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Estimates of Biomass and Age Compositions for that Portion of the  
Division 2J+3KL Cod Stock Beyond the Canadian 200 mile Fishery Zone

by

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Introduction

This document provides an update of information presented at previous Scientific Council meetings (Baird 1987; Baird and Bowering, 1986; Wells et al. 1988), in response to the Fisheries Commission request that the Scientific Council continue to provide information on the proportion of the Div. 2J3KL cod stock occurring in the Regulatory Area. Some information is also provided on the age compositions of that portion of the stock occurring in the Regulatory Area.

The area of NAFO Div. 3L in depths 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.

Results and Discussion

Survey coverage

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 1971-82 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

Estimates of cod biomass outside the Canadian 200 mile fishing zone in Div. 3L by depth strata from research vessel surveys conducted during spring are presented in Table 3. Only during 1985 was there survey coverage deeper than 200 fathoms, but results from this survey indicated that biomass at these depths was minimal at that time of year. The percentage of biomass estimated to occur in the Regulatory Area ranged from 0.4 to 6.1% and averaged about 2.8% for the years examined. The estimates of 0.4% occurred during the most recent two survey years.

Results of autumn surveys indicate that the proportion of the total Div. 3L cod biomass occurring in the Regulatory Area ranged from 0.5 to 7.7% and averaged 2.9% for the 1981-88 period (Table 4). During winter surveys conducted only in 1985 and 1986 about 25% of the Div. 3L biomass occurred outside the Canadian 200 mile fishery zone (Table 5).

Autumn surveys conducted in all three divisions (2J, 3K, and 3L) showed that the proportion of the entire Div. 2J3KL cod biomass that occurs in the Regulatory Area at this time of year is generally less than 1% (Table 6). Assuming that the average divisional proportion of biomass in autumn (Table 7) is similar to other times during the year, then the proportion of the entire Div. 2J3KL cod stock estimated to occur in the Regulatory Area is about 2 to 3% on average throughout the year.

Age compositions

Age compositions derived from research vessel surveys conducted in Div. 3L during spring and autumn were examined for a recent period (1986-88), while percent at age from winter surveys were examined for 1985 and 1986. Results were similar for spring and autumn, when only a small portion of the entire Div. 3L biomass occurs in the Regulatory Area, with proportionately larger numbers of younger fish occurring in the Regulatory Area than in the entire division (Tables 8-9, Fig. 2-3). However, the autumn, 1986 results, indicated that percent at age for the entire division and the area outside the Canadian 200 mile fishery zone were similar.

During winter, when the maximum proportion of the Div. 3L biomass occurs in the Regulatory Area, age compositions for all of Div. 3L and that portion outside the Canadian zone are very similar (Table 10, Fig. 4).

Percent age compositions of cod derived from Canadian autumn research surveys in Div. 2J3KL (Tables 11 and 12) were similar both for the area as a whole and for Div. 3L (Table 9).

References

Baird, J. W. 1986. An update of biomass estimates for cod in NAFO Div. 2J+3KL beyond the Canadian 200 mile fishery zone. NAFO SCR Doc. 84/54. Ser. No. N1343, 5 p.

Baird, J. W., and W. R. Bowering. 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.

Wells, R., J. W. Baird, and C. A. Bishop. 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 <sup>2</sup> ) (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 1977-88. The number of successful sets is in parenthesis.

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

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 1981-88. The number of successful sets is in parenthesis.

| Strata                    | Depth zone (fath) | % Area outside 200 mi. zone | ATC               |                    | WT                |                     |                     | AN 72 (142) 1986 | WT 65 (165) 1987 | WT 78 (189) 1988 |
|---------------------------|-------------------|-----------------------------|-------------------|--------------------|-------------------|---------------------|---------------------|------------------|------------------|------------------|
|                           |                   |                             | 323-325 (96) 1981 | 333-334 (120) 1982 | WT 7-9 (125) 1983 | WT 16-18 (208) 1984 | WT 37-39 (231) 1985 |                  |                  |                  |
| 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                          | -                 | 2,125              | -                 | 1,697               | 1,563               | 1,068            | 1,074            | 436              |
| 391                       | "                 | 100                         | -                 | 487                | 159               | 79                  | 325                 | 370              | 70               | 6                |
| 387                       | 151-200           | 37                          | 494               | 3,410              | -                 | 2,762               | 1,501               | 7,483            | 1,014            | 477              |
| 388                       | "                 | 99                          | -                 | 456                | -                 | 610                 | 1,892               | -                | 114              | 362              |
| 392                       | "                 | 100                         | -                 | 220                | 109               | 68                  | 106                 | 11               | 8                | 41               |
| 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            |
| Total 3L biomass          |                   |                             | 109,706           | 87,997             | 131,267           | 191,701             | 165,417             | 190,731          | 151,936          | 139,726          |
| % Outside 200 miles       |                   |                             | 0.5               | 7.7                | 0.6               | 3.4                 | 3.4                 | 4.7              | 1.6              | 1.0              |

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   | WT 42-44   |
|---------------------------|--------------------|-----------------------------|------------|------------|
|                           |                    |                             | (182) 1985 | (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 mi. fishery zone from Canadian research vessel surveys.

|                         | 1981    | 1982    | 1983    | 1984    | 1985    | 1986    | 1987    | 1988    | Average |
|-------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| Biomass outside 200 mi. | 501     | 6,732   | 788     | 6,523   | 5,693   | 9,006   | 2,480   | 1,450   |         |
| Total 2J3KL             | 513,623 | 437,986 | 570,845 | 548,739 | 388,169 | 952,231 | 450,315 | 463,248 |         |
| % Outside               | 0.1     | 1.5     | 0.1     | 1.2     | 1.5     | 0.9     | 0.6     | 0.3     | 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  |                |
|-------------------|-------|-------|-------|-------|-------|-------|-------|-------|----------------|
| 2J                | 228.8 | 216.5 | 267.1 | 181.7 | 136.7 | 404.6 | 174.8 | 252.9 |                |
| 3K                | 185.4 | 142.2 | 183.7 | 181.9 | 86.0  | 356.4 | 123.3 | 75.4  |                |
| 3L                | 114.5 | 89.1  | 157.0 | 190.5 | 164.7 | 191.2 | 151.9 | 139.7 |                |
| Total             | 528.7 | 447.8 | 607.8 | 554.1 | 387.4 | 952.2 | 450.0 | 468.0 |                |
| <u>Percentage</u> |       |       |       |       |       |       |       |       | <u>Average</u> |
| 2J                | 43    | 48    | 44    | 33    | 35    | 43    | 39    | 54    | 42             |
| 3K                | 35    | 32    | 30    | 33    | 22    | 37    | 27    | 16    | 29             |
| 3L                | 22    | 20    | 26    | 34    | 43    | 20    | 34    | 30    | 29             |
| Total             | 100   | 100   | 100   | 100   | 100   | 100   | 100   | 100   | 100            |

Table 8. Percent age compositions for all of Division 3L and that portion of Division 3L in the Regulatory Area for 1986-88 derived from spring RV surveys.

| Age | 1986     |                 | 1987     |                 | 1988     |                 |
|-----|----------|-----------------|----------|-----------------|----------|-----------------|
|     | WT 48    |                 | WT 59-60 |                 | WT 70-71 |                 |
|     | 3L Total | Regulatory Area | 3L Total | Regulatory Area | 3L Total | Regulatory Area |
| 2   | 1        | 1               | 1        | 6               | 1        | 4               |
| 3   | 7        | 19              | 5        | 40              | 10       | 57              |
| 4   | 25       | 42              | 11       | 30              | 9        | 20              |
| 5   | 26       | 20              | 28       | 13              | 15       | 5               |
| 6   | 19       | 10              | 27       | 5               | 33       | 6               |
| 7   | 9        | 4               | 14       | 3               | 16       | 3               |
| 8   | 7        | 3               | 5        | 1               | 8        | 2               |
| 9   | 2        | 1               | 4        | 1               | 3        | 1               |
| 10  | 1        | -               | 1        | 1               | 2        | 1               |
| 11  | 2        | 1               | 1        | -               | 1        | -               |
| 12  | 1        | -               | 1        | 1               | 1        | -               |

Table 9. Percent age compositions for all of Division 3L and that portion of Division 3L in the Regulatory Area for 1986-88 derived from autumn RV surveys.

| Age | 1986     |                 | 1987     |                 | 1988     |                 |
|-----|----------|-----------------|----------|-----------------|----------|-----------------|
|     | AN 72    |                 | WT 65    |                 | WT 78    |                 |
|     | 3L Total | Regulatory Area | 3L Total | Regulatory Area | 3L Total | Regulatory Area |
| 1   |          |                 | 1        | 7               |          | 3               |
| 2   | 3        | 4               | 9        | 62              | 6        | 37              |
| 3   | 6        | 4               | 6        | 18              | 16       | 36              |
| 4   | 27       | 20              | 12       | 2               | 8        | 6               |
| 5   | 23       | 23              | 30       | 2               | 17       | 2               |
| 6   | 24       | 26              | 23       | 1               | 21       | 3               |
| 7   | 7        | 8               | 11       | 1               | 16       | 3               |
| 8   | 6        | 6               | 4        | 1               | 8        | 2               |
| 9   | 2        | 3               | 3        | 2               | 4        | 1               |
| 10  | 1        | 1               | -        | -               | 2        | 1               |
| 11  | 1        | 2               | -        | 1               |          | 1               |
| 12  | 1        | 1               | 1        | 1               |          | 1               |

Table 10. Percent age compositions for all of Division 3L and that portion of Division 3L in the Regulatory Area for 1985-86 derived from winter RV surveys.

| Age | 1985     |                 | 1986     |                 |
|-----|----------|-----------------|----------|-----------------|
|     | WT 22-24 |                 | WT 42-44 |                 |
|     | 3L Total | Regulatory Area | 3L Total | Regulatory Area |
| 1   |          |                 |          |                 |
| 2   | 1        | 0               | 1        | 0               |
| 3   | 11       | 13              | 8        | 8               |
| 4   | 19       | 25              | 36       | 38              |
| 5   | 29       | 27              | 30       | 28              |
| 6   | 17       | 14              | 17       | 17              |
| 7   | 13       | 11              | 4        | 4               |
| 8   | 5        | 5               | 2        | 3               |
| 9   | 2        | 2               | -        | 1               |
| 10  | 1        | 2               | -        | -               |
| 11  | 1        | 1               | -        | -               |



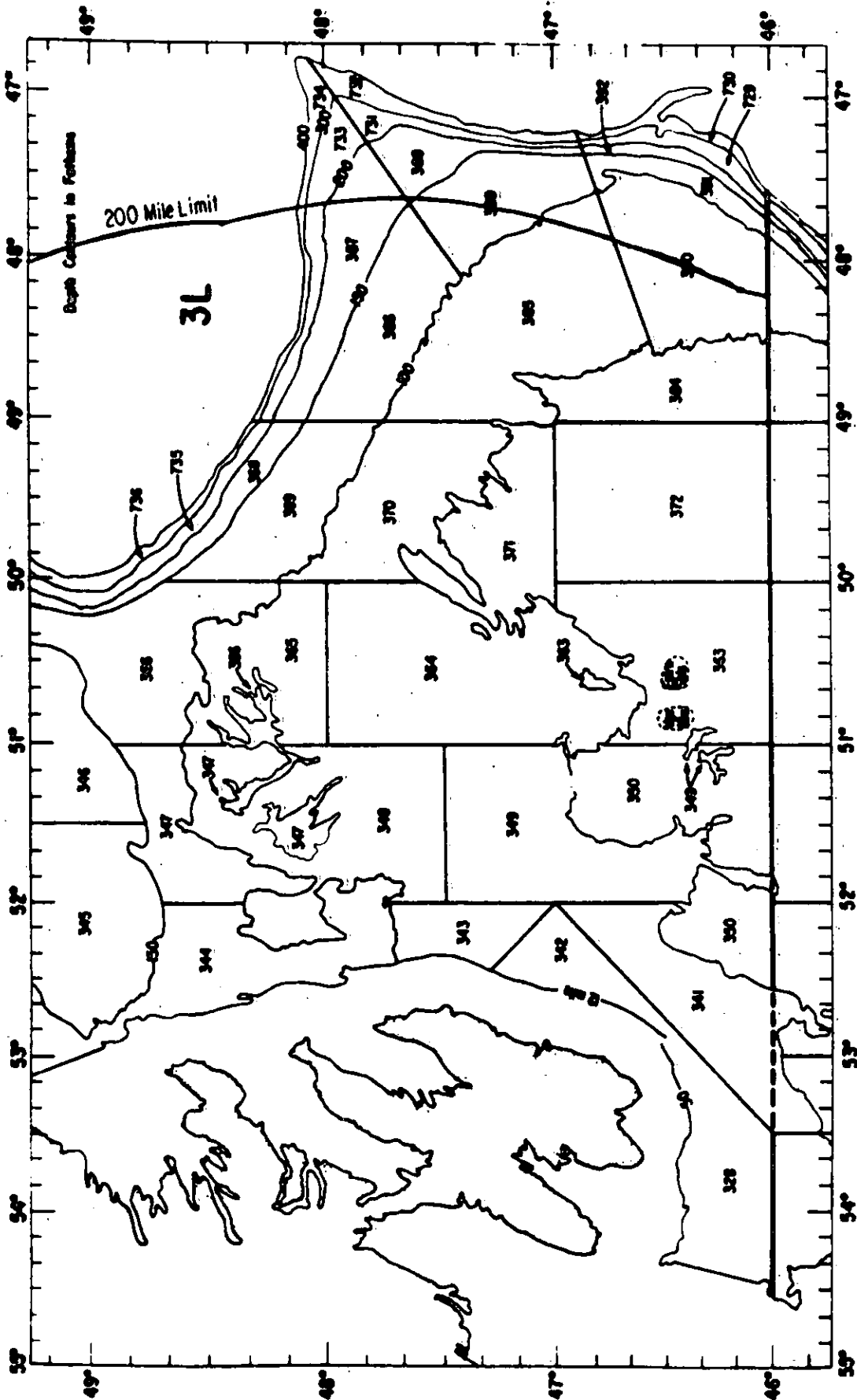


Fig. 1. Stratification scheme for NAFO Div. 3L relative to the 200 mi. economic zone.



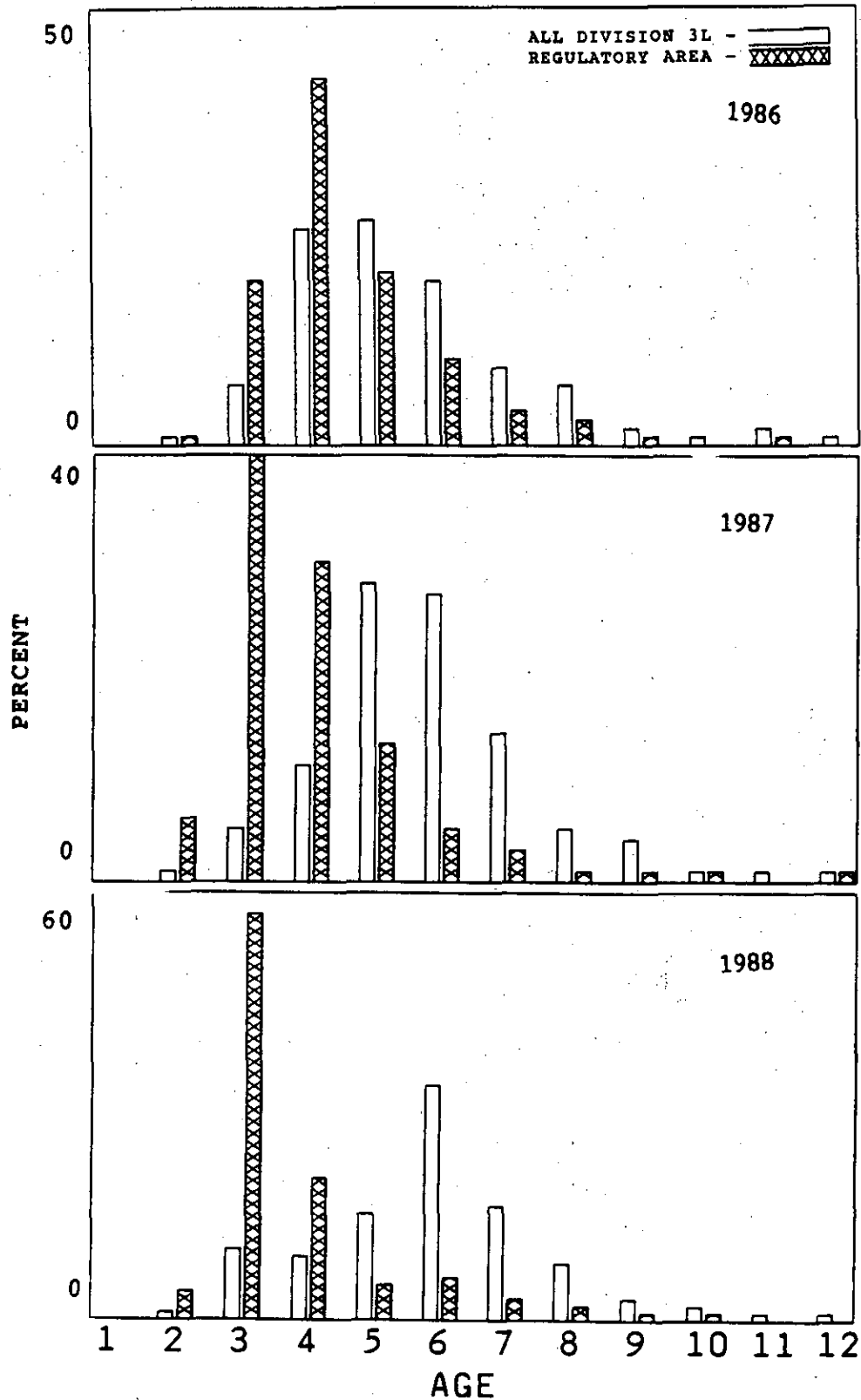


Figure 2. Percent age compositions for all of Div. 3L and that portion of Div. 3L in the Regulatory Area for 1986-88 derived from spring RV surveys.

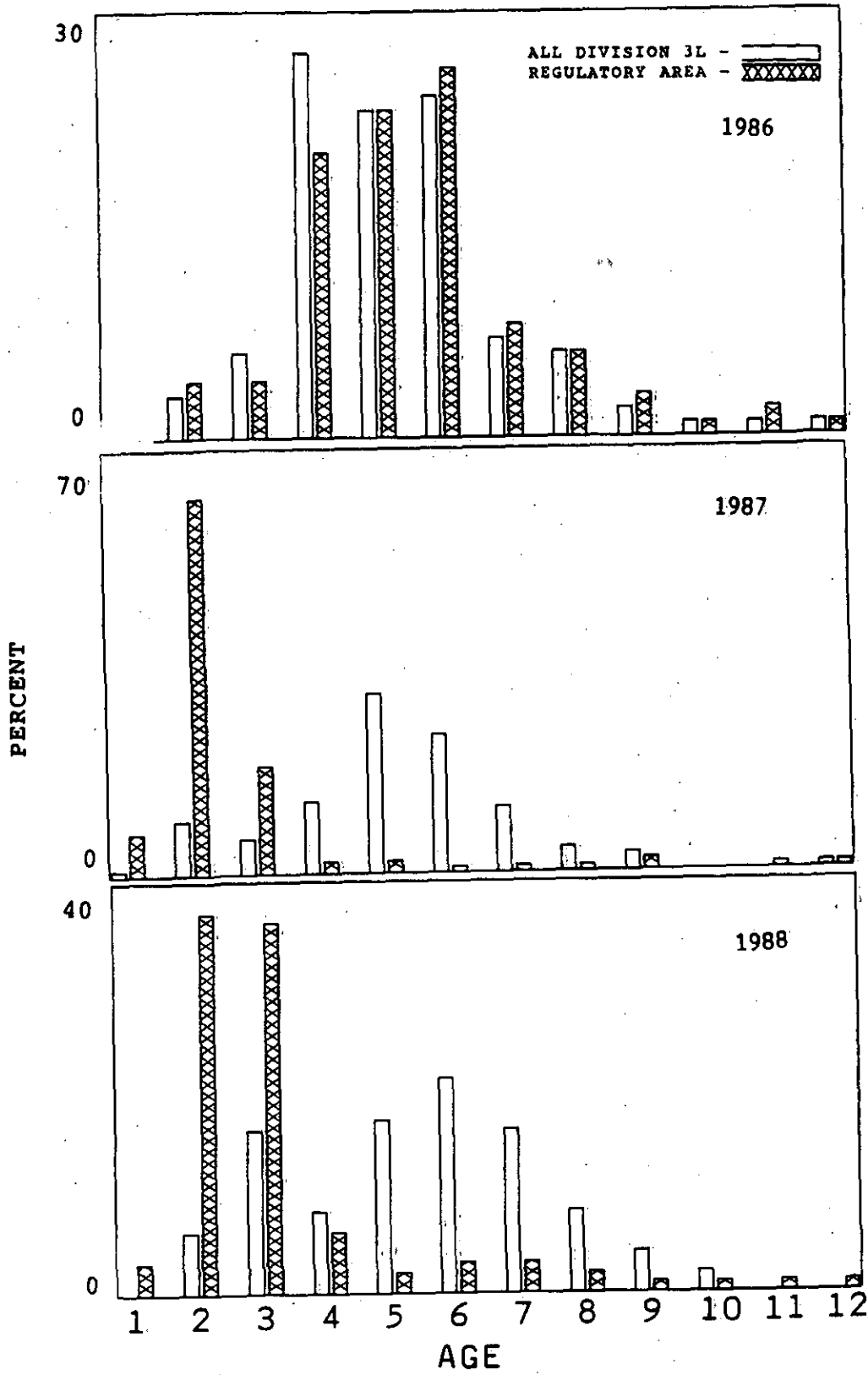


Figure 3. Percent age compositions for all of Div. 3L and that portion of Div. 3L in the Regulatory Area for 1986-88 derived from autumn RV surveys.

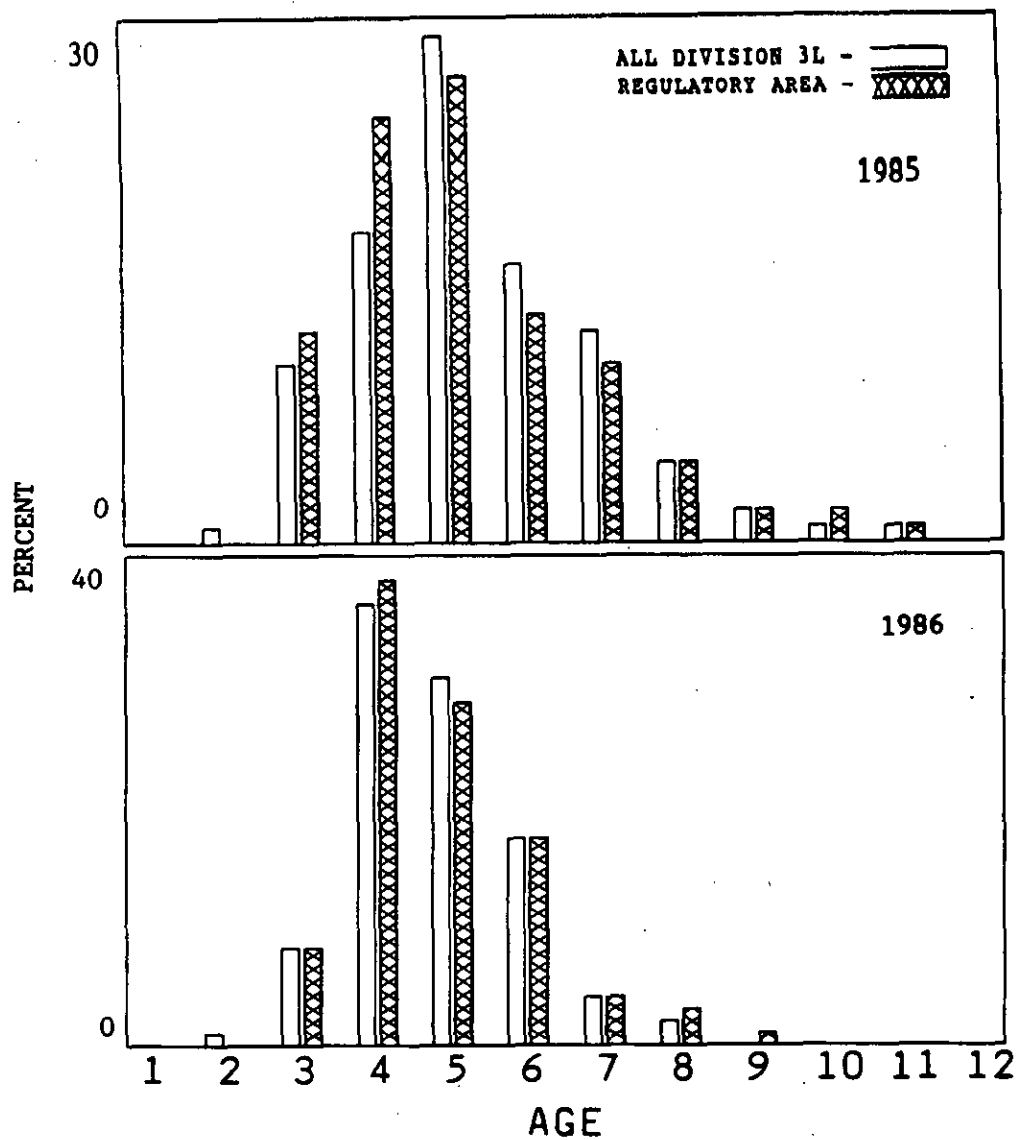


Figure 4. Percent age compositions for all of Div. 3L and that portion of Div. 3L in the Regulatory Area for 1985-86 derived from winter RV surveys.