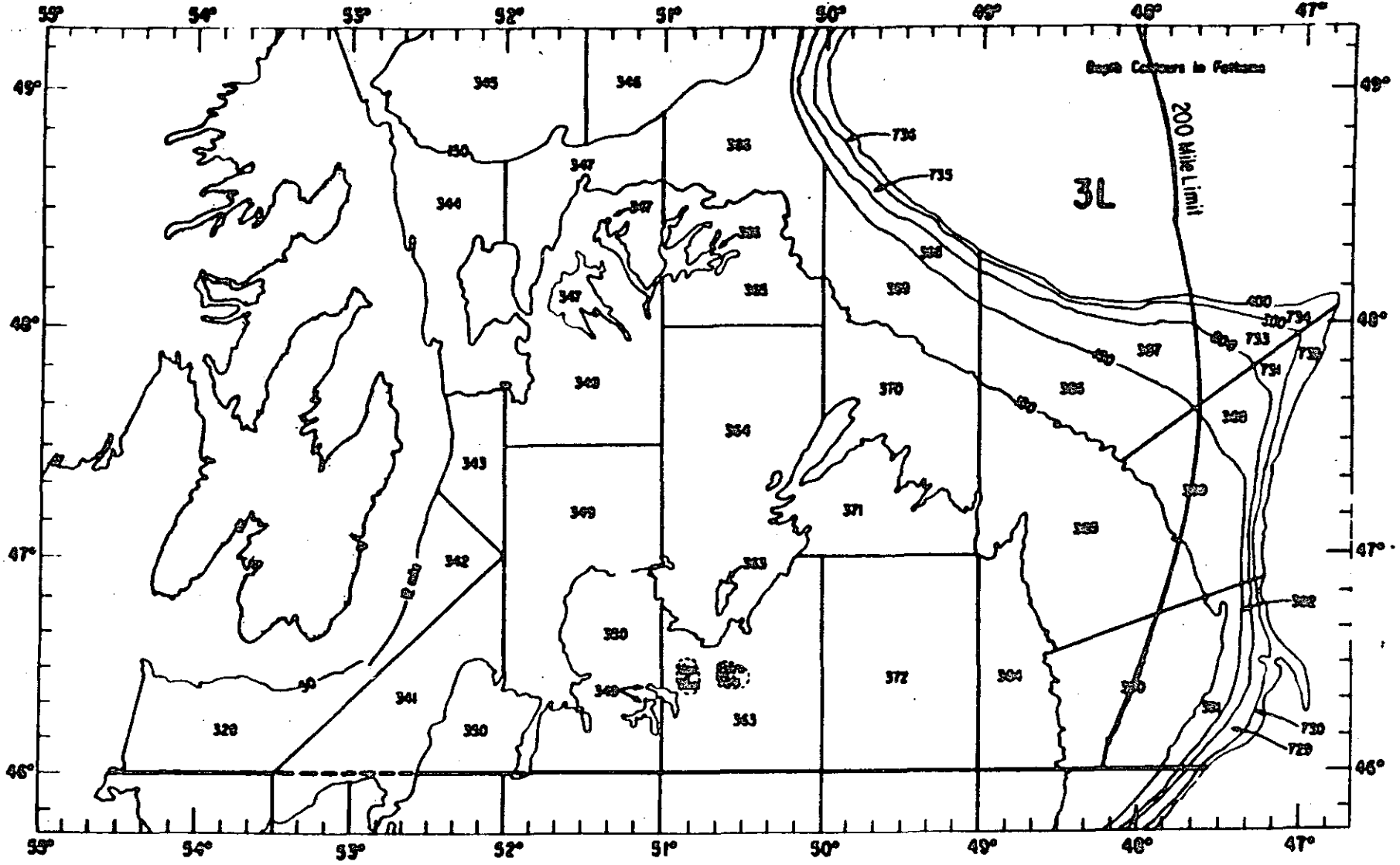

Fig. 1. Stratification scheme for NAFO Div. 3L relative to the 200 mi. economic zone.

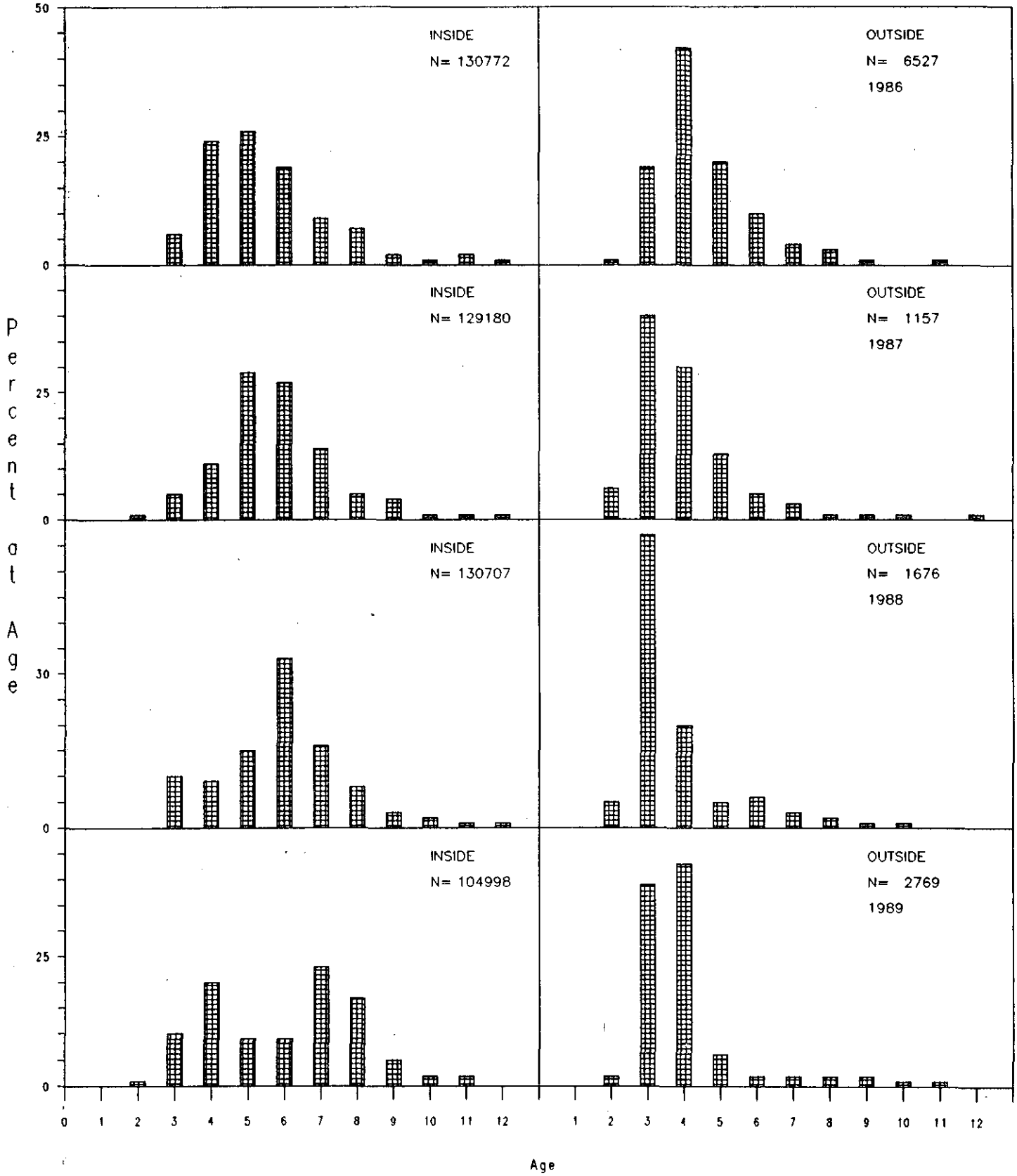

Figure 2. Percent age composition for Div. 3L inside and outside the 200 mile limit as derived from the 1986-1989 spring RV surveys.

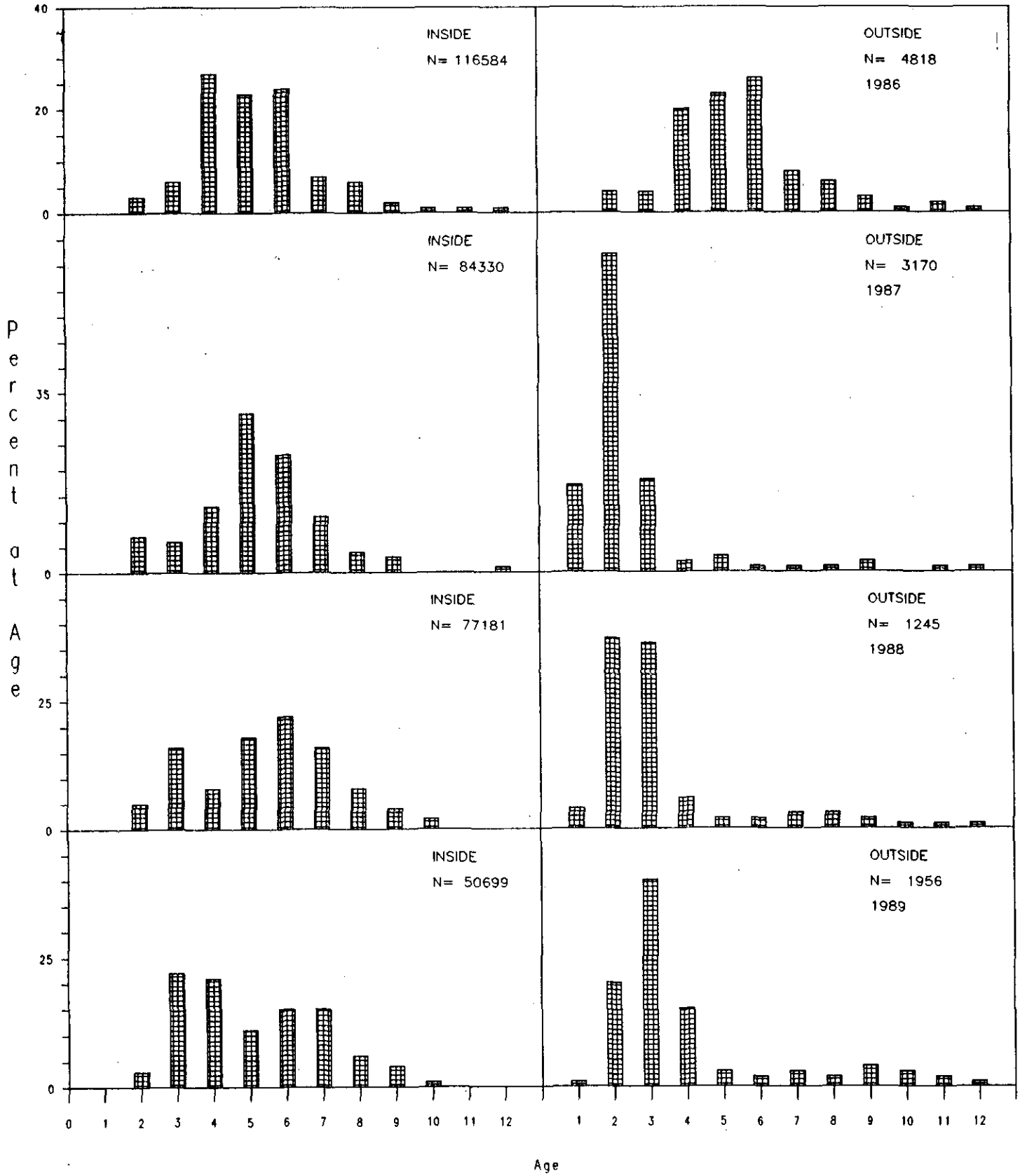

Figure 3. Percent age composition for Div. 3L inside and outside the 200 mile limit as derived from the 1986-1989 fall RV surveys.

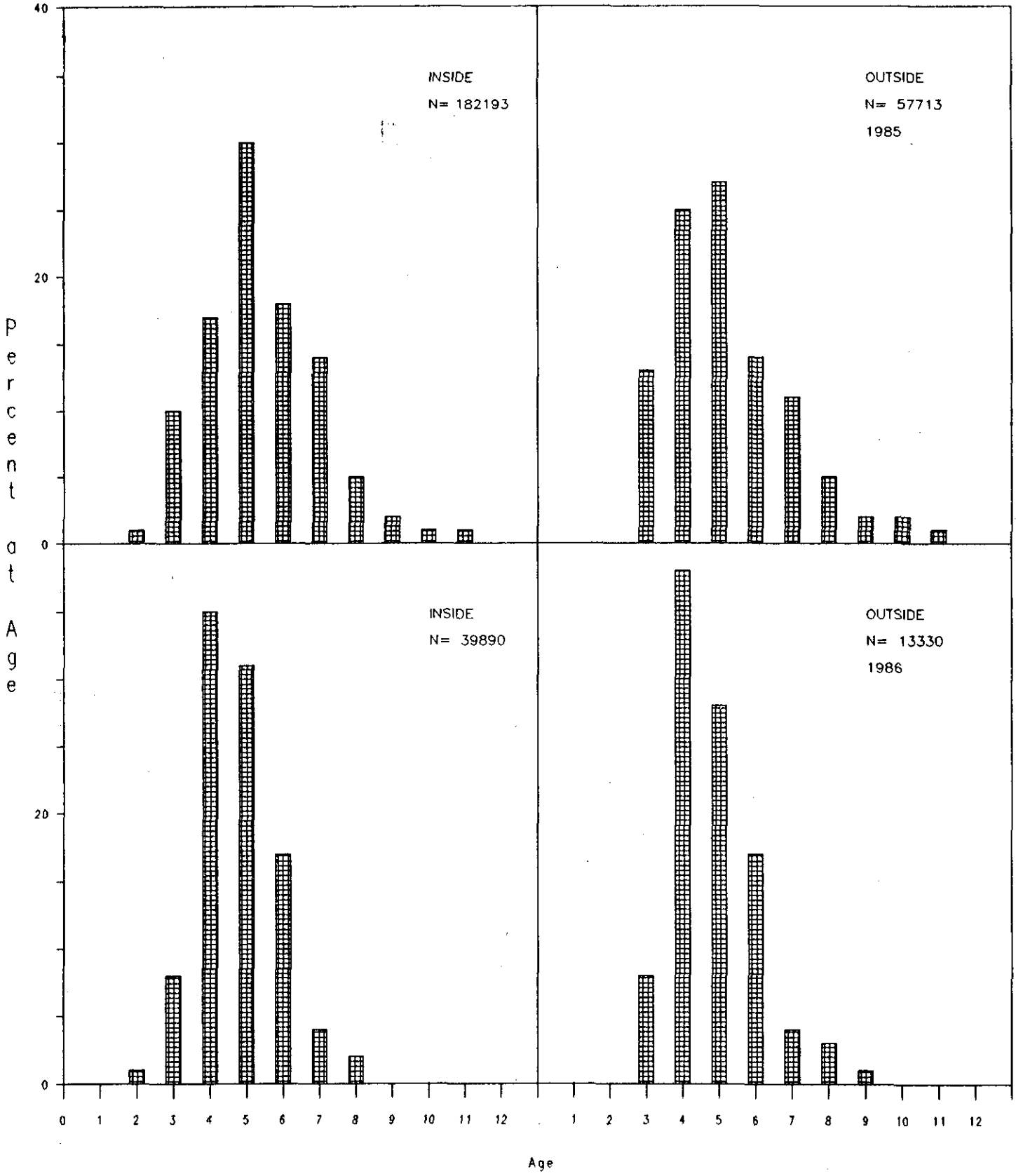

Figure 4. Percent age composition for Div. 3L inside and outside the 200 mile limit as derived from the 1985-1986 winter RV surveys.