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SCIENTIFIC COUNCIL MEETING - JUNE 1995

Age Structure of Roughhead Grenadier (*Macrourus pergax*) 3LM, 1993-1994

by

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PLEASE REPLACE TABLES 7, 8, 9, 10 AND 11 WITH THE ATTACHED NEW TABLES.

TABLE 7 - Catch by age in 3L Division, 1993, 3th quarter

| AGE | OTO | JULY | AUGUST | SEPTEMBER | TOTAL |
|-----|-----|------|----------|-----------|-----------|
| 2 | 2 | 0 | 0 | 2544 | 2544 |
| 3 | 13 | 0 | 650,8 | 18114 | 18764,8 |
| 4 | 23 | 0 | 2368 | 42357 | 44725 |
| 5 | 27 | 0 | 15719 | 75824 | 91543 |
| 6 | 50 | 0 | 81270 | 195437 | 276707 |
| 7 | 53 | 0 | 151295 | 279356 | 430651 |
| 8 | 25 | 0 | 83168 | 151105 | 234273 |
| 9 | 18 | 0 | 59553 | 100340 | 159893 |
| 10 | 16 | 0 | 39574 | 77788 | 117362 |
| 11 | 17 | 0 | 37448 | 76898 | 114346 |
| 12 | 19 | 0 | 50859 | 110686 | 161545 |
| 13 | 16 | 0 | 33422 | 62588 | 96010 |
| 14 | 10 | 0 | 2469 | 31662 | 34131 |
| 15 | 4 | 0 | 8976 | 11962 | 20938 |
| 16 | 7 | 0 | 20744 | 20194 | 40938 |
| 17 | 5 | 0 | 19627 | 16613 | 36240 |
| 18 | 0 | 0 | 0 | 0 | 0 |
| 19 | 1 | 0 | 223 | 2456 | 2679 |
| TOT | 306 | 0 | 607365,8 | 1275924 | 1883289,8 |

TABLE 8- Catch by age in 3L Division, 1993, 4th quarter

| AGE | OTO | OCT | NOV | DEC | TOTAL |
|-------|-----|--------|---------|---------|---------|
| 3 | 12 | 770 | 47922 | 4761 | 53453 |
| 4 | 27 | 7645 | 205108 | 52205 | 264958 |
| 5 | 19 | 14368 | 157917 | 123616 | 295901 |
| 6 | 31 | 75517 | 538843 | 519445 | 1133805 |
| 7 | 23 | 108195 | 576894 | 637290 | 1322379 |
| 8 | 16 | 87316 | 389983 | 464511 | 941810 |
| 9 | 13 | 47314 | 214913 | 254593 | 516820 |
| 10 | 10 | 33814 | 145887 | 167465 | 347166 |
| 11 | 7 | 22670 | 76699 | 111008 | 210377 |
| 12 | 12 | 33773 | 108011 | 165759 | 307543 |
| 13 | 12 | 27830 | 93721 | 176441 | 297992 |
| 14 | 6 | 13243 | 40033 | 77371 | 130647 |
| 15 | 3 | 6760 | 35057 | 42022 | 83839 |
| 16 | 1 | 1303 | 17144 | 34786 | 53233 |
| 17 | 0 | 0 | 0 | 0 | 0 |
| 18 | 1 | 1862 | 9782 | 26152 | 37796 |
| TOTAL | 193 | 482380 | 2657914 | 2857425 | 5997719 |

TABLE 9- Catch by age in 3L Division, 1994, Second quarter

| AGE | OTO | APRIL | MAY | JUNE | TOTAL |
|--------------|------------|----------------|----------------|----------------|-----------------|
| 2 | 1 | 0 | 1803 | 2563 | 4366 |
| 3 | 8 | 4935 | 39865 | 49840 | 94640 |
| 4 | 13 | 38851 | 197611 | 94249 | 330711 |
| 5 | 20 | 175748 | 479707 | 212057 | 867512 |
| 6 | 30 | 408676 | 565081 | 233854 | 1207611 |
| 7 | 43 | 670120 | 966992 | 374899 | 2012011 |
| 8 | 34 | 546289 | 979561 | 371510 | 1897360 |
| 9 | 34 | 468872 | 792461 | 319337 | 1580670 |
| 10 | 18 | 172851 | 233604 | 99453 | 505908 |
| 11 | 17 | 153692 | 193310 | 64884 | 411886 |
| 12 | 24 | 227231 | 275427 | 69461 | 572119 |
| 13 | 18 | 225871 | 163013 | 31145 | 420029 |
| 14 | 9 | 97663 | 55040 | 7503 | 160206 |
| 15 | 9 | 66958 | 46646 | 10312 | 123916 |
| 16 | 9 | 65995 | 43354 | 11322 | 120671 |
| 17 | 8 | 55715 | 33384 | 7674 | 96773 |
| 18 | 4 | 24118 | 14803 | 8001 | 46922 |
| 19 | 5 | 24118 | 17713 | 8093 | 49924 |
| 20 | 5 | 25283 | 12057 | 5345 | 42685 |
| 21 | 4 | 9804 | 2481 | 2348 | 14633 |
| 22 | 1 | 2089 | 1589 | 1849 | 5527 |
| TOTAL | 314 | 3464879 | 5115502 | 1985699 | 10566080 |

TABLE 10- Catch by age in 3M Division, 1994, First quarter

| AGE | OTO | JANUARY | FEBRUARY | MARCH | TOTAL |
|--------------|------------|---------------|-----------------|-----------------|-----------------|
| 3 | 10 | 1572 | 66836 | 304703 | 373111 |
| 4 | 8 | 2358 | 353381 | 732285 | 1088024 |
| 5 | 15 | 10747 | 731845 | 1701612 | 2444204 |
| 6 | 25 | 16369 | 1947258 | 3997380 | 5961007 |
| 7 | 27 | 26132 | 4898230 | 7785166 | 12709528 |
| 8 | 21 | 22626 | 4610544 | 7004477 | 11637647 |
| 9 | 14 | 9200 | 2274448 | 3424312 | 5707960 |
| 10 | 13 | 6381 | 1605184 | 2492455 | 4104020 |
| 11 | 14 | 6895 | 1135660 | 2497520 | 3640075 |
| 12 | 11 | 6416 | 896555 | 1980896 | 2883867 |
| 13 | 7 | 4480 | 575260 | 1079884 | 1659624 |
| 14 | 6 | 2122 | 387542 | 645990 | 1035654 |
| 15 | 7 | 1611 | 321390 | 441092 | 764093 |
| 16 | 4 | 393 | 91783 | 185898 | 278074 |
| 17 | 5 | 236 | 94717 | 177163 | 272116 |
| 18 | 6 | 393 | 60270 | 223078 | 283741 |
| 19 | 8 | 432 | 78692 | 222144 | 301268 |
| 20 | 8 | 236 | 47546 | 159245 | 207027 |
| 21 | 4 | 471 | 46547 | 107749 | 154767 |
| 22 | 4 | 0 | 18676 | 63657 | 82333 |
| TOTAL | 217 | 119070 | 20242364 | 35226706 | 55588140 |

TABLE 11 - Catchy by age in 3 M Division, 1994, Second quarter

| AGE | OTO | APRIL | MAY | JUNE | TOTAL |
|-------|-----|----------|---------|--------|----------|
| 5 | 1 | 96752 | 1078 | 3623 | 101453 |
| 6 | 3 | 816595 | 263746 | 35873 | 1116214 |
| 7 | 7 | 1398338 | 537086 | 41062 | 1976486 |
| 8 | 20 | 4180227 | 1509566 | 78034 | 5767827 |
| 9 | 10 | 1789303 | 827657 | 31337 | 2648297 |
| 10 | 9 | 1054116 | 429492 | 16923 | 1500531 |
| 11 | 7 | 846341 | 355983 | 6604 | 1208928 |
| 12 | 6 | 648900 | 265395 | 4588 | 918883 |
| 13 | 6 | 634036 | 191884 | 6162 | 832082 |
| 14 | 6 | 581327 | 190503 | 4793 | 776623 |
| 15 | 3 | 195366 | 54959 | 588 | 250913 |
| 16 | 2 | 154182 | 67829 | 828 | 222839 |
| 17 | 2 | 84484 | 32852 | 1170 | 118506 |
| 18 | 0 | 0 | 0 | 0 | 0 |
| 19 | 4 | 308324 | 86106 | 3397 | 397827 |
| 20 | 0 | 0 | 0 | 0 | 0 |
| 21 | 3 | 135832 | 42680 | 1823 | 180335 |
| TOTAL | 89 | 12924123 | 4856816 | 236805 | 18017744 |

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Age Structure of Roughhead Grenadier
(*Macrourus berglax*) 3LM, 1993-94

by

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Abstract

The age-length keys and catch distribution by age of roughhead grenadier are presented in this paper for 3LM Divisions in 1993 and 1994. Age was determined by reading otoliths. Growth was expressed by von Bertalanffy formula. The results confirmed the slow growth and multiaged structure of roughhead grenadier.

Introduction

Roughhead grenadier has a prolonged life cycle and multiaged structure, which are typical of deepwater fish. They are found in 200-1400m depth range (Snelgrove and Haedrich, 1985)

Material and Methods

Samples were taken on board vessels of the deep water in NAFO Divisions 3L and 3M (Paz and Iglesias, 1994). Fish were measured from tip of snout to base of first anal-fin ray, in 0.5 cm interval, as adopted by NAFO in June 1980 (Savvatimsky, 1986), although length results are presented to the lowest cm. Females were much larger than males. Otoliths broken by the nucleus were read with light directed to the concave surface (Casas, 1994).

Results

The growth pattern was estimated by the von Bertalanffy equation for 3L and 3M Divisions in 1993 and 1994. Males older than 13 years were not found but the oldest age of females was 22 years. Growth differences between males and females were analyzed: mean age at length were compared and no significant differences were found. Table 1 presents the year, quarter, Division and number of otoliths analyzed by sex. The length-age keys for Division, year and quarter of roughheadgrenadier are shown in Table 2,3,4,5,6 and confirmed the multiaged structure of *M. berglax*. Otoliths of larger fish (>10 years old), are difficult to read because there are too many rings and they lie close to each other. Males and females of *M. berglax*, 3LM Divisions in 1993 and 1994 are presented in Figure 1, 2 and 3.

Catch at age for each Division and month were calculated with the above quarterly age-length keys and monthly length distributions. Monthly catch figures were considered 1000 Kg.

References

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Savvatimsky P.I. 1994. Age structure of Roughhead Grenadier (*Macrourus berglax*) in the Northwest Atlantic, 1985. NAFO Sci. Coun. Studies, 20:53-64

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TABLE 1- Area, Year, Quarter and number of otoliths by sex

| Number of otoliths | | | | | |
|--------------------|------|---------|-------|---------|-------|
| DIVISION | YEAR | QUARTER | TOTAL | FEMALES | MALES |
| 3L | 1993 | 3 | 306 | 187 | 119 |
| 3L | 1993 | 4 | 193 | 119 | 74 |
| 3L | 1994 | 2 | 314 | 195 | 119 |
| 3M | 1994 | 1 | 217 | 139 | 78 |
| 3M | 1994 | 2 | 89 | 48 | 41 |

TABLE 2- Length-age key of *M. berglax* from Div. 3L, 3th quarter, 1993

| Length (cm) | AGE | | | | | | | | | | | | | | | | | | | TOT | |
|----------------|-----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|-----|-----|---|
| | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | | | |
| 6 | 1 | | | | | | | | | | | | | | | | | | | 1 | |
| 7 | 1 | 1 | | | | | | | | | | | | | | | | | | 2 | |
| 8 | | 2 | | | | | | | | | | | | | | | | | | 2 | |
| 9 | | 7 | 7 | | | | | | | | | | | | | | | | | 14 | |
| 10 | | 3 | 5 | 2 | | | | | | | | | | | | | | | | 10 | |
| 11 | | | 6 | 1 | 1 | | | | | | | | | | | | | | | 8 | |
| 12 | | | 4 | 8 | 5 | | | | | | | | | | | | | | | 17 | |
| 13 | | | 1 | 9 | 10 | 1 | | | | | | | | | | | | | | 21 | |
| 14 | | | | 7 | 6 | 5 | | | | | | | | | | | | | | 18 | |
| 15 | | | | | 13 | 8 | | | | | | | | | | | | | | 21 | |
| 16 | | | | | 11 | 10 | 3 | | | | | | | | | | | | | 24 | |
| 17 | | | | | 3 | 14 | 5 | | | | | | | | | | | | | 22 | |
| 18 | | | | | 1 | 13 | 5 | 2 | | | | | | | | | | | | 21 | |
| 19 | | | | | | 2 | 10 | 4 | | | | | | | | | | | | 16 | |
| 20 | | | | | | | 2 | 8 | 5 | | | | | | | | | | | 15 | |
| 21 | | | | | | | | 4 | 4 | 3 | 3 | | | | | | | | | 14 | |
| 22 | | | | | | | | | 5 | 6 | 2 | | | | | | | | | 13 | |
| 23 | | | | | | | | | | 2 | 5 | 2 | | | | | | | | 9 | |
| 24 | | | | | | | | | 1 | 1 | 4 | 1 | | | | | | | | 7 | |
| 25 | | | | | | | | | | 2 | 1 | 6 | 2 | 1 | | | | | | 12 | |
| 26 | | | | | | | | | 1 | 3 | 2 | 2 | 3 | | | | | | | 11 | |
| 27 | | | | | | | | | | | | 2 | 3 | 1 | | | | | | 6 | |
| 28 | | | | | | | | | | | | 1 | 3 | 2 | | 1 | 1 | | | 8 | |
| 29 | | | | | | | | | | | | | | | | 1 | 1 | | | 3 | |
| 30 | | | | | | | | | | | | | | | | 1 | 2 | 2 | | 5 | |
| 31 | | | | | | | | | | | | | | | | | 1 | 1 | | 2 | |
| 32 | | | | | | | | | | | | | | | | | 1 | 1 | | 2 | |
| 33 | | | | | | | | | | | | | | | | | | 1 | | 1 | 2 |
| TOT | 2 | 13 | 23 | 27 | 50 | 53 | 25 | 18 | 16 | 17 | 19 | 16 | 10 | 4 | 7 | 5 | 0 | 1 | 306 | | |

TABLE 3- Length-age from Div 3L, 4th quarter, 1993

| Length (cm) | AGE | | | | | | | | | | | | | | | | | | TOT |
|----------------|-----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|---|-----|-----|
| | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | | | |
| 6 | 1 | | | | | | | | | | | | | | | | | 1 | |
| 7 | 8 | 1 | | | | | | | | | | | | | | | | 9 | |
| 8 | 2 | 8 | | | | | | | | | | | | | | | | 10 | |
| 9 | 1 | 10 | 1 | | | | | | | | | | | | | | | 12 | |
| 10 | | 5 | 4 | | | | | | | | | | | | | | | 9 | |
| 11 | | 3 | 7 | | | | | | | | | | | | | | | 10 | |
| 12 | | | 3 | 6 | | | | | | | | | | | | | | 9 | |
| 13 | | | 4 | 6 | | | | | | | | | | | | | | 10 | |
| 14 | | | | 8 | 3 | | | | | | | | | | | | | 11 | |
| 15 | | | | 5 | 3 | | | | | | | | | | | | | 8 | |
| 16 | | | | 3 | 6 | 1 | | | | | | | | | | | | 10 | |
| 17 | | | | 2 | 4 | 4 | | | | | | | | | | | | 10 | |
| 18 | | | | 1 | 5 | 5 | 1 | | | | | | | | | | | 12 | |
| 19 | | | | | 2 | 3 | 4 | 1 | | | | | | | | | | 10 | |
| 20 | | | | | | 2 | 5 | 3 | | | | | | | | | | 10 | |
| 21 | | | | | | 1 | 2 | 2 | 1 | 2 | | | | | | | | 8 | |
| 22 | | | | | | | 1 | 2 | 2 | 2 | | | | | | | | 7 | |
| 23 | | | | | | | | 2 | 2 | | | | | | | | | 5 | |
| 24 | | | | | | | | | 1 | 3 | 2 | | | | | | | 6 | |
| 25 | | | | | | | | | | 1 | 3 | 2 | | | | | | 6 | |
| 26 | | | | | | | | | | | 2 | 1 | 2 | 1 | | | | 6 | |
| 27 | | | | | | | | | | | | 3 | 1 | 1 | | | | 5 | |
| 28 | | | | | | | | | | | | 2 | 2 | | | | | 4 | |
| 29 | | | | | | | | | | | | 1 | 1 | | | | | 2 | |
| 30 | | | | | | | | | | | | | | | | 1 | | 1 | |
| 31 | | | | | | | | | | | | | | | | | 1 | 1 | |
| 32 | | | | | | | | | | | | | | | | | | 1 | |
| TOT | 12 | 27 | 19 | 31 | 23 | 16 | 13 | 10 | 7 | 12 | 12 | 6 | 3 | 1 | 0 | 1 | 1 | 193 | |

TABLE 4- Length-age key 3L Div, Second quarter, 1994

| Length (cm) | AGE | | | | | | | | | | | | | | | | | | | | | | TOT |
|----------------|-----|---|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|-----|-----|
| | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | | |
| 7 | 1 | 1 | | | | | | | | | | | | | | | | | | | | 2 | |
| 8 | | 5 | | 1 | | | | | | | | | | | | | | | | | | 6 | |
| 9 | | 2 | 4 | | | | | | | | | | | | | | | | | | | 6 | |
| 10 | | | 7 | 3 | | | | | | | | | | | | | | | | | | 10 | |
| 11 | | | 2 | 3 | | | | | | | | | | | | | | | | | | 5 | |
| 12 | | | | 3 | 1 | | | | | | | | | | | | | | | | | 4 | |
| 13 | | | | 5 | 3 | | | | | | | | | | | | | | | | | 8 | |
| 14 | | | | 4 | 13 | 3 | | | | | | | | | | | | | | | | 20 | |
| 15 | | | | 1 | 8 | 10 | | | | | | | | | | | | | | | | 19 | |
| 16 | | | | | 4 | 14 | | | | | | | | | | | | | | | | 18 | |
| 17 | | | | | 1 | 9 | 11 | | | | | | | | | | | | | | | 21 | |
| 18 | | | | | | 7 | 11 | 5 | | | | | | | | | | | | | | 23 | |
| 19 | | | | | | | 9 | 14 | | | | | | | | | | | | | | 23 | |
| 20 | | | | | | | 3 | 14 | 6 | | | | | | | | | | | | | 23 | |
| 21 | | | | | | | | 1 | 10 | 8 | 1 | | | | | | | | | | | 20 | |
| 22 | | | | | | | | | 2 | 4 | 4 | | | | | | | | | | | 10 | |
| 23 | | | | | | | | | | 3 | 10 | 1 | | | | | | | | | | 14 | |
| 24 | | | | | | | | | | 2 | 5 | 1 | | | | | | | | | | 8 | |
| 25 | | | | | | | | | | | 4 | 5 | | | | | | | | | | 9 | |
| 26 | | | | | | | | | | | | 6 | 4 | 1 | | | | | | | | 11 | |
| 27 | | | | | | | | | | | | 5 | 3 | 1 | | | | | | | | 9 | |
| 28 | | | | | | | | | | | | | 1 | 3 | 3 | 1 | | | | | | 8 | |
| 29 | | | | | | | | | | | | | 1 | 3 | 2 | 3 | | | | | | 9 | |
| 30 | | | | | | | | | | | | | | 1 | 2 | 2 | | | | | | 5 | |
| 31 | | | | | | | | | | | | | | | 1 | 2 | 1 | 1 | 1 | | | 6 | |
| 32 | | | | | | | | | | | | | | | | 1 | 1 | 1 | 1 | | | 4 | |
| 33 | | | | | | | | | | | | | | | | | | | 3 | 2 | | 5 | |
| 34 | | | | | | | | | | | | | | | | | | 1 | 1 | | | 2 | |
| 35 | | | | | | | | | | | | | | | | | | 1 | 1 | | 1 | 3 | |
| 36 | | | | | | | | | | | | | | | | | | | | | | 0 | |
| 37 | | | | | | | | | | | | | | | | | | | | | 2 | 2 | |
| 38 | | | | | | | | | | | | | | | | | | | | 1 | | 1 | |
| TOT | 1 | 8 | 13 | 20 | 30 | 43 | 34 | 34 | 18 | 17 | 24 | 18 | 9 | 9 | 9 | 8 | 4 | 5 | 5 | 4 | 1 | 314 | |

TABLE 5- Length-age key 3M Div, First quarter, 1994

| Length (cm) | AGE | | | | | | | | | | | | | | | | | | | TOT | |
|----------------|-----|---|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|-----|-----|
| | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | | 22 |
| 7 | 2 | | | | | | | | | | | | | | | | | | | | 2 |
| 8 | 4 | 1 | | | | | | | | | | | | | | | | | | | 5 |
| 9 | 4 | 2 | | | | | | | | | | | | | | | | | | | 6 |
| 10 | | 4 | | | | | | | | | | | | | | | | | | | 4 |
| 11 | | 1 | 5 | | | | | | | | | | | | | | | | | | 6 |
| 12 | | | 4 | 3 | | | | | | | | | | | | | | | | | 7 |
| 13 | | | 4 | 5 | | | | | | | | | | | | | | | | | 9 |
| 14 | | | 2 | 9 | | | | | | | | | | | | | | | | | 11 |
| 15 | | | | 7 | 7 | | | | | | | | | | | | | | | | 14 |
| 16 | | | | 1 | 9 | 2 | | | | | | | | | | | | | | | 12 |
| 17 | | | | | 7 | 5 | | | | | | | | | | | | | | | 12 |
| 18 | | | | | 4 | 8 | 1 | | | | | | | | | | | | | | 13 |
| 19 | | | | | | 6 | 5 | 2 | | | | | | | | | | | | | 13 |
| 20 | | | | | | | 6 | 4 | | | | | | | | | | | | | 10 |
| 21 | | | | | | | 2 | 5 | 4 | 3 | 1 | | | | | | | | | | 11 |
| 22 | | | | | | | | 2 | | 6 | 3 | | | | | | | | | | 11 |
| 23 | | | | | | | | | | 3 | 2 | | | | | | | | | | 5 |
| 24 | | | | | | | | | | 1 | 2 | 1 | 1 | | | | | | | | 5 |
| 25 | | | | | | | | | | 1 | 2 | 3 | | | | | | | | | 6 |
| 26 | | | | | | | | | | | 1 | 3 | | | | | | | | | 5 |
| 27 | | | | | | | | | | | | 3 | 2 | | | | | | | | 5 |
| 28 | | | | | | | | | | | | 1 | 4 | | | | | | | | 5 |
| 29 | | | | | | | | | | | | | 1 | 2 | | | | | | | 6 |
| 30 | | | | | | | | | | | | | | 2 | | | | | | | 4 |
| 31 | | | | | | | | | | | | | | | 2 | | | | | | 5 |
| 32 | | | | | | | | | | | | | | | | 1 | 2 | 1 | | 1 | 5 |
| 33 | | | | | | | | | | | | | | | | 2 | 2 | | | | 4 |
| 34 | | | | | | | | | | | | | | | | 1 | 1 | 1 | 1 | | 3 |
| 35 | | | | | | | | | | | | | | | 1 | | 1 | 1 | 2 | | 5 |
| 36 | | | | | | | | | | | | | | | | | 1 | 2 | | 1 | 4 |
| 37 | | | | | | | | | | | | | | | | | | 2 | | 1 | 3 |
| 38 | | | | | | | | | | | | | | | | | | | | 0 | 0 |
| 39 | | | | | | | | | | | | | | | | | | | | 1 | 1 |
| TOT | 10 | 8 | 15 | 25 | 27 | 21 | 14 | 13 | 14 | 11 | 7 | 6 | 7 | 4 | 5 | 6 | 8 | 8 | 4 | 4 | 217 |

TABLE 6- Length-age key 3M Div., Second quarter, 1994

| Length (cm) | AGE | | | | | | | | | | | | | | | | TOT | | | | |
|----------------|-----|---|---|----|----|----|----|----|----|----|----|----|----|----|----|----|-----|----|--|--|----|
| | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | | 21 | | | |
| 12 | 1 | | | | | | | | | | | | | | | | | | | | 1 |
| 13 | | 1 | | | | | | | | | | | | | | | | | | | 1 |
| 14 | | 2 | | | | | | | | | | | | | | | | | | | 2 |
| 15 | | | 3 | | | | | | | | | | | | | | | | | | 3 |
| 16 | | | 4 | 1 | | | | | | | | | | | | | | | | | 5 |
| 17 | | | | 4 | | | | | | | | | | | | | | | | | 4 |
| 18 | | | | | 11 | 3 | | | | | | | | | | | | | | | 14 |
| 19 | | | | | 3 | 4 | | | | | | | | | | | | | | | 7 |
| 20 | | | | | 1 | 2 | 4 | | | | | | | | | | | | | | 7 |
| 21 | | | | | | 1 | 5 | 3 | 1 | | | | | | | | | | | | 10 |
| 22 | | | | | | | 2 | 1 | | | | | | | | | | | | | 3 |
| 23 | | | | | | | 2 | 2 | 1 | | | | | | | | | | | | 5 |
| 24 | | | | | | | | | 2 | 1 | | | | | | | | | | | 3 |
| 25 | | | | | | | | | 1 | 2 | 2 | | | | | | | | | | 5 |
| 26 | | | | | | | | | 1 | 1 | 2 | | | | | | | | | | 4 |
| 27 | | | | | | | | | | | 1 | | | | | | | | | | 2 |
| 28 | | | | | | | | | | | | | | | | | | | | | 0 |
| 29 | | | | | | | | | | | | 2 | | | | | | | | | 2 |
| 30 | | | | | | | | | | | | 1 | 1 | 1 | | 1 | | | | | 5 |
| 31 | | | | | | | | | | | | | | 1 | | | 2 | | | | 4 |
| 32 | | | | | | | | | | | | | | | 1 | | | | | | 1 |
| 33 | | | | | | | | | | | | | | | | | | | | | 0 |
| 34 | | | | | | | | | | | | | | | | 1 | | | | | 1 |
| TOT | 1 | 3 | 7 | 20 | 10 | 9 | 7 | 6 | 6 | 6 | 6 | 3 | 2 | 2 | 0 | 4 | | 3 | | | 89 |

Table 7. - Catch at age in Div. 3L 1993 (Third quarter)

| Length | Oct | TOTAL | JUL | AUG | SEPT | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | |
|--------|-----|---------|-----|--------|---------|-------|--------|-------|-------|-------|------|---|---|----|----|----|----|----|----|----|----|----|----|--|
| 6 | 1 | 1696 | 0 | 0 | 1696 | 1696 | 0 | | | | | | | | | | | | | | | | | |
| 7 | 2 | 1696 | 0 | 0 | 1696 | 848 | 848 | | | | | | | | | | | | | | | | | |
| 8 | 2 | 2830 | 0 | 0 | 2830 | 2830 | | | | | | | | | | | | | | | | | | |
| 9 | 14 | 22105 | 0 | 1034 | 21071 | 11053 | 11053 | | | | | | | | | | | | | | | | | |
| 10 | 10 | 13450 | 0 | 446 | 13004 | 4035 | 6725 | 2690 | | | | | | | | | | | | | | | | |
| 11 | 8 | 22058 | 0 | 588 | 21470 | 16544 | 2757 | 2757 | | | | | | | | | | | | | | | | |
| 12 | 17 | 26242 | 0 | 1176 | 25066 | 6175 | 12349 | 7718 | | | | | | | | | | | | | | | | |
| 13 | 21 | 88820 | 0 | 19118 | 69702 | 4230 | 38066 | 42295 | 4230 | | | | | | | | | | | | | | | |
| 14 | 18 | 91753 | 0 | 17511 | 74242 | 35682 | 30584 | 25487 | | | | | | | | | | | | | | | | |
| 15 | 21 | 115417 | 0 | 29684 | 85733 | 71449 | 43968 | | | | | | | | | | | | | | | | | |
| 16 | 24 | 180272 | 0 | 74451 | 105821 | 82625 | 75113 | 22534 | | | | | | | | | | | | | | | | |
| 17 | 22 | 218167 | 0 | 67980 | 150187 | 29750 | 138834 | 49583 | 0 | | | | | | | | | | | | | | | |
| 18 | 21 | 200106 | 0 | 86950 | 113156 | 9529 | 123875 | 47644 | 19058 | | | | | | | | | | | | | | | |
| 19 | 16 | 153158 | 0 | 48840 | 104318 | 19145 | 95724 | 38290 | | | | | | | | | | | | | | | | |
| 20 | 15 | 140916 | 0 | 53888 | 87028 | 18789 | 75155 | 46972 | 0 | 0 | 0 | | | | | | | | | | | | | |
| 21 | 14 | 95869 | 0 | 36126 | 59743 | 27391 | 27391 | 20543 | 20543 | 0 | 0 | | | | | | | | | | | | | |
| 22 | 13 | 64428 | 0 | 12740 | 51688 | 24780 | 29736 | 9912 | | | | | | | | | | | | | | | | |
| 23 | 9 | 101845 | 0 | 32042 | 69803 | 0 | 22632 | 56581 | 22632 | 0 | | | | | | | | | | | | | | |
| 24 | 7 | 78556 | 0 | 17874 | 60682 | 11222 | 11222 | 44889 | 11222 | 0 | | | | | | | | | | | | | | |
| 25 | 12 | 55324 | 0 | 15858 | 39466 | 0 | 9221 | 4610 | 27662 | 9221 | 4610 | | | | | | | | | | | | | |
| 26 | 11 | 76970 | 0 | 42203 | 34767 | 6997 | 20992 | 13995 | 13995 | 20992 | 0 | | | | | | | | | | | | | |
| 27 | 6 | 44110 | 0 | 17589 | 26521 | 0 | 14703 | 22055 | 7352 | | | | | | | | | | | | | | | |
| 28 | 8 | 15457 | 0 | 6089 | 9368 | 1932 | 5796 | 3864 | 0 | 1932 | 1932 | | | | | | | | | | | | | |
| 29 | 3 | 27253 | 0 | 10163 | 17090 | 9084 | 0 | 0 | 9084 | 9084 | 0 | | | | | | | | | | | | | |
| 30 | 5 | 34796 | 0 | 19149 | 15647 | 6959 | 13918 | 13918 | | | | | | | | | | | | | | | | |
| 31 | 2 | 22613 | 0 | 15639 | 6974 | 0 | 11307 | 11307 | | | | | | | | | | | | | | | | |
| 32 | 2 | 4036 | 0 | 1787 | 2249 | 2018 | 2018 | 0 | | | | | | | | | | | | | | | | |
| 33 | 2 | 5358 | 0 | 446 | 4912 | 0 | 2679 | 0 | | | | | | | | | | | | | | | | |
| TOT | 306 | 1905301 | 0 | 629371 | 1275930 | | | | | | | | | | | | | | | | | | | |

Table 9.- Catch at age in Div 3L 1994 (second quarter)

| Length | OTO | TOTAL | A | MA | J | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | |
|--------|-----|----------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|-------|----|----|----|----|----|----|----|----|----|----|----|----|----|--|
| 7 | 2 | 8733 | 0 | 3606 | 5127 | 4367 | 4367 | | | | | | | | | | | | | | | | | | | | |
| 8 | 6 | 93399 | 5133 | 34554 | 53712 | 77521 | 15904 | | | | | | | | | | | | | | | | | | | | |
| 9 | 6 | 37323 | 1972 | 27801 | 7550 | 12391 | 24782 | | | | | | | | | | | | | | | | | | | | |
| 10 | 10 | 211175 | 29637 | 120498 | 61040 | 147823 | 63353 | | | | | | | | | | | | | | | | | | | | |
| 11 | 5 | 395018 | 41976 | 236821 | 116221 | 158007 | 237011 | | | | | | | | | | | | | | | | | | | | |
| 12 | 4 | 215206 | 25817 | 145224 | 44165 | | 161405 | 53802 | | | | | | | | | | | | | | | | | | | |
| 13 | 8 | 309303 | 84484 | 154501 | 70318 | | 193314 | 115989 | | | | | | | | | | | | | | | | | | | |
| 14 | 20 | 794495 | 269111 | 374817 | 150567 | | 158899 | 119174 | | | | | | | | | | | | | | | | | | | |
| 15 | 19 | 721366 | 281756 | 289977 | 149633 | | 38232 | 305859 | 382324 | | | | | | | | | | | | | | | | | | |
| 16 | 18 | 725921 | 271486 | 339426 | 115009 | | | 159703 | 558959 | | | | | | | | | | | | | | | | | | |
| 17 | 21 | 1183384 | 349734 | 622335 | 210315 | | | 55619 | 500571 | 611810 | | | | | | | | | | | | | | | | | |
| 18 | 23 | 1450322 | 395663 | 745887 | 308772 | | | 446699 | 701956 | 319071 | | | | | | | | | | | | | | | | | |
| 19 | 23 | 1217561 | 358803 | 626580 | 232178 | | | | 482154 | 750018 | | | | | | | | | | | | | | | | | |
| 20 | 23 | 823583 | 256559 | 392076 | 174648 | | | | 108713 | 507327 | 217426 | | | | | | | | | | | | | | | | |
| 21 | 20 | 458971 | 165806 | 205210 | 87955 | | | | 22949 | 229486 | 183588 | 22949 | | | | | | | | | | | | | | | |
| 22 | 10 | 307883 | 115102 | 143592 | 49189 | | | | 61577 | 123153 | 123153 | | | | | | | | | | | | | | | | |
| 23 | 14 | 210494 | 74338 | 107822 | 28334 | | | | | 49256 | 164185 | 16419 | | | | | | | | | | | | | | | |
| 24 | 8 | 240163 | 101600 | 122741 | 15822 | | | | | 60041 | 150102 | 36020 | | | | | | | | | | | | | | | |
| 25 | 9 | 282518 | 126679 | 121503 | 34336 | | | | | | 124308 | 155385 | | | | | | | | | | | | | | | |
| 26 | 11 | 208788 | 140684 | 63832 | 4272 | | | | | | 112746 | 18791 | | | | | | | | | | | | | | | |
| 27 | 9 | 187446 | 109346 | 67771 | 10329 | | | | | | 103095 | 61837 | 20619 | | | | | | | | | | | | | | |
| 28 | 8 | 112690 | 55232 | 42778 | 14680 | | | | | | | | | | | | | | | | | | | | | | |
| 29 | 9 | 69439 | 28372 | 35023 | 6044 | | | | | | | | | | | | | | | | | | | | | | |
| 30 | 5 | 93519 | 59248 | 27986 | 6285 | | | | | | | | | | | | | | | | | | | | | | |
| 31 | 6 | 66400 | 46963 | 15505 | 3932 | | | | | | | | | | | | | | | | | | | | | | |
| 32 | 4 | 58033 | 29806 | 23007 | 5220 | | | | | | | | | | | | | | | | | | | | | | |
| 33 | 5 | 28519 | 16675 | 6203 | 5641 | | | | | | | | | | | | | | | | | | | | | | |
| 34 | 2 | 31642 | 13502 | 9756 | 8384 | | | | | | | | | | | | | | | | | | | | | | |
| 35 | 3 | 16582 | 6267 | 4767 | 5548 | | | | | | | | | | | | | | | | | | | | | | |
| 36 | 0 | 15247 | 12177 | 3070 | 0 | | | | | | | | | | | | | | | | | | | | | | |
| 37 | 2 | 3226 | 3134 | 0 | 92 | | | | | | | | | | | | | | | | | | | | | | |
| 38 | 1 | 3002 | 0 | 2910 | 92 | | | | | | | | | | | | | | | | | | | | | | |
| TOT | 314 | 16581351 | | | | | | | | | | | | | | | | | | | | | | | | | |

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TABLE 12- Parameters of von Bertalanffy equation of *Macrourus berglax*

| | 3L 1993 | | 3L 1994 | | 3M 1994 | |
|--------------|---------|---------|---------|---------|---------|---------|
| | Males | Females | Males | Females | Males | Females |
| K | 0.111 | 0.0591 | 0.078 | 0.040 | 0.103 | 0.048 |
| L_{∞} | 29.35 | 48.73 | 34.82 | 59.47 | 31.136 | 53.78 |
| t_0 | -0.6963 | -0.1319 | -1.3503 | -1.4019 | -0.0457 | -0.7104 |

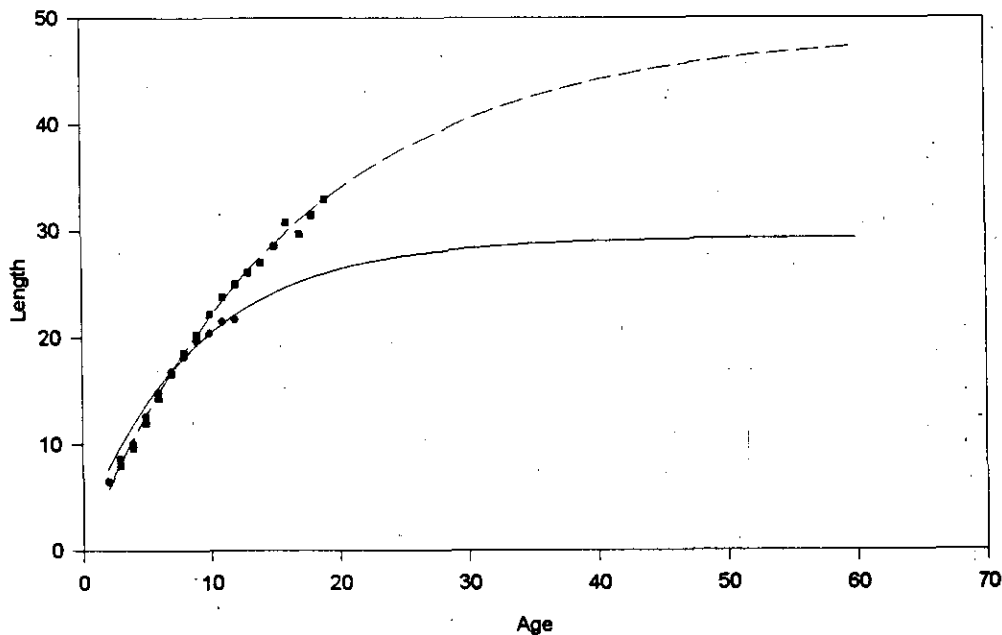


Figure 1.- Mean length at age and von Bertalanffy growth equation in Div 3L 1993.

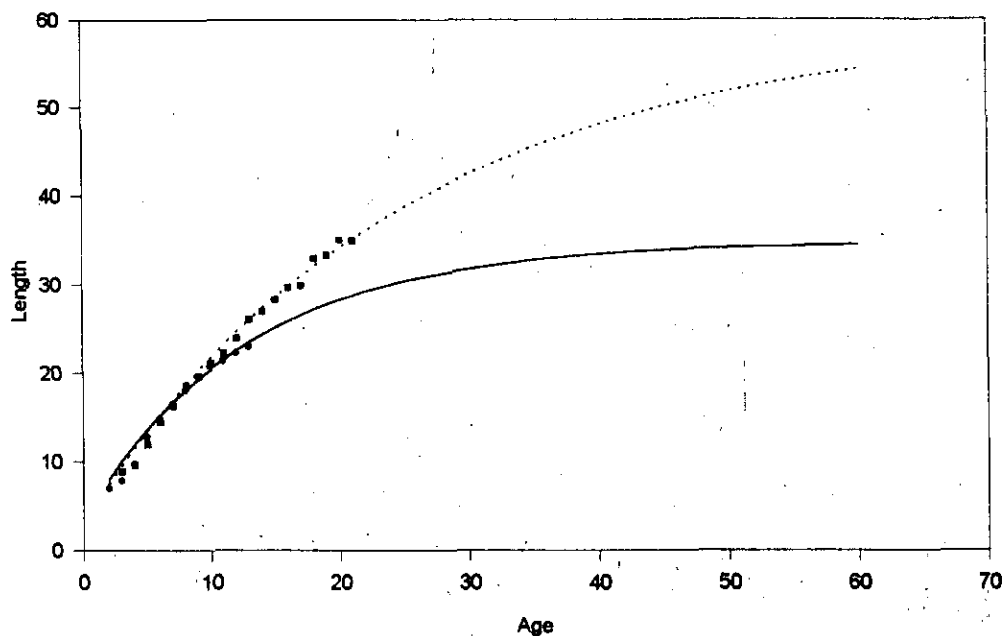


Figure 2.- Mean length at age and von Bertalanffy growth equation in Div 3L 1994

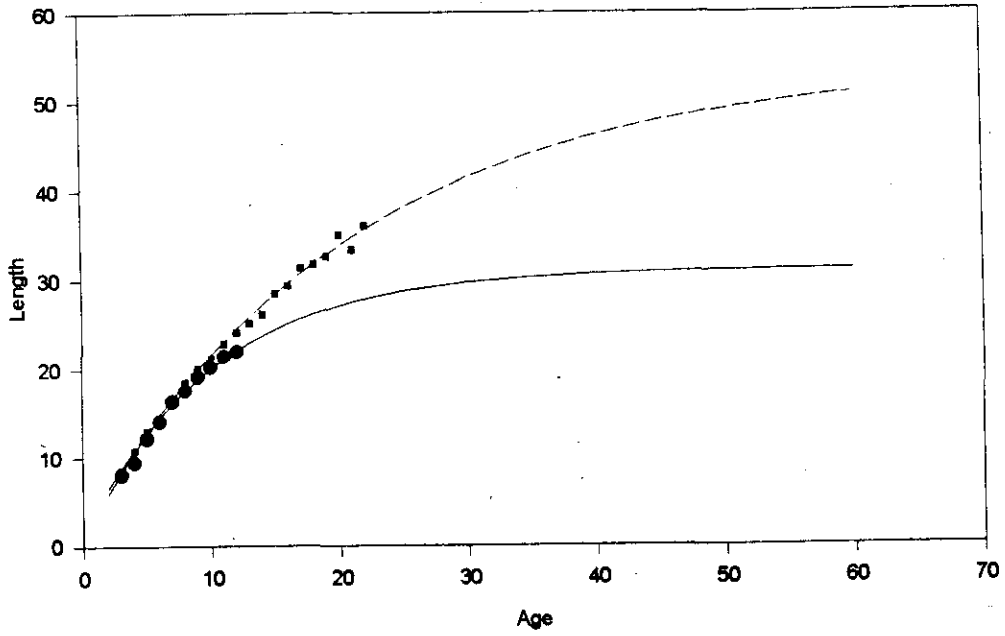


Figure 3. - Mean length at age and von Bertalanffy growth equation in Div 3M 1994