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Sex Ratios of North Esk Salmon in relation to Age

by

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Since 1962, the net and coble catches on the North Esk have been sampled on two days per week throughout the commercial fishing season and, as part of this programme, each fish examined was sexed, on external appearance. In addition, in each year since 1961, a proportion of the smolts migrating downstream has been trapped and small samples of these, 2944 in all, were killed and sexed by internal examination. This material has been used in this report to provide information on the sex ratio of North Esk salmon at various stages in their life history.

As the adult fish in these samples could not be opened to provide internal evidence of their sex, this was determined on the general shape and appearance of the head; a total of 795 fish of known sex, examined between 1964 and 1970, having shown that males had longer heads than females of the same length and less rounded opercula. The presence or absence of a small hook on the lower jaw was ignored, as both sexes exhibited this character before the development of their secondary sexual characteristics.

While this method of sex determination may seem subjective, it has been found to give relatively good results in practice. For example, using external criteria, a total of 233 female salmon and grilse were selected from the commercial catch during 1964 and 1965 for fecundity measurements and only one, a small grilse, was found to be a male.

Table 1 gives the sex ratio of grilse in each year and Table 2 gives the combined sex ratio for all age groups of salmon, together with the breakdown of the latter for each sea-age group of maiden fish and for previous spawners.

Table 3 gives the sex ratio of the smolts sampled in each year from 1961 to 1970 and the sex ratio of the maiden survivors in each sea age group derived from each smolt migration, together with the combined values for all maiden salmon (2-4SW) and all maiden survivors, including grilse (1-4SW). The sex ratios in this table are based on samples of the commercial catch and smaller numbers of fish trapped and sexed on external appearance during the annual close season.

The data was also examined for a relationship between sex ratio and smolt age but no significant differences were found between fish of the same sea age but different smolt age.

Table 1

Net and Coble Catches, N. Esk, 1962-71
Grilse - Sex Ratio

| Year | No. in Sample | Male : Female |
|------|---------------|---------------|
| 1962 | 346 | 1.00 : 1.02 |
| 1963 | 918 | 1.00 : 0.79 |
| 1964 | 845 | 1.00 : 0.55 |
| 1965 | 896 | 1.00 : 0.20 |
| 1966 | 972 | 1.00 : 0.69 |
| 1967 | 1043 | 1.00 : 0.41 |
| 1968 | 688 | 1.00 : 0.72 |
| 1969 | 1337 | 1.00 : 0.33 |
| 1970 | 911 | 1.00 : 0.74 |
| 1971 | 787 | 1.00 : 0.63 |

Table 2

Net and Coble Catches, N. Esk, 1962-71
Salmon - Sex Ratios

| Year | 2SW | | | 3SW | | | Sea Age -- 4SW -- | | | Prev. Spawners | | | Overall | | |
|------|------|------|------|-----|------|------|----------------------|------|------|----------------|------|------|---------|------|------|
| | No. | M | F | No. | M | F | No. | M | F | No. | M | F | No. | M | F |
| 1962 | 200 | 1.00 | 0.98 | 28 | 1.00 | 0.12 | | | | 9 | 1.00 | 3.50 | 237 | 1.00 | 0.85 |
| 1963 | 1403 | 1.00 | 1.20 | 52 | 1.00 | 3.33 | | | | 38 | 1.00 | 2.80 | 1495 | 1.00 | 1.25 |
| 1964 | 1173 | 1.00 | 0.89 | 102 | 1.00 | 0.50 | 2 | 2.00 | 0.00 | 23 | 1.00 | 2.29 | 1298 | 1.00 | 0.86 |
| 1965 | 1059 | 1.00 | 0.98 | 143 | 1.00 | 0.91 | | | | 41 | 1.00 | 2.15 | 1243 | 1.00 | 1.00 |
| 1966 | 1520 | 1.00 | 1.18 | 200 | 1.00 | 1.11 | | | | 43 | 1.00 | 4.38 | 1764 | 1.00 | 1.21 |
| 1967 | 1993 | 1.00 | 1.57 | 383 | 1.00 | 1.16 | 1 | 1.00 | 0.00 | 9 | 1.00 | 0.13 | 76 | 1.00 | 2.17 |
| 1968 | 1316 | 1.00 | 1.40 | 250 | 1.00 | 1.17 | 15 | 1.00 | 0.50 | 26 | 1.00 | 2.71 | 2461 | 1.00 | 1.50 |
| 1969 | 605 | 1.00 | 1.37 | 246 | 1.00 | 1.56 | 1 | 1.00 | 0.00 | 7 | 1.00 | 6.00 | 1607 | 1.00 | 1.36 |
| 1970 | 1024 | 1.00 | 1.84 | 123 | 1.00 | 1.20 | 5 | 1.00 | 1.33 | 4 | 1.00 | 1.00 | 859 | 1.00 | 1.43 |
| 1971 | 1630 | 1.00 | 1.70 | 121 | 1.00 | 1.05 | 5 | 5.00 | 0.00 | 9 | 1.00 | 2.00 | 1156 | 1.00 | 1.75 |
| | | | | | | | | | | | | | 1765 | 1.00 | 1.63 |

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Table 3

Sex Ratios of the Maiden Survivors of Various Sea Ages resulting from each smolt migration

| <u>Year of Migration</u> | <u>Smolts</u> | | <u>Sea Age</u> | | | | | | | | | | | |
|--------------------------|---------------|-------------|----------------|-------------|------|-------------|-----|-------------|-----|-------------|------|--------------------------|------|--------------------------|
| | No. | M : F | No. | M : F | No. | M : F | No. | M : F | No. | M : F | No. | M : F | | |
| 1961 | 113 | 1.00 : 1.76 | 346 | 1.00 : 1.02 | 1421 | 1.00 : 1.22 | 112 | 1.00 : 0.53 | | | | | | |
| 1962 | 99 | 1.00 : 1.83 | 1018 | 1.00 : 0.80 | 1406 | 1.00 : 1.16 | 192 | 1.00 : 0.94 | 1 | 1.00 : 0.00 | 1533 | 1.00 : 1.13 | 1879 | 1.00 : 1.13 |
| 1963 | 142 | 1.00 : 1.78 | 1080 | 1.00 : 0.56 | 1316 | 1.00 : 0.94 | 220 | 1.00 : 1.12 | 9 | 1.00 : 0.13 | 1599 | 1.00 : 1.13 | 2617 | 1.00 : 0.99 |
| 1964 | 837 | 1.00 : 1.53 | 1200 | 1.00 : 0.28 | 1706 | 1.00 : 1.22 | 420 | 1.00 : 1.09 | 15 | 1.00 : 0.50 | 1545 | 1.00 : 0.99 | 2625 | 1.00 : 0.77 |
| 1965 | 1220 | 1.00 : 1.95 | 1096 | 1.00 : 0.72 | 2196 | 1.00 : 1.56 | 271 | 1.00 : 1.15 | 2 | 1.00 : 1.00 | 2141 | 1.00 : 1.17 | 3341 | 1.00 : 0.74 |
| 1966 | 76 | 1.00 : 1.71 | 1155 | 1.00 : 0.41 | 1480 | 1.00 : 1.33 | 251 | 1.00 : 1.56 | 7 | 1.00 : 1.33 | 2469 | 1.00 : 1.52 | 3565 | 1.00 : 1.20 |
| 1967 | 89 | 1.00 : 1.78 | 722 | 1.00 : 0.67 | 658 | 1.00 : 1.37 | 123 | 1.00 : 1.20 | 5 | 5.00 : 0.00 | 1738 | 1.00 : 1.42 | 2893 | 1.00 : 0.86 |
| 1968 | 67 | 1.00 : 1.58 | 1527 | 1.00 : 0.41 | 1026 | 1.00 : 1.83 | 121 | 1.00 : 1.05 | | | 786 | 1.00 : 1.32 | 1508 | 1.00 : 0.96 |
| 1969 | 54 | 1.00 : 2.00 | 911 | 1.00 : 0.74 | 1630 | 1.00 : 1.70 | | | | | 1147 | 1.00 : 1.73 ^a | 2674 | 1.00 : 0.78 ^a |
| 1970 | 247 | 1.00 : 1.84 | 787 | 1.00 : 0.63 | | | | | | | 1630 | 1.00 : 1.70 ^a | 2541 | 1.00 : 1.25 ^a |
| | | | | | | | | | | | | | 787 | 1.00 : 0.63 ^a |

^a Incomplete