Northwest Atlantic Fisheries Organization

Serial No. N3054

NAFO SCR Doc. 98/62

SCIENTIFIC COUNCIL MEETING - JUNE 1998

# Cod in Divisions 2J+3KL –Estimates of Biomass and Age Composition for the portion of the Stock in the NAFO Regulatory Area from Canadian Research Vessel Surveys

By

E.F. Murphy

Science Branch, Department of Fisheries and Oceans
P.O. Box 5667, St. John's, Newfoundland A1C 5X1

## Introduction

The Fisheries Commission with the concurrence of the coastal state has annually requested available information on ' the stock separation in Div. 2J+3KL and the portion of the biomass of the cod stock in Div. 3L in the Regulatory Area. Information is also requested on the age composition of that portion of the stock occurring in the Regulatory Area'. This document updates information presented previously (Murphy, 1997) on the portion of the biomass occurring in the NAFO Regulatory Area (NRA) and the age composition of this biomass using data from Canadian research vessel survey in the area. This document, as in the past, presents a comparison of the age composition inside and outside the 200 mile fishing zone.

## Results and Discussion

### Stock separation

There is no new information on stock separation in Division 2J+3KL. The issue has been addressed in some detail by Scientific Council in the past (NAFO Scientific Council Report, 1986) and the general conclusions have been that the stock be managed as a single complex. As reported previously (Bentzen et al. 1996) work has shown that within the northern cod complex , two pooled samples, NORTH (Hamilton, Funk and Belle Isle Banks) and SOUTH (the northern Grand Bank area) are distinguishable using microsatellite DNA techniques. This lends support to tagging work (Lear 1984, and Taggart et al. 1995) which show that cod tagged in spawning aggregations on offshore banks show fidelity to these banks. Genetic work is continuing on the issue of inshore or bay stocks and also possible relationships with other adjacent stocks. The ability to define distinct elements within the 2J+3KL stock complex and relationships with adjacent stocks may have implications on how this stock is managed in the future.

### Survey coverage

The area of NAFO Div 3L, in depths to 400 fathoms is 42,265 sq. naut. miles, of which 3700 or 9% is in the NRA (Table 1, Fig. 1). All areas within this depth zone in Div. 2J and 3K are on the shoreward side of the Canadian 200- mile fishery zone. The total area in 2J+3KL to 400 fathoms is about 106,000 sq. naut. miles (Table 2.); therefore, the area to this depth in the NRA is about 3.5 % of the total.

Stratified – random surveys have been conducted by Canada in Divisions 2J, 3K and 3L during the autumn since 1977, 1978 and 1981 respectively. Stratified-random surveys have also been conducted during the spring since 1971 (excluding 1983-84) and during the winter in 1985 and 1986. Spring surveys during the period 1971-1976 were incomplete with regards to strata coverage and have been excluded from analysis in this document.

Changes to surveys

It should be noted that in the fall of 1995 the survey trawl used changed from the Engles 145 to the Campelen 1800 shrimp trawl. Although conversion factors exist for the data from 1984 -1994 they have not been used in data presented. The change in gear should result in an increase in the percentage of small fish.

In the fall 1996 and 1997 strata shoreward of the scheme used previously were surveyed, however data from these strata are not included in the calculation of biomass inside and outside the zone or the percentages at age.

Biomass estimates

Winter surveys are not regularly conducted in Division 3L. Results of winter surveys conducted in 1985 and 1986 indicated that about 25% of the 3L biomass occurred in the NRA (Murphy et al. 1991). No stratified – random surveys have been conducted during the winter since that time.

Spring surveys conducted during 1977-1990 period showed the portion of the biomass in the NRA has ranged from 0.4% to 6.0% with a mean of 2.9%. Since 1991 this percentage has increased from 10.8% to a high of 63% in 1994 and was 2.2% in 1997 (Table 3).

Autumn survey results for the years 1981-94 indicate that on average 3.5% of the 3L biomass occurs in the NRA with the 1994 value of 9.7% being the highest observed. The value decreased in 1996 to 0.2 % the lowest observed, but increased to 8.5% in the fall of 1997 (Table 4).

Surveys conducted during the autumn for 1981-1992 in Divisions 2J+3KL indicate that on only a small portion, less than 1%, of the total 2J+3KL biomass occurs in the NRA at that time. In 1993 this portion increased to 5% in the NRA and was less than 1% in 1995 and 1996 and increased to 5% in 1997 (Table 5).

The average divisonal biomass (Table 6) has been variable in recent years. Biomass has declined substantially since 1990 and are currently (1997) at an extremely low level.

Age composition

The age composition from spring and autumn research vessel surveys in Div. 3L since 1986 (Tables 7-8; Figures 2-5) indicated for most years a higher portion of younger cod are found in the NRA.

The 1985 and 1986 winter survey results indicated the highest seasonal proportion of 3L biomass in the NRA and age compositions were similar to those inside the Canadian 200-mile zone.

Age composition of cod for the entire 2J3KL research surveys series (Table 9) were similar to those, which occur in Div 3L inside the 200-mile fishing zone.

## REFERENCES

Bentzen P. ,C.T. Taggart, D.E. Ruzzante and D. Cook. 1996. Microsatellite Polymorphism and Population Structure of Atlantic Cod (*Gadus morhua)* in the Northwest Atlantic. NAFO SCR Doc 96/21. Ser.N2694. 20 p.

Lear, W.H. 1984. Discrimination of the stock complex of Atlantic cod (*Gadus Morhua)* of southern Labrador and eastern Newfoundland, as inferred from tagging studies. J. Northw. Atl. Fish Sci. 5:143-159

Murphy, E.F., C.A. Bishop, and J.W. Baird. 1991. Cod in Divisions 2J+3KL Estimates of biomass and age composition for the portion of the stock beyond the Canadian 200 mile fishing zone. NAFO SCR DOC 91/51. Ser. No. N1934. 12 p.

Murphy, E.F. 1997. Cod in Divisions 2J+3KL –Estimates of Biomass and Age Composition for the portion of the Stock in the NAFO Regulatory Area from Canadian Research Vessel Surveys. . NAFO SCR DOC 97/57. Ser. No. N2891. 11 p.

Taggart, C.T., P. Penny, N. Barrowman and C. George. 1995. The 1954 –1993 Newfoundland Cod Tagging database: Statistical summaries and Spatial – temporal distributions. Can. Tech. Rep. Fish Aquat. Sci. 2042.

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

| Depth fathoms | Depth meters | 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 nuatical miles in Div 2J, 3K and 3L.

| Division | Survey area (mi . sq.) (0-750 m) | % |
|---|---|---|
| 2J | 27,633 | 26 |
| 3K | 36,545 | 34 |
| 3L | 42,262 | 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 Canadian RV surveys conducted in the spring over the period 1977-97. The number of successful set are 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 385 | 51-100 | 5 | 21 | 4 | 56 | 314 | 21 | 0 | 104 | 21 | 53 | 107 |
| 390 | " | 55 | 278 | 437 | 1169 | 1539 | 275 | 119 | 144 | 223 | 277 | 0 |
| 389 | 101-150 | 62 | 833 | 659 | 681 | 4292 | 296 | 1031 | 3825 | 558 | 401 | 429 |
| 391 | " | 100 | 634 | 356 | 1048 | 2064 | 1212 | 95 | 429 | 826 | 201 | 41 |
| 387 | 151-200 | 37 | 45 | 68 | 170 | 95 | 90 | 871 | 7952 | 2425 | 72 | 192 |
| 388 | " | 99 | 1169 | 179 | 346 | 107 | 188 | 1308 | 343 | 1556 | 10 | 177 |
| 392 | " | 100 | 30 | 66 | 189 | 0 | 128 | 256 | 2237 | 435 | 3 | 98 |
| 729 | 201-300 | 100 | | | | | | | 35 | | | |
| 731 | " | 100 | | | | | | | 36 | | | |
| 733 | " | 50 | | not surveyed | | | | | 158 | Not surve | Not surveyed | |
| 730 | 301-400 | 100 | | | | | | | 0 | | | |
| 732 | " | 100 | | | | | | | 0 | | | |
| 734 | " | 67 | | | | | | | 0 | | | |
| biomass outside 200 mi. limit | | | 3010 | 1769 | 3659 | 8411 | 2210 | 3680 | 15263 | 6044 | 1017 | 1044 |
| total 3L biomass | | | 70815 | 78212 | 129117 | 139030 | 220979 | 140578 | 267516 | 239857 | 257564 | 259080 |
| % outside | | | 4.3% | 2.3% | 2.8% | 6.0% | 1.0% | 2.6% | 5.7% | 2.5% | 0.4% | 0.4% |

| Strata | Depth zone fath. | % Area outside 200 mi. zone | WT 83 (194) 1989 | WT 96 (156) 1990 | WT 106-107 (138) 1991 | WT 119-122 (178) 1992 | WT 137-138 (181) 1993 | WT 152-154 (160) 1994 | WT 168-170 (151) 1995 | WT 189-91 (188) 1996 | WT 204-208 (158) 1997 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 385 | 51-100 | 5 | 154 | 40 | 325 | 2 | 5 | 0 | 0 | 0 | 0 |
| 390 | " | 55 | 109 | 35 | 202 | 20 | 16 | 0 | 0 | 17 | 0 |
| 389 | 101-150 | 62 | 382 | 318 | 140 | 39 | 0 | 0 | 6 | 0 | 5 |
| 391 | " | 100 | 95 | 621 | 283 | 0 | 0 | 0 | 0 | 0 | 0 |
| 387 | 151-200 | 37 | 927 | 10557 | 3422 | 3005 | 241 | 0 | 20 | 31 | 105 |
| 388 | " | 99 | 121 | 1162 | 995 | 239 | 481 | 0 | 9 | 12 | 0 |
| 392 | " | 100 | 57 | | 179 | 10 | 5 | 0 | 9 | 18 | 0 |
| 729 | 201-300 | 100 | | | 170 | 552 | 15 | 6 | 0 | 13 | 0 |
| 731 | " | 100 | | | 670 | 253 | 84 | 2094 | 0 | 152 | 0 |
| 733 | " | 50 | | | 1290 | 384 | 55 | 62 | 46 | 21 | 35 |
| 730 | 301-400 | 100 | | | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 732 | " | 100 | | | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 734 | " | 67 | | | 173 | 0 | 0 | 0 | 0 | 0 | 0 |
| biomass outside 200 mi. limit | | | 1845 | 12733 | 7849 | 4505 | 901 | 2162 | 90 | 264 | 145 |
| total 3L biomass | | | 192713 | 228865 | 72416 | 27919 | 2248 | 3429 | 343 | 10884 | 6651 |
| % outside | | | 1.0% | 5.6% | 10.8% | 16.1% | 40.1% | 63.1% | 26.2% | 2.4% | 2.2% |

Table 4. Estimates of cod biomass outside the 200 mile fishery zone in Division 3L by strata and depth zone from Canadian RV surveys conducted in the autumn over the period 1981-97. The number of successful set are in parenthesis.

| Strata | Depth zone fath. | % Area outside 200 mi. zone | ATC 323-325 (99) 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 |
|---|---|---|---|---|---|---|---|---|---|---|
| 385 | 51-100 | 5 | 2 | 2 | 51 | 94 | 5 | 55 | 48 | 16 |
| 390 | " | 55 | 5 | 32 | 469 | 622 | 5 | 19 | 152 | 112 |
| 389 | 101-150 | 62 | | 2125 | | 1697 | 1563 | 1068 | 1074 | 436 |
| 391 | " | 100 | | 487 | 159 | 79 | 325 | 370 | 70 | 6 |
| 387 | 151-200 | 37 | 494 | 3410 | | 2762 | 1501 | 7483 | 1014 | 477 |
| 388 | " | 99 | | 456 | | 610 | 1892 | | 114 | 362 |
| 392 | " | 100 | | 220 | 109 | 68 | 106 | 11 | 8 | 41 |
| 729 | 201-300 | 100 | | | | 59 | 0 | 0 | | |
| 731 | " | 100 | | | | 49 | 146 | | | |
| 733 | " | 50 | not surveyed | | | 483 | 150 | | | |
| 730 | 301-400 | 100 | | | | 0 | 0 | not surveye | not surveyed | |
| 732 | " | 100 | | | | 0 | 0 | | | |
| 734 | " | 67 | | | | 0 | 0 | | | |
| biomass outside 200 mi. limit | | | 501 | 6732 | 788 | 6523 | 5693 | 9006 | 2480 | 1450 |
| total 3L biomass | | | 109819 | 87997 | 131267 | 191702 | 165169 | 190732 | 151936 | 139726 |
| % outside | | | 0.5% | 7.7% | 0.6% | 3.4% | 3.4% | 4.7% | 1.6% | 1.0% |

| Strata | Depth zone fath. | WT 87 (174) 1989 | WT 101 (161) 1990 | WT 114-115 (219) 1991 | WT 129-130 (215) 1992 | WT 145-146 (153) 1993 | WT 160-162 (200) 1994 | WT 176-181 (166) 1995 | Tel 41 WT 196-198 (211) 1996 | Tel 54-58 WT 214-217 (171) 1997 |
|---|---|---|---|---|---|---|---|---|---|---|
| 385 | 51-100 | 3 | 36 | 6 | 14 | 0 | 0 | 0 | 1 | 0 |
| 390 | " | 59 | 36 | 0 | 14 | 0 | 0 | 7 | 0 | 0 |
| 389 | 101-150 | 1246 | 1162 | 563 | 0 | 0 | 0 | 8 | 0 | 21 |
| 391 | " | 23 | 165 | 15 | 1 | 10 | 0 | 0 | 0 | 21 |
| 387 | 151-200 | 176 | 3198 | 641 | 303 | 267 | 34 | 9 | 7 | 315 |
| 388 | " | 1348 | 1056 | 255 | 124 | 90 | 43 | 34 | 0 | 77 |
| 392 | " | 22 | 120 | 30 | 2 | 6.0 | 0 | 15 | 7 | 10 |
| 729 | 201-300 | | 57 | 0 | 27 | 83 | 0 | 0 | 0 | 19 |
| 731 | " | | 11 | 25 | 35 | 54 | 8 | 5 | nf | 178 |
| 733 | " | | 227 | 7 | 64 | 138 | 17 | 7 | 0 | 80 |
| 730 | 301-400 | | | 0 | 0 | 0 | 5 | 0 | 0 | 0 |
| 732 | " | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 734 | " | | 0 | 0 | 0 | 4 | 12 | 0 | 0 | 210 |
| biomass outside 200 mi. limit | | 2877 | 6068 | 1542 | 584 | 651 | 119 | 85 | 15 | 931 |
| total 3L biomass | | 73514 | 210725 | 52750 | 50506 | 10808 | 1232 | 5275 | 7066 | 11004 |
| % outside | | 3.9% | 2.9% | 2.9% | 1.2% | 6.0% | 9.7% | 1.6% | 0.2% | 8.5% |

Table 5. Cod biomass distribution in NAFO Divisions 2J3KL derived from fall surveys in relation to the 200 mile fishery zone.

| year | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 |
|---|---|---|---|---|---|---|---|---|
| biomass outside 200 mi. limit | 501 | 6732 | 788 | 6523 | 5693 | 9006 | 2480 | 1450 |
| Total 2J3KL offshore biomass | 518793 | 441702 | 598492 | 551626 | 387172 | 952231 | 450687 | 464295 |
| % OUTSIDE | 0.10% | 1.52% | 0.13% | 1.18% | 1.47% | 0.95% | 0.55% | 0.31% |

| year | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 |
|---|---|---|---|---|---|---|---|---|---|
| biomass outside 200 mi. limit | 2877 | 6068 | 1542 | 584 | 651 | 119 | 85 | 15 | 931 |
| Total 2J3KL offshorebiomass | 504932 | 436175 | 206156 | 62260 | 12593 | 2704 | 13344 | 24381 | 17881 |
| % OUTSIDE | 0.57% | 1.39% | 0.75% | 0.94% | 5.17% | 4.40% | 0.64% | 0.06% | 5.21% |

Table 6. Biomass estimates (000 t) for all offshore strata of cod from autumn research vessel surveys in NAFO Div. 2J3KL.

| | Biomass | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Divisions | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 |
| 2J | 229 | 217 | 267 | 182 | 137 | 405 | 175 | 249 |
| 3K | 178 | 136 | 176 | 179 | 86 | 356 | 123 | 75 |
| 3L | 112 | 89 | 155 | 190 | 164 | 191 | 152 | 140 |
| Total | 519 | 442 | 598 | 551 | 387 | 952 | 450 | 464 |
| | | | | | | | | |
| 2J | 44% | 49% | 45% | 33% | 35% | 43% | 39% | 54% |
| 3K | 34% | 31% | 29% | 32% | 22% | 37% | 27% | 16% |
| 3L | 22% | 20% | 26% | 34% | 42% | 20% | 34% | 30% |
| Total | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% |

| Divisions | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | |
|---|---|---|---|---|---|---|---|---|---|---|
| 2J | 141 | 33 | 29 | 2 | 1 | 0.5 | 3 | 4 | 4 | |
| 3K | 291 | 193 | 126 | 9 | 3 | 1 | 5 | 6 | 4 | |
| 3L | 74 | 210 | 52 | 51 | 9 | 1 | 5 | 6 | 10 | |
| Total | 506 | 436 | 207 | 62 | 13 | 2.5 | 13 | 16 | 18 | |
| | | | | | | | | | | AVERAGE |
| 2J | 28% | 8% | 14% | 3% | 8% | 20% | 23% | 25% | 22% | 29% |
| 3K | 58% | 44% | 61% | 15% | 23% | 40% | 38% | 38% | 22% | 33% |
| 3L | 15% | 48% | 25% | 82% | 69% | 40% | 38% | 38% | 56% | 38% |
| Total | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% |

Table 7. Percent age compositions Divisions 3L inside and outside the 200 mile limit as derived from the 1986-97 spring RV surveys.

| | 1986 | | 1987 | | 1988 | | 1989 | | 1990 | | 1991 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | WT48 | | WT 59-60 | | WT 70 -71 | | WT 83 | | WT 96 | | WT 106 -107 | |
| Age | Inside | Outside | Inside | Outside | Inside | Outside | Inside | Outside | Inside | Outside | Inside | Outside |
| 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2 | 0 | 1 | 1 | 6 | 0 | 5 | 1 | 2 | 1 | 1 | 1 | 2 |
| 3 | 6 | 19 | 5 | 40 | 10 | 57 | 10 | 39 | 10 | 22 | 8 | 19 |
| 4 | 24 | 42 | 11 | 30 | 9 | 19 | 20 | 43 | 29 | 36 | 25 | 46 |
| 5 | 26 | 20 | 29 | 13 | 15 | 5 | 9 | 6 | 21 | 24 | 30 | 21 |
| 6 | 19 | 10 | 27 | 5 | 33 | 6 | 9 | 2 | 8 | 6 | 18 | 8 |
| 7 | 9 | 4 | 14 | 3 | 16 | 3 | 23 | 2 | 8 | 4 | 6 | 1 |
| 8 | 7 | 3 | 5 | 1 | 8 | 2 | 17 | 2 | 11 | 3 | 5 | 1 |
| 9 | 2 | 1 | 4 | 1 | 3 | 1 | 5 | 2 | 6 | 2 | 4 | 1 |
| 10 | 1 | 0 | 1 | 1 | 2 | 1 | 2 | 1 | 3 | 1 | 2 | 0 |
| 11 | 2 | 1 | 1 | 0 | 1 | 0 | 2 | 1 | 1 | 0 | 2 | 0 |
| 12 | 1 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |

| | 1992 | | 1993 | | 1994 | | 1995 | | 1996 | | 1997 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | WT 119-122 | | WT137 -138 | | WT152-154 | | WT168-170 | | WT189-191 | | WT204-208 | |
| Age | Inside | Outside | Inside | Outside | Inside | Outside | Inside | Outside | Inside | Outside | Inside | Outside |
| 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 0 |
| 2 | 1 | 1 | 0 | 0 | 1 | 0 | 15 | 5 | 23 | 25 | 15 | 9 |
| 3 | 7 | 10 | 29 | 14 | 15 | 7 | 14 | 11 | 17 | 24 | 35 | 62 |
| 4 | 31 | 20 | 28 | 34 | 35 | 36 | 31 | 36 | 32 | 32 | 15 | 23 |
| 5 | 46 | 37 | 16 | 26 | 37 | 38 | 25 | 25 | 15 | 16 | 7 | 6 |
| 6 | 12 | 22 | 15 | 19 | 8 | 12 | 12 | 14 | 8 | 3 | 3 | 0 |
| 7 | 3 | 8 | 8 | 4 | 3 | 7 | 2 | 2 | 1 | 0 | 17 | 0 |
| 8 | 1 | 1 | 3 | 3 | 0 | 1 | 2 | 6 | 0 | 0 | 5 | 0 |
| 9 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 |
| 10 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| 11 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| 12 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

Table 8. Percent age compositions Divisions 3L inside and outside the 200 mile limit as derived from the 1986-97 autumn RV surveys.

| | 1986 | | 1987 | | 1988 | | 1989 | | 1990 | | 1991 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | AN 72 | | WT65 | | WT 78 | | WT 87 | | WT 101 | | WT 114 -115 | |
| Age | Inside | Outside | Inside | Outside | Inside | Outside | Inside | Outside | Inside | Outside | Inside | Outside |
| 1 | 0 | 0 | 0 | 7 | 0 | 4 | 0 | 1 | 0 | 1 | 0 | 2 |
| 2 | 3 | 4 | 7 | 62 | 5 | 37 | 3 | 20 | 1 | 4 | 5 | 19 |
| 3 | 6 | 4 | 6 | 18 | 16 | 36 | 24 | 40 | 13 | 18 | 10 | 18 |
| 4 | 27 | 20 | 13 | 2 | 8 | 6 | 23 | 15 | 30 | 31 | 29 | 26 |
| 5 | 23 | 23 | 31 | 3 | 18 | 2 | 11 | 3 | 21 | 11 | 30 | 20 |
| 6 | 24 | 26 | 23 | 1 | 22 | 2 | 14 | 2 | 12 | 4 | 17 | 10 |
| 7 | 7 | 8 | 11 | 1 | 16 | 3 | 14 | 3 | 8 | 3 | 3 | 2 |
| 8 | 6 | 6 | 4 | 1 | 8 | 3 | 5 | 2 | 7 | 5 | 2 | 1 |
| 9 | 2 | 3 | 3 | 2 | 4 | 2 | 4 | 4 | 4 | 7 | 2 | 1 |
| 10 | 1 | 1 | 0 | 0 | 2 | 1 | 1 | 3 | 1 | 4 | 1 | 1 |
| 11 | 1 | 2 | 0 | 1 | 0 | 1 | 0 | 2 | 1 | 3 | 0 | 0 |
| 12 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 1 | 0 | 3 | 0 | 0 |

| | 1992 | | 1993 | | 1994 | | 1995 | | 1996 | | 1997 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | WT 129-130 | | WT 145-148 | | WT 160 - 160 | | WT176-181 | | Tel 41 WT176-181 | | Tel54-58 WT213-217 | |
| Age | Inside | Outside | Inside | Outside | Inside | Outside | Inside | Outside | Inside | Outside | Inside | Outside |
| 1 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 1 | 3 | 0 | 3 | 1 |
| 2 | 2 | 8 | 9 | 5 | 6 | 6 | 21 | 32 | 15 | 23 | 14 | 19 |
| 3 | 18 | 27 | 26 | 27 | 19 | 15 | 34 | 50 | 26 | 58 | 22 | 47 |
| 4 | 29 | 19 | 38 | 44 | 35 | 54 | 18 | 13 | 31 | 18 | 32 | 22 |
| 5 | 28 | 18 | 17 | 15 | 23 | 22 | 10 | 4 | 14 | 0 | 15 | 8 |
| 6 | 17 | 21 | 8 | 7 | 11 | 3 | 8 | 0 | 7 | 0 | 7 | 2 |
| 7 | 5 | 6 | 2 | 2 | 6 | 1 | 2 | 0 | 3 | 0 | 4 | 1 |
| 8 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 |
| 9 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 |
| 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 11 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 12 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

Table 9. MEAN NUMBERS OF COD PER TOW AT AGE FROM AUTUMN RV SURVEYS IN DIVISIONS 2J3KL.

| Age | 1978 | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.02 | 0.41 | 0.27 | 0.16 | 0.51 | 1.04 | 0.36 | 0.02 | 0.14 | 0.21 |
| 2 | 0.40 | 0.32 | 3.00 | 1.59 | 2.49 | 6.09 | 5.57 | 1.10 | 1.85 | 1.56 |
| 3 | 5.39 | 1.94 | 2.48 | 5.11 | 5.86 | 12.31 | 10.79 | 7.27 | 4.77 | 2.04 |
| 4 | 11.51 | 11.78 | 3.83 | 2.74 | 5.93 | 10.65 | 15.23 | 12.35 | 20.70 | 4.03 |
| 5 | 13.95 | 16.79 | 13.23 | 3.26 | 3.83 | 10.88 | 11.34 | 10.01 | 31.29 | 13.23 |
| 6 | 5.51 | 10.53 | 13.31 | 9.67 | 2.79 | 3.88 | 9.59 | 7.28 | 21.29 | 11.61 |
| 7 | 1.62 | 2.27 | 4.99 | 8.78 | 5.82 | 2.44 | 2.30 | 4.24 | 10.14 | 4.38 |
| 8 | 0.63 | 0.92 | 1.19 | 3.66 | 5.31 | 5.35 | 1.37 | 0.92 | 5.26 | 2.67 |
| 9 | 0.47 | 0.31 | 0.37 | 0.74 | 2.59 | 2.94 | 2.09 | 0.78 | 1.37 | 1.38 |
| 10 | 0.33 | 0.26 | 0.23 | 0.23 | 0.57 | 1.42 | 1.30 | 0.67 | 0.58 | 0.34 |
| 11 | 0.12 | 0.19 | 0.11 | 0.10 | 0.16 | 0.36 | 0.54 | 0.41 | 0.68 | 0.17 |
| 12 | 0.09 | 0.06 | 0.16 | 0.11 | 0.09 | 0.14 | 0.28 | 0.15 | 0.42 | 0.19 |
| 13 | 0.06 | 0.04 | 0.05 | 0.10 | 0.07 | 0.13 | 0.12 | 0.06 | 0.19 | 0.13 |
| 1+ | 40.11 | 45.80 | 43.21 | 36.23 | 36.03 | 57.63 | 60.87 | 45.25 | 98.68 | 41.96 |
| 2+ | 40.09 | 45.39 | 42.94 | 36.08 | 35.52 | 56.58 | 60.51 | 45.23 | 98.54 | 41.74 |
| 3+ | 39.69 | 45.07 | 39.94 | 34.49 | 33.03 | 50.49 | 54.94 | 44.13 | 96.69 | 40.18 |
| 4+ | 34.30 | 43.13 | 37.47 | 29.38 | 27.16 | 38.18 | 44.15 | 36.86 | 91.92 | 38.14 |
| 5+ | 22.79 | 31.35 | 33.64 | 26.64 | 21.23 | 27.53 | 23.93 | 24.52 | 71.22 | 34.11 |
| 6+ | 8.84 | 14.57 | 20.41 | 23.38 | 17.40 | 16.66 | 17.59 | 14.50 | 39.93 | 20.88 |

| Age | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.59 | 0.66 | 0.40 | 0.03 | 0.01 | 0.00 | 0.01 | 1.58 | 0.38 | 0.05 |
| 2 | 2.14 | 8.25 | 1.91 | 1.34 | 0.29 | 0.37 | 0.05 | 0.97 | 1.37 | 0.68 |
| 3 | 3.93 | 8.98 | 10.93 | 3.35 | 1.78 | 0.60 | 0.16 | 0.74 | 0.85 | 0.90 |
| 4 | 3.20 | 8.30 | 12.95 | 13.97 | 2.30 | 0.83 | 0.13 | 0.30 | 0.41 | 0.28 |
| 5 | 5.29 | 6.20 | 8.61 | 9.00 | 2.72 | 0.34 | 0.08 | 0.12 | 0.15 | 0.12 |
| 6 | 10.57 | 6.52 | 5.64 | 3.31 | 1.42 | 0.22 | 0.02 | 0.06 | 0.04 | 0.02 |
| 7 | 10.13 | 8.23 | 3.90 | 1.10 | 0.35 | 0.04 | 0.02 | 0.01 | 0.03 | 0.03 |
| 8 | 2.58 | 4.84 | 3.98 | 0.50 | 0.04 | 0.01 | 0.01 | 0.00 | 0.00 | 0.04 |
| 9 | 1.55 | 1.62 | 1.68 | 0.35 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 10 | 0.79 | 0.98 | 0.55 | 0.16 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 11 | 0.15 | 0.43 | 0.23 | 0.04 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 12 | 0.11 | 0.16 | 0.12 | 0.02 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 13 | 0.08 | 0.10 | 0.04 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 1+ | 41.11 | 55.29 | 50.93 | 33.18 | 8.96 | 2.41 | 0.48 | 3.79 | 3.24 | 2.12 |
| 2+ | 40.53 | 54.62 | 50.53 | 33.15 | 8.94 | 2.41 | 0.47 | 2.21 | 2.85 | 2.07 |
| 3+ | 38.38 | 46.37 | 48.62 | 31.81 | 8.65 | 2.03 | 0.42 | 1.24 | 1.48 | 1.39 |
| 4+ | 34.46 | 37.39 | 37.70 | 28.46 | 6.87 | 1.43 | 0.26 | 0.50 | 0.63 | 0.49 |
| 5+ | 31.26 | 29.09 | 24.75 | 14.49 | 4.57 | 0.61 | 0.13 | 0.20 | 0.22 | 0.21 |
| 6+ | 25.97 | 22.89 | 16.14 | 5.49 | 1.85 | 0.27 | 0.05 | 0.08 | 0.07 | 0.09 |

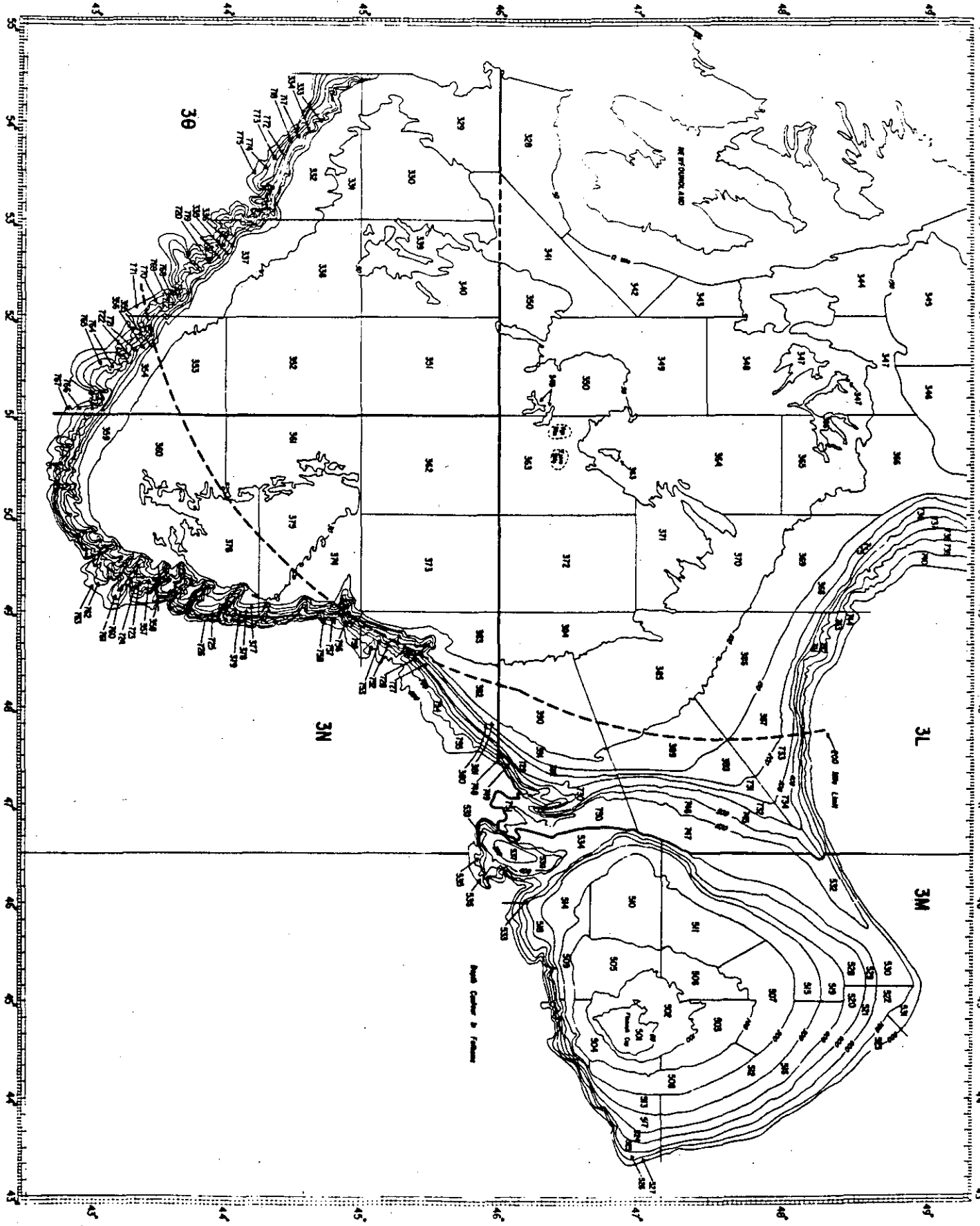


Fig. 1 Stratification scheme for NAFO Divisions 3LMNO.

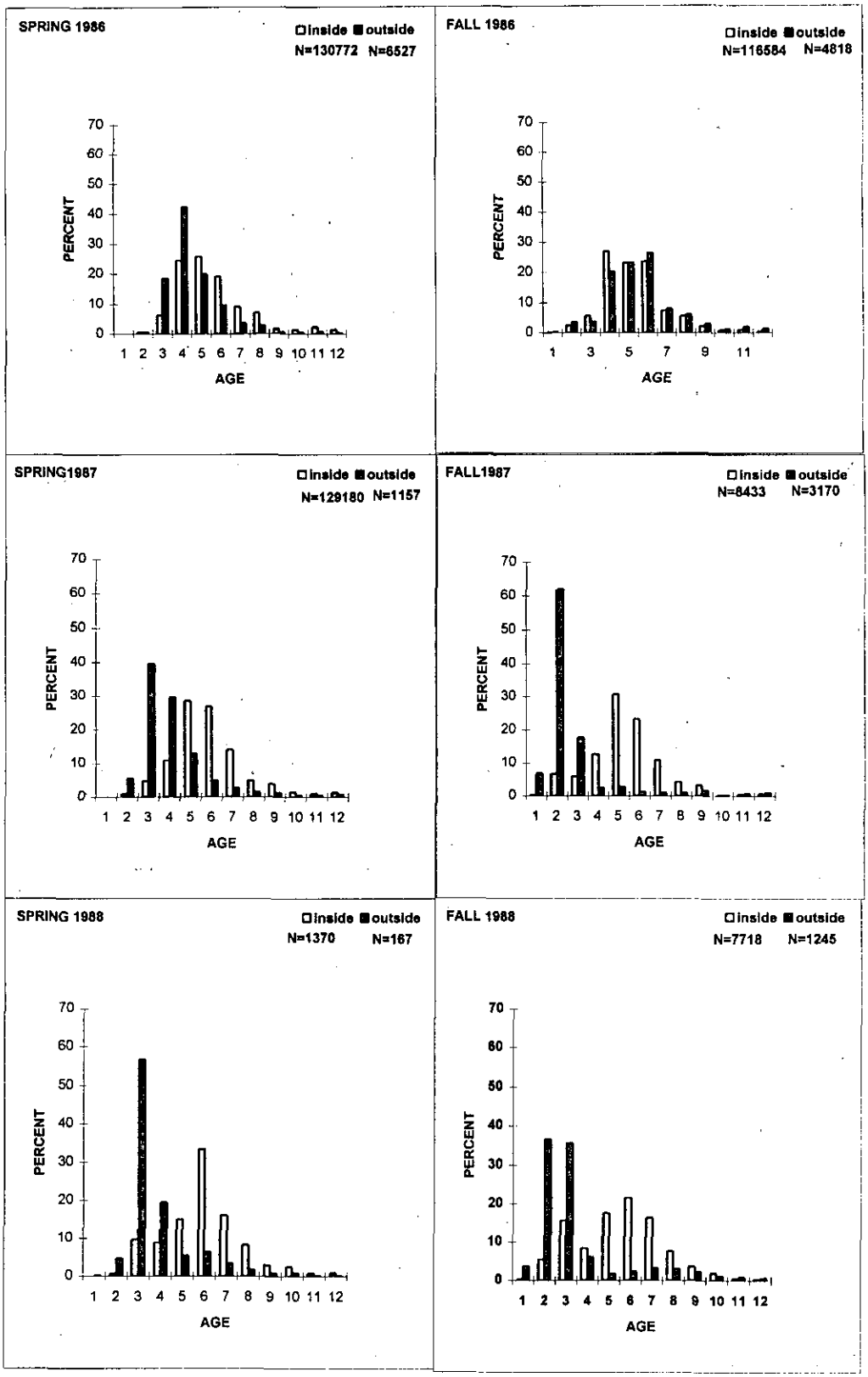


Fig 2. Percent at age composition for Division 3L inside and outside the 200-mile limit derived from 1986-1988 spring and fall Canadian RV surveys.

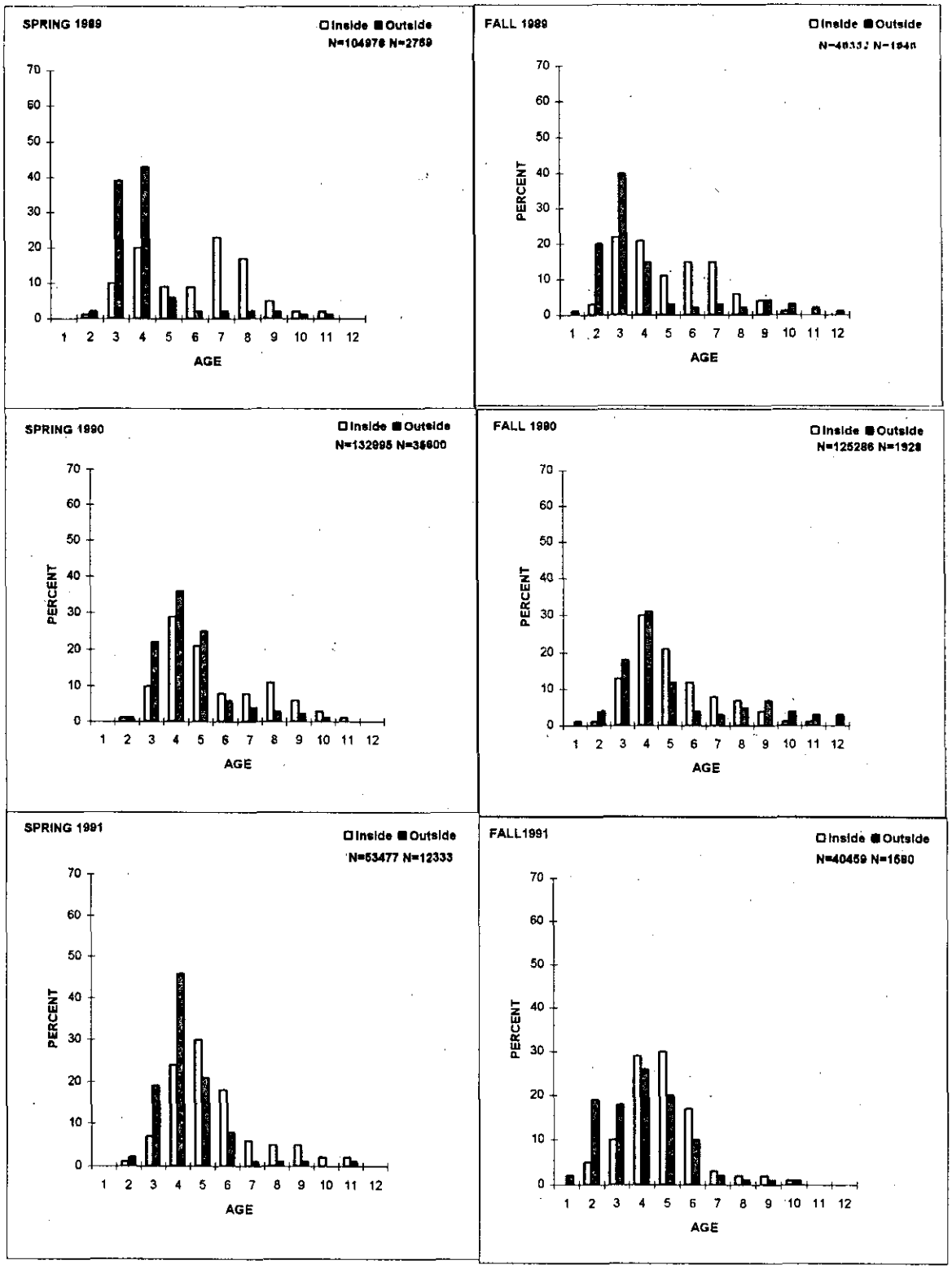


Fig 3. Percent age composition for Division 3L inside and outside the 200-mile limit derived from 1989 -1991 spring and autumn Canadian RV surveys.

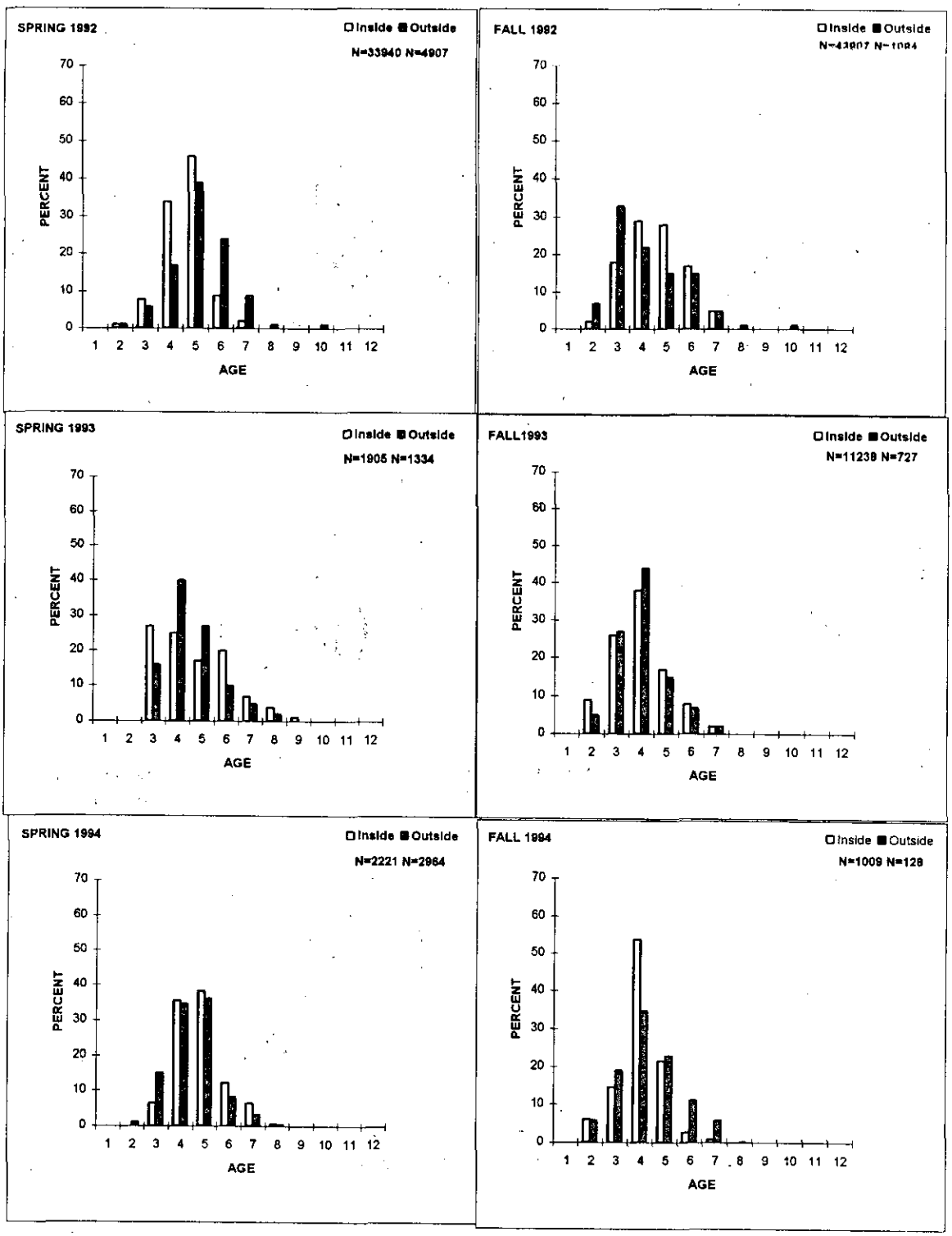


Fig 4. Percent age composition for Division 3L inside and outside the 200-mile limit derived from 1992 -1994 spring and autumn Canadian RV surveys.

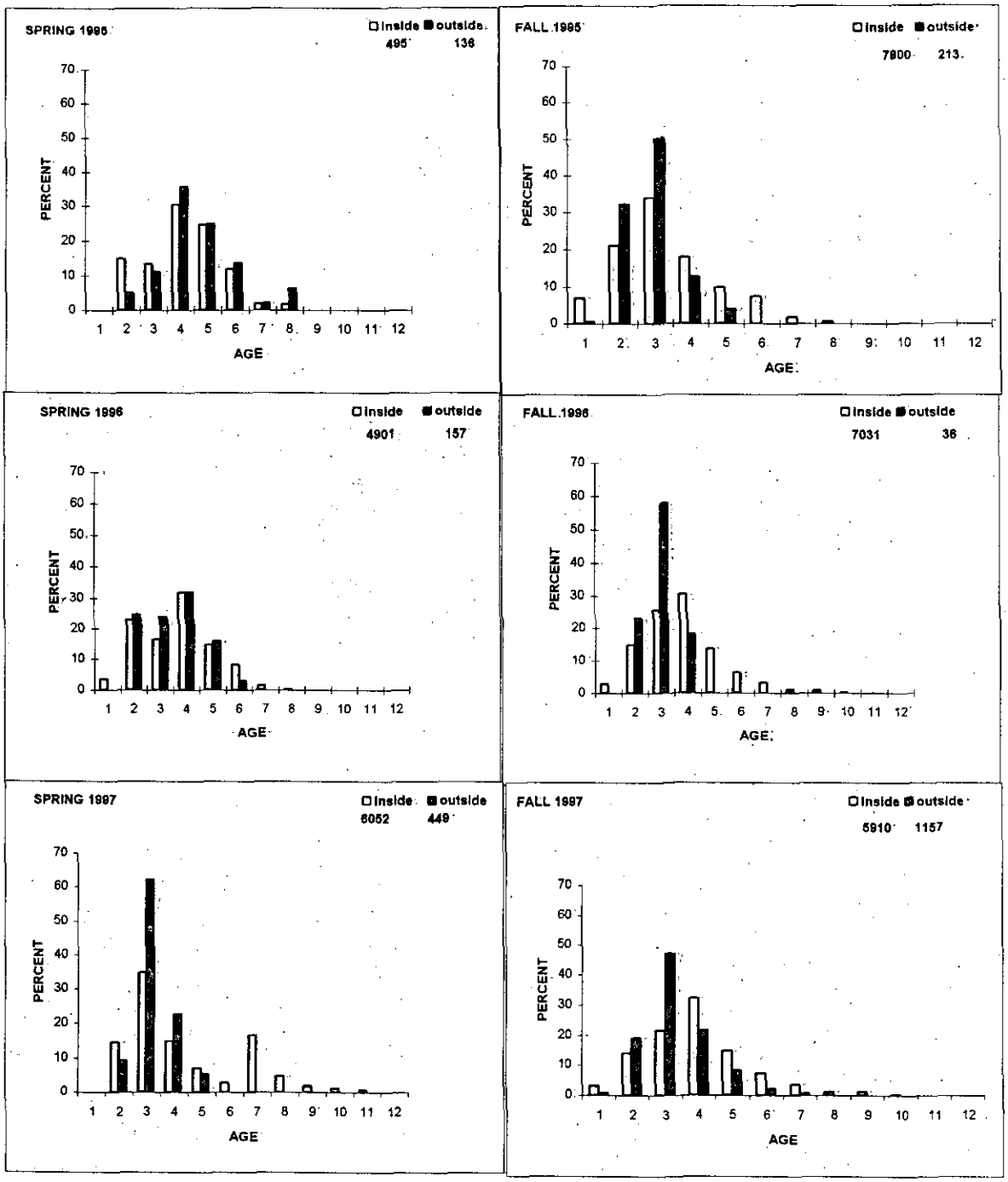


**Fig 5. Percent at age composition for 3L inside and outside the 200 mile limit derived from the 1995-1997 spring and fall Canadian RV surveys**