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Size distributions of the migrant ommastrephid squid, <u>Illex illecebrosus</u> (LeSueur), in Newfoundland inshore waters

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## Introduction

Migrant juvenile ommastrephid squid, <u>Illex illecebrosus</u>, generally arrive inshore at Newfoundland in late June or July and depart in November by which time many of the males are mature. Relationships between these stocks and those exploited by rapidly developing offshore fisheries in other parts of the Northwest Atlantic are yet to be resolved and the problem is one that must be addressed in attempting to manage the resource.

Size distributions and growth of the species at Newfoundland have previously been described by Squires (1957, 1967) and Mercer (1965, 1966, 1969a) and further data are available on size distributions in offshore areas of the Northwest Atlantic (Mercer, 1969b, 1969c, 1970, 1973a; Mercer and Paulmier, 1974). This paper analyzes in detail the heterogeneity in size compositions previously noted by the author (Mercer, 1966, 1969a) and collates data in a form amenable to application in stock discrimination particularly when viewed in combination with detailed summaries of maturity data previously reported (Mercer, 1973b).

#### Materials and Methods

Specimens examined

All specimens were taken by handline and jigger in inshore waters of less than 20 metres depth (Fig. 1). Conception Bay samples were taken at various localities in 1965 and all were obtained at Holyrood in succeeding years. Hermitage Bay samples were taken at various localities in 1966 and at Rencontre West only in 1965 and 1967.

Dorsal mantle lengths were measured from the antero-dorsal proturberance to the apex of the tail fin, to the nearest centimetre in 1965-67 and to the nearest half-centimetre 1971-73. Measurements of 33,041 specimens are examined in this paper.

#### Data analysis

Sample modes were determined by inspection where the length frequency distributions approached fairly smooth unimodal or bimodal curves. Where unimodal distributions were platykurtic (and only moderately skewed) such that the two or three adjacent size classes had nearly equal frequencies, the mode was estimated from the relationship mode = 3 median - 2 mean as outlined by Simpson <u>et al</u>. (1960). In some bimodal but platykurtic distributions this method could not be applied; in such cases the range within which the mode occurred was determined by visual inspection and this range applied in tables and graphs. Bulges in size distributions (corresponding to modes in temporally adjacent samples) were taken to indicate "probable modes" which were estimated from visual inspection and tabulated as such.

Arithmetic sample means calculated for unimodal distributions were found to be biased by skewness in nearly all cases. To adjust for this mean sizes were determined by plotting the cumulative length frequency distributions on probability paper, accumulating from the tail of the distribution opposite the skew. This accomplished a linear transformation and straight lines were fitted by eye to the principal data points, excluding those from the skewed end, and means were read off where the lines intersected the 50 percent co-ordinate. The standard deviation was read as the distance between the mean and the 0.8413 co-ordinate. If skewness is interpreted to be related to admixture of different size groups the above adjustment gives a better approximation of the population mean for the principal size group (see Results section). Some probability plots did not produce linear transformations and resultant plots were strongly skewed; hence the log-normal rather than the normal model was applied.

Sample means and standard deviations for bimodal distributions were calculated by the technique developed by Harding (1949) as outlined by Cassie (1950).

### Results

For inshore Newfoundland three size groups can be distinguished by examination of modes of mantle length in males as follows:

- I. Mode ca. 21 cm in early August increasing to 24 cm by the end of September and to 24-25 cm in October.
- II. Mode ca. 17 cm in early August increasing to ca. 22 cm by the end of September and to 22-23 cm in October, November.
- III. Mode ca. 16 cm in mid-August increasing to ca. 20 cm by the end of September and to ca. 20-21 cm in October.

We can analyze the composition of the samples from the various bays for each year on the basis of these groupings.

#### 1965

Substantial homogeneity was evinced by samples taken in Conception and Trinity bays July 27 to November 13, 1965 (Fig. 2). Most samples had unimodal and fairly leptokurtic distributions comprising group I squid but two taken early in the season showed bimodality with the second mode comprising group II squid.

In 5 samples taken at Englee August 11 to September 14, 1965, length distributions were unimodal and skewed comprising predominantly group I squid; in the last sample group III was also represented.

Three samples taken at Rencontre West August 7-23, 1965, were heterogeneous comprising mostly group II squid with group III squid represented in one sample.

#### 1966

Bimodality was apparent (Fig. 3) in samples taken from Holyrood, July 20 to November 2, 1966 (groups I and II) with a further group of small squid (group III) entering the area at the end of the season (November 2). Modes for group I squid increased from 19 to 24 cm from July 20 to October 19 for males and 20 to 26-27 cm for females. Modes for group II increased from 17 to 23 cm for males and 17 to 25 cm for females from July 20 to November 2.

Heterogeneity was also found in samples taken in Hermitage and Fortune bays, August 3-October 28, 1966 (Fig. 3). Here the situation was complex with group III predominating; group I was represented twice, forming the bulk of one sample and group II was less conspicuous. Modes for both

sexes in this group increased from 15 cm in mid-August to 20 cm at the end of September; modal length remained 20 cm throughout October.

1967

Samples from Holyrood, July 17 to November 23, 1967, had unimodal distributions (Fig. 4). These were negatively skewed so that arithmetic mean mantle lengths were smaller than those calculated from cumulative probability plots; this I attribute to slight intermixture of group II and/or group III squid. Adjusted mean male mantle lengths increased from 19.5 cm on July 17 to an "asymptotic length" of 25.6 cm on October 18; five samples examined October 18 to November 23 had mean lengths 25.5-25.6 cm (Table 1). Females grew from 20.0 to 28.2 cm over the same period; five samples examined October 18 to November 23 had mean lengths 28.1-28.4 cm. Dispersion about the mean was less in the more leptokurtic male length frequencies where coefficients of variation were 3.54 to 8.57; in females, which grew to a larger size, these were 5.20 to 10.40 (Table 1). Average growth per month to "asymptotic length" was thus 20 mm for males and 27 mm for females; however, growth per month in successive monthly periods commencing mid-July decreased from 24-18-16 mm for males and 34-26-23 mm for females, both by October 18.

Most samples taken at Rencontre West August 7 to October 16, 1967, were also unimodal although a few were bimodal (Fig. 4). The unimodal distributions were positively skewed so that arithmetic means were higher than those calculated from the cumulative probability plots; this I attribute to slight admixture of group I squid. Group III predominated in 2 catches and appeared as a second modal group in a third. Adjusted mean male mantle lengths for group'II increased from 16.9 cm on August 7 to 23.0 cm on October 16 at which time "asymptotic length" seemed to be approached. Females grew from 17.3 cm on August 7 to 24.3 cm on October 9 when "asymptotic length" was apparently reached; a sample taken on October 16 had a mean mantle length of 24.2 cm. As found in Holyrood samples, variability was less in males, V = 5.56 to 8.11, than in females, V = 6.01 to 8.55, for unimodal distributions (Table 1).

Average growth per month from August 14-September 13 was 42 mm for males and 52 mm for females and from September 13 to October 9 it was 30 mm for both sexes (Fig. 6). Modes for the principal size group increased from 17 to 23 and 18 to 25 cm in males and females, respectively (Fig. 4). October samples were bimodal, containing groups of smaller squid.

## 1971

All samples from Holyrood, July 6 to November 9-10, 1971, had unimodal leptokurtic distributions of group I squid. Modes increased from 17 and 18 cm to 24 and 27 cm for males and females, respectively. In contrast to samples obtained in 1967 the early length frequencies were positively skewed. Unadjusted mean mantle lengths increased from 17.9 cm and 18.3 cm to 24.0 cm and 26.4 cm for males and females, respectively (Table 1). No samples were obtained between September 10 and November 1 by which time "asymptotic length" had been approached. The increase in unadjusted mean mantle length between November 1 and November 10 was 1 mm for males and 3 mm for females; the latter difference can be eliminated by adjustment for skew. "Asymptotic lengths" were about 15 mm and 20 mm lower for males and females, respectively, than those observed in 1967. Growth per month was also lower than that observed in 1967; in two successive months commencing mid-July it decreased from 22 to 17 mm for males and 25 to 21 mm for females.

# <u> 1973</u>

The three samples obtained at Holyrood July 20 to August 22, 1973, had unimodal leptokurtic distributions, the first two of which were positively skewed and the last negatively. Characteristics of the distributions approximated those observed in previous years (Table 1).

### Discussion

Squires (1957, 1967) reported substantial homogeneity in length distributions of <u>Illex</u> <u>illecebrosus</u> at Newfoundland, finding only one modal class except in November of some years. He reported the appearance inshore of a group of small squid in November, 1952 (Squires, 1957, Fig. 9) and cited fishermen's reports of small squid inshore in southern Newfoundland late in the season.

Given a homogeneous age composition, between year and regional differences are still to be expected in the size composition of a short-lived rapidly growing species in response to variability in such factors as temperature and availability of food. However, results presented here indicate

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the presence of distinct modal classes which can be followed throughout the season in a given area, especially in 1966. This suggests presence of mixed age groups within a single year-class, possibly related to a protracted spawning season and area (Mercer, 1969a). The general pattern observed at Newfoundland is that the larger size classes of squid range farther north than do the smaller (cff 1967 data, Fig. 4). Positive skewness in Rencontre West samples contrasted with negative skewness observed at Holyrood in 1967 can be interpreted as resulting from slight admixture of the two size groups and in this case the adjustment for skew applied in analyzing length compositions produces more accurate estimates of mean sizes for the size groups.

Squires (1967) suggested a range of spawning from January to June with a major winter spawning at an age of about one year. I concur that populations fished at Newfoundland probably spawn and die in winter. An analogy can be drawn with the second southward migratory group of <u>Todarodes pacificus</u> at Japan as documented by Hamabe and Shimizu (1966); this group is purported to have a life span of one year, to mature at about the same size as <u>Illex illecebrosus</u> at Newfoundland (cff Mercer, 1973b), and to undergo an extensive southward migration in the same season. I have previously noted a decline in the proportion of male <u>Illex illecebrosus</u> inshore at Newfoundland late in the season (Mercer, 1973b) and suggested that this may relate to offshore migration of mature males. Such a circumstance apparently occurs in the analogous group of <u>T. pacificus</u> as Hamabe and Shimizu (1966) note that mature males preponderate in the southwestern Sea of Japan at the time of arrival of the group, the sex composition equalizing as more females retreat from the north.

It remains now to collate size and maturity data for offshore areas, particularly Subarea 5 Statistical Area 6 where summer fisheries for <u>Illex illecebrosus</u> have recently developed. A perusal of the author's limited unpublished data from this region indicates the possibility of distinguishing spawning groups analogous to those proposed for <u>I. pacificus</u>; however, the need for further detailed sampling is indicated.

# References

- Cassie, R. M. 1950. The analysis of polymodal frequency distributions by the probability paper method. New Zeal. Sci. Rev. 8: 89-91.
- Hamabe, M. and T. Shimizu. 1966. Ecological studies on the common squid, <u>Todarodes pacificus</u> Steenstrup, mainly in the southwestern waters of the Sea of Japan. Bull. Jap. Sea Fish. Res. Lab. 16: 13-55 (in Japanese). (Cited from Fish. Res. Board Can. Transl. Ser. No. 812).
- Harding, J. P. 1949. The use of probability paper for the graphical analysis of polymodal frequency distributions. J. Mar. Biol. Ass. 28: 141-153.
- Mercer, M. C. 1965. Contribution to the biology of the short-finned squid, <u>Illex illecebrosus</u> (LeSueur), in the Newfoundland area. Fish. Res. Board Can. MS Rept. Ser. (Biol). No. 834, 36 p.

1966. Squid investigations. Fish. Res. Board Can. St. John's Biol. Sta. Circ. 13: 42-48, 4 figs.

1969a. Biological characteristics of migrant ommastrephid squid, <u>Illex</u> <u>illecebrosus</u> (LeSueur), in the Newfoundland area. Amer. J. Zool. 9: 618-619.

1969b. <u>A. T. Cameron</u> cruise 130, otter-trawl survey from southern Nova Scotia to Cape Hatteras, March-April 1967. Fish. Res. Board Can. Tech. Rept. 103: 24 p.

1969c. <u>A. T. Cameron</u> cruise 150, otter-trawl survey of the Mid-Atlantic Bight, August-September 1968. Fish. Res. Board Can. Tech. Rept. 122: 47 p.

1970. <u>A. T. Cameron</u> cruise 157, otter-trawl survey of the southwestern North Atlantic, February 1969. Fish. Res. Board Can. Tech. Rept. 199: 66 p.

1973a. Distribution and biological characteristics of the ommastrephid squid <u>Illex</u> <u>illecebrosus</u> (LeSueur) on the Grand Bank, St. Pierre Bank and Nova Scotian Shelf (Subareas 3 and 4) as determined by otter-trawl surveys 1970 to 1972. Intern. Comm. Northw. Atlant. Fish. Res. Doc. 73/79, Ser. No. 3031, 11 p.

1973b. Sexual maturity and sex ratios of the ommastrephid squid, <u>Illex illecebrosus</u> (LeSueur), at Newfoundland (Subarea 3). Intern. Comm. Northw. Atlant. Fish. Res. Doc. 73/71, Ser. No. 3023, 14 p.

- Mercer, M. C. and G. Paulmier. 1974. Distribution and biological characteristics of the Short-finned Squid (<u>111ex illecebrosus</u>) on the continental shelf of Subareas 3 and 4 in May-June, 1973. Intern. Comm. Northw. Atlant. Fish. Res. Doc. 74/87, Ser. No. 3323, 11 p.
- Simpson, G. G., A. Roe and R. C. Lewontin. 1960. Quantitative Zoology. Harcourt, Brace and <sup>Co.</sup> Inc., N.Y., 440 p.

Squires, H. J. 1957. Squid, <u>Illex illecebrosus</u> (LeSueur), in the Newfoundland fishing area. J. Fish. Res. Board Can. 14: 693-728.

1967. Growth and hypothetical age of the Newfoundland bait squid <u>Illex</u> <u>illecebrosus</u>. <u>illecebrosus</u>. Ibid. 24: 1209-1217.

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$ \begin{bmatrix} 1/4 & 23 \\ 20.9 & 10.90 & 233.0^{8} + 1486 \\ 19.3 + 1634 \\ 19 & 26 & 286 \\ 28 & 20 & 19.5 & 5.44 \\ 28 & 20 & 19.5 & 5.44 \\ 28 & 210 & 19.5 & 5.44 \\ 210 & 5.62 & 20.0 + 1157 \\ 210 & 5.62 & 210 & 5.62 \\ 210 & 210 & 5.62 & 20.0 + 1157 \\ 210 & 5.62 & 210 & 5.62 & 20.0 + 1157 \\ 210 & 5.62 & 210 & 5.62 & 20.0 + 1157 \\ 211 & 211 & 22 & 211 & 5.44 & 213 + 1867 \\ 212 & 211 & 213 & 214 + 1322 \\ 212 & 211 & 213 & 214 + 1332 \\ 212 & 211 & 213 & 214 + 1332 \\ 212 & 211 & 213 & 221 & 211 & 213 + 1887 \\ 212 & 211 & 212 & 211 & 5.99 & 22.11 & 1441 \\ 211 & 22 & 211 & 0 & 5.62 & 210 & 7.24 & 231 + 2234 \\ 212 & 211 & 222 & 221 & 0 & 147 & 222 & 221 & 7.24 & 231 + 2234 \\ 212 & 213 & 221 & 2132 & 0 & 147 & 222 & 221 & 7.26 & 5.47 & 2334 + 223 \\ 212 & 223 & 231 & 5 & 232 & 6 & 1332 & 0 & 147 & 226 & 241 & 233 + 22334 \\ 212 & 223 & 231 & 5 & 232 & 5 & 6 & 243 & 7 & 2334 & 0 \\ 212 & 223 & 231 & 5 & 232 & 5 & 6 & 243 & 7 & 2334 & 264 & 7 & 2334 & 234 \\ 212 & 223 & 231 & 232 & 5 & 264 & 1332 & 0 & 147 & 256 & 243 & 234 & 234 & 244 & 7 & 2352 & 266 & 244 & 234 & 234 & 244 & 235 & 266 & 244 & 234 & 244 & 235 & 266 & 244 & 244 & 236 & 266 & 7 & 2334 & 266 & 7 & 2334 & 266 & 7 & 2334 & 266 & 7 & 2334 & 266 & 7 & 2334 & 266 & 244 & 7 & 236 & 266 & 7 & 2334 & 266 & 266 & 7 & 2334 & 266 & 7 & 2334 & 266 & 266 & 7 & 2334 & 266 & 266 & 7 & 2334 & 266 & 266 & 7 & 2334 & 266 & 266 & 7 & 2334 & 266 & 266 & 7 & 2334 & 266 & 266 & 7 & 2334 & 266 & 266 & 7 & 2334 & 266 & 266 & 7 & 2334 & 266 & 266 & 7 & 2334 & 266 & 266 & 7 & 2334 & 266 & 266 & 7 & 2334 & 266 & 266 & 7 & 2334 & 26$	1/4         23         20.9         10.90 $23.0^{64} + 1486$ 181 $25$ $0od - 1967$ :         19         19.5 + .1126         19.5 + .1126         19.5 + .1126         19         19         19         19         19         19         19         19         19         19         18 $5.46$ 19.5 + .1126         19         287         19         19         19         19         18 $6.25$ $5.145$ $21.07 + .1269$ 0         287         19         19         19         287         21 $7.17$ 297         21 $27.65$ 21 $27.65$ 21 $27.65$ 21 $27.65$ 21 $27.65$ 21 $27.65$ 21 $27.65$ 21 $27.65$ 21 $27.65$ 21 $27.65$ 21 $27.65$ 21 $27.65$ 21 $27.65$ 21 $27.65$ 21 $27.65$ 21         27         22         22         22         22         23         22         24         22         22         23         23         23         23         23         23 <td< td=""><td></td><td>169</td><td>22</td><td>22.0</td><td></td><td></td><td>+ ~ - ~ -</td><td>. 2262</td><td></td><td>247</td><td>24 19</td><td>23.4</td><td>9.54</td><td>+ +</td><td>120</td><td></td></td<>		169	22	22.0			+ ~ - ~ -	. 2262		247	24 19	23.4	9.54	+ +	120	
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	ood - 1967:         1967:           17         297         19         18.6         5.46         19.5 $\pm$ .1126         0         287         19           17         276         21         19.5         5.44         20.7 $\pm$ .1269         0         287         19           18.6         5.46         19.5         5.44         20.7 $\pm$ .11269         0         287         19           14         276         21         19.5         5.25         21.2 $\pm$ .1392         -         177         22           14         276         21         19.5         5.23         21.4 $\pm$ .1342         0         266         21         27         22         21.0         233         22.2.14 $\pm$ .1904         22         23         23         23.5         5.83         21.4 $\pm$ .1342         0         194         22         24         22         23         23         23.5         23.9 $\mp$ .23.3         23.5         23.9 $\mp$ .23.3         23.5         23.9 $\mp$ .23.3         23.6 $\mp$ .23.3         23.6 $\pm$ .23.3         23.6 $\pm$ .1387         0         147         22         24           19         201         25.5         24.1 $\pm$ .1382         0         147         26         24		174	53	20.9		•	+ +  0 0 0	.1486 .1634		181	19	22.1	13.24	+ +   + +	355	- 6 -
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	$ \begin{bmatrix} 17 & 297 & 19 & 18.6 & 5.46 & 19.5 \pm .1126 & 0 & 287 & 19 \\ 258 & 20 & 19.5 & 5.44 & 20.7 \pm .1269 & 0 & 206 & 21 \\ 12 & 276 & 21 & 19.5 & 5.44 & 20.7 \pm .1392 & - & 177 & 22 \\ 14 & 216 & 22 & 21.0 & 5.99 & 22.14 \pm .1342 & 0 & 194 & 22 \\ 15 & 212 & 222 & 21.0 & 5.99 & 22.74 \pm .1304 & - & 238 & 23 \\ 15 & 213 & 22 & 23.5 & 5.82 & 23.9 \pm .2338 & 0 & 147 & 22 \\ 28 & 220 & 24 & 23.0 & 4.96 & 24.2 \pm .1314 & - & 238 & 236 \\ 28 & 220 & 24 & 23.0 & 4.96 & 24.2 \pm .1314 & - & 238 & 256 \\ 28 & 29 & 224 & 23.0 & 4.96 & 24.2 \pm .1338 & - & 181 & 22 \\ 28 & 200 & 24 & 23.0 & 4.96 & 24.2 \pm .1338 & - & 181 & 256 \\ 28 & 29 & 224 & 23.0 & 4.96 & 24.2 \pm .1338 & - & 188 & 226 \\ 28 & 299 & 24 & 23.5 & 3.97 & 24.7 \pm .2269 & 0 & 147 & 256 \\ 28 & 99 & 24 & 23.5 & 3.97 & 24.7 \pm .2269 & 0 & 147 & 256 \\ 28 & 201 & 25 & 25.6 & 3.1738 & - & 188 & 228 & 266 \\ 28 & 214 & 21338 & - & 11338 & - & 188 & 228 \\ 28 & 201 & 25 & 25.6 & 3.174 & - & 188 & 228 \\ 28 & 201 & 25 & 25.6 & 3.174 & - & 188 & 228 \\ 28 & 201 & 25 & 5.4 & 11308 & - & 182 & 256 \\ 28 & 210 & 28 & 24.7 & 25.6 & 11374 & - & 188 & 266 \\ 28 & 28 & 28 & 28.6 & 24.174 & - & 288 & 266 \\ 28 & 201 & 25 & 5.4 & 11308 & - & 182 & 256 \\ 28 & 28 & 28 & 28.6 & 28.1337 & 0 & 200 & 288 \\ 28 & 201 & 25 & 5.4 & 11308 & - & 182 & 288 \\ 28 & 201 & 25 & 5.4 & 11308 & - & 182 & 288 \\ 28 & 201 & 25 & 5.4 & 11308 & - & 182 & 288 \\ 28 & 201 & 25 & 5.4 & 11308 & - & 245 & 288 \\ 28 & 28 & 28 & 28 & 28 & 286 & - & 11308 & - & 245 & 288 \\ 28 & 28 & 28 & 28 & 28 & - & 1477 & - & 245 & 288 \\ 28 & 28 & 28 & 28 & - & 1477 & - & 245 & 288 \\ 28 & 28 & 28 & - & 1477 & - & 245 & 288 & - & 246 $	- 1															
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	17       297       19       18.6       5.46       19.5 $\pm$ .1126       0       287       19         1       276       21       19.5       5.44       20.7 $\mp$ .1269       0       206       21         1       276       21       19.5       5.44       20.7 $\mp$ .1269       0       206       21         14       216       22       21.2 $\mp$ .1392       -       177       22         24       271       23       21.14       1342       0       194       22         21       248       271       22       21.4       203       22.14 $\pm$ .1392       -       177       22         21       222       21.0       5.93       21.4 $\mp$ .1342       0       194       22         21       222       21.0       5.93       22.4 $\pm$ .1904       -       23       23         19       222       23.3       23.4 $\mp$ .1342       0       147       22         28       230       24.4 $\mp$ .1382       -       233       26       23         28       220       24.7 $\mp$ .2369       0       147       26       26         28       23.5       54.7			;						1	100	•	(			ł	4
$ \begin{bmatrix} 2.06 & 21 & 19.5 & 6.25 & 21.2 \pm 1392 & - & 1// & 22 & 21.0 & 6.4/ & 21.8 \pm 1812 & - \\ 14 & 216 & 22 & 21.0 & 5.99 & 22.14 \pm 1342 & 0 & 194 & 22 & 22.0 & 7.21 & 22.3 \pm 2237 & 0 \\ 15 & 22 & 21.0 & 5.99 & 22.2 \pm 1441 & - & 238 & 23 & 23.2 \pm 2244 & - \\ 15 & 22 & 21.0 & 8.57 & 22.4 \pm 1904 & - & 238 & 23 & 22.6 & 8.47 & 23.5 \pm 2058 & 0 \\ 16 & 218 & 22 & 23.0 & 4.95 & 23.9 \pm 2338 & 0 & 147 & 25(23) & 25.7 \pm 2348 & - 1 \\ 18 & 201 & 24 & 23.0 & 4.95 & 24.4 \pm 1382 & - & 203 & 265 & 26.1 & 7.49 & 26.7 \pm 2333 & 1 \\ 28 & 220 & 24 & 23.0 & 4.95 & 24.4 \pm 1382 & - & 203 & 266 & 24.3 & 7.87 & 26.1 \pm 2234 & - \\ 28 & 220 & 24 & 23.0 & 4.95 & 24.7 \pm .2269 & 0 & 147 & 25(23) & 25.6 & 17.49 & 26.5 \pm .2333 & 0 \\ 28 & 220 & 24 & 23.0 & 4.95 & 24.7 \pm .2269 & 0 & 142 & 26.1 & 7.49 & 26.1 \pm .2234 & - \\ 28 & 220 & 24 & 23.0 & 4.95 & 24.7 \pm .2269 & 0 & 142 & 26.5 & 5.66 & 24.3 & 7.87 & 26.1 \pm .2234 & - \\ 28 & 201 & 25 & 24.5 & 4.11 & 25.6 \pm .1308 & - & 182 & 28.5 & 5.38 & 28.1 \pm .2209 & - \\ 28 & 201 & 25 & 25.6 \pm .1308 & - & 182 & 28.2 & 28.1 \pm .2049 & 0 \\ 6 & 148 & 25 & 25.6 \pm .1308 & - & 182 & 28 & 28.0 & 5.30 & 28.4 \pm .1719 & 0 \\ 6 & 148 & 25 & 25.6 \pm .1300 & - & 178 & 28 & 28.0 & 5.30 & 28.4 \pm .1719 & 0 \\ 6 & 148 & 25 & 25.6 \pm .1300 & - & 178 & 28 & 28.0 & 5.30 & 28.4 \pm .1719 & 0 \\ 6 & 148 & 25 & 25.6 \pm .1300 & - & 178 & 28 & 28.0 & 5.30 & 28.4 \pm .1719 & 0 \\ 6 & 148 & 25 & 25.6 \pm .1300 & - & 178 & 28 & 28.0 & 5.30 & 28.4 \pm .1719 & 0 \\ 6 & 148 & 25 & 25.6 \pm .1300 & - & 178 & 28 & 28.0 & 5.30 & 28.4 \pm .1719 & 0 \\ 6 & 148 & 25 & 25.6 \pm .1300 & - & 178 & 28 & 28.0 & 5.30 & 28.4 \pm .1719 & 0 \\ 6 & 148 & 25 & 25.6 \pm .1300 & - & 178 & 28 & 28.0 & 5.30 & 28.4 \pm .1719 & 0 \\ 6 & 148 & 25 & 25.6 \pm .1300 & - & 178 & 28 & 28.0 & 5.30 & 28.4 \pm .1719 & 0 \\ 6 & 148 & 25 & 25.6 \pm .1337 & 0 & 200 & 28 & 28.0 & 5.30 & 28.4 \pm .1719 & 0 \\ 6 & 148 & 25 & 25.6 \pm .1337 & 0 & 200 & 28 & 28.0 & 28.4 \pm .1719 & 0 \\ 6 & 148 & 25 & 25.6 \pm .1337 & 0 & 200 & 28 & 28.0 & 28.4 \pm .1719 & 0 \\ 6 & 148 & 26 & 26 & 24.4 \pm .1718 & 26 & 24.4 \pm .1718 & 26 & 24.4 \pm .1718 &$	I       Z/6       ZI       19.5       6.25       ZI. $\frac{2}{4}$ , 1342       -       1//       Z2         14       216       22       21.6       5.99       22.1 $\frac{14}{14}$ , 1342       0       194       22         24       271       22       21.0       5.99       22.1 $\frac{14}{14}$ , 1342       0       194       22         1       248       22       23.3       22.5       4       1867       -       181       22         15       125       23.0       8.57       22.4       13441       -       238       23         19       201       24       23.5       5.82       23.9       24.4       23       26       23         28       220       24       24.0       4.48       24.4       1382       26       23       26         28       220       24       23.6       24.7       25.6       1374       -       185       26         28       201       25       3.97       24.7       25.6       1374       -       185       26         29       26       24.5       1374       -       186       27       23       26       26		258 258	50	19.5	5.40 1440	22	+ +  ^	.1269	20	28/	521	20.5	5.02 6.24	+ +  ⊃ო⊂	239	<b>)</b> 1
258       21       20.5       5.66       21.4 ± .1342       0       194       22       22.0       7.21       22.3 ± .2234       -         14       216       22       21.0       5.99       22.14 ± .1342       0       194       22       22.0       7.21       22.3 ± .2234       -       -         15       210       5.99       22.14 ± .1367       -       181       22       22.0       7.24       23.1 ± .2244       -       -       -       181       22       22.14 ± .1328       0       -       -       181       22       22.0       7.24       23.1 ± .2244       -       -       -       181       22       22.1 ± .2244       -       -       181       22       22.1 ± .2244       -       -       233       23.5       5.30       23.5       5.30       23.5       5.30       23.6       5.30       23.6       5.30       23.6       5.30       23.6       1.30       23.6       1       23.6       25.7       23.6       1       23.6       25.7       23.6       26.1 ± .2234       -       23.6       26.1 ± .2339       1       23.6       26.1 ± .2339       1       23.6       26.1 ± .2334       23.6       26.1 ±	14       21       20.5       5.83       21.4 ± .1342       0       194       22         14       216       22       21.5       7.33       22.7±       1441       -       1867       -       181       22         15       125       22       21.5       7.33       22.2±       1441       -       238       23         15       125       22.2       21.0       5.99       22.14 ± .1904       -       238       23         15       125       23.1       8.57       22.4 ± .1904       -       238       23         28       220       24       24.0       4.45       24.7 ± .1332       0       147       25(23)         28       220       24       24.0       4.4 ± .1332       0       147       25(23)         28       220       24       24.0       4.4 ± .1332       0       147       25(23)         28       220       24       24.1       23.6       24.7 ± .2269       0       147       28         29       26       24.5       4.11       25.6 ± .1308       0       142       28         2148       255       25.6 ± .1308       0	_	276	23	19.5	6.25		++	.1392	. (	1/1	22	21.0	6.47	+  · ∞ «	212	
14 $Z10$ $2.2$ $Z1.1$ $5.99$ $Z2.1+1$ $186/$ $Z2$ $Z2.1$ $Z2.1+1$ $Z24$ $Z2.1$ $Z2.1+1$ $Z24$ $Z2.1$ $Z2.1+1$ $Z24$ $Z2.1$	14 $Z10$ $Z2$ $Z1, U$ $9.99$ $Z22, P+ 1860$ $-181$ $Z2$ 1 $Z48$ $Z22$ $Z1, U$ $9.99$ $Z22, 2+ 1441$ $-228$ $238$ $23$ 15 $125$ $222$ $21.5$ $7.33$ $22.2.7 + 1800$ $-222$ $238$ $23$ 19 $201$ $22$ $21.0$ $8.57$ $22.4 + 1904$ $-222$ $238$ $23$ 28 $220$ $24$ $23.0$ $4.48$ $24.4 + 13382$ $ 203$ $26$ 28 $220$ $24$ $23.0$ $4.95$ $24.2 + 1374$ $ 203$ $26$ 29 $24$ $23.5$ $3.97$ $24.7 + 2269$ $0$ $147$ $22$ $26$ 23 $186$ $25.5$ $4.11$ $25.6 + 1337$ $0$ $142$ $28$ $26$ 26 $148$ $25.6 + 1337$ $0$ $1312$ $28$ $26$ $26$ $26$ $26$ $26$ $26$ $26$ $26$ $26$ $26$ <td< td=""><td></td><td>258</td><td>2</td><td>20.5</td><td>5.83</td><td></td><td>+  ·</td><td>.1342</td><td>Ð</td><td>194</td><td>22</td><td>22.0</td><td>12.7</td><td>+  - m =</td><td>10</td><td>5</td></td<>		258	2	20.5	5.83		+  ·	.1342	Ð	194	22	22.0	12.7	+  - m =	10	5
1       248       22       21.0       8.57       22.4 $\pm$ 1904       -       222       24       23.4       10.40       23.6 $\pm$ 3828       -       -       1         15       125       23       23.0       4.48       23.4 $\pm$ 1904       -       222       24       23.4       10.40       23.6 $\pm$ 3888       -       -       1         19       201       24       23.0       4.48       24.4 $\pm$ 1382       -       2338       0       147       25(23)       25.0       7.30       25.6 $\pm$ 2339       1       2 <t< td=""><td>1       248       22       21.0       8.57       22.4       1904       -       222       24         15       125       23       23       2       4       -       1382       2       2         19       201       24       23.5       5.82       23.9       +       1382       2       2         28       220       24       24.0       4.48       24.4       -       1382       2       26         28       220       24       23.0       4.95       24.2       -       1382       26         28       220       24       23.6       24.7       -       1382       2       26         28       220       24       23.5       3.97       24.7       -       203       26         28       201       25       24.1       25.6       -       1308       -       185       26         23       186       25       24.1       25.6       -       1308       -       182       28         26       148       25.6       4.11       25.6       +       1308       -       182       28         27       2</td><td>ug. 14</td><td>212</td><td>200</td><td>21.0</td><td>5, 53 53</td><td>36</td><td>+   +</td><td>100/</td><td>1</td><td>181</td><td>77</td><td>22.0</td><td>47 /</td><td>+   +  u</td><td>15.0</td><td>ı c</td></t<>	1       248       22       21.0       8.57       22.4       1904       -       222       24         15       125       23       23       2       4       -       1382       2       2         19       201       24       23.5       5.82       23.9       +       1382       2       2         28       220       24       24.0       4.48       24.4       -       1382       2       26         28       220       24       23.0       4.95       24.2       -       1382       26         28       220       24       23.6       24.7       -       1382       2       26         28       220       24       23.5       3.97       24.7       -       203       26         28       201       25       24.1       25.6       -       1308       -       185       26         23       186       25       24.1       25.6       -       1308       -       182       28         26       148       25.6       4.11       25.6       +       1308       -       182       28         27       2	ug. 14	212	200	21.0	5, 53 53	36	+   +	100/	1	181	77	22.0	47 /	+   + u	15.0	ı c
$ \begin{bmatrix} 15 & 125 & 23 & 23.5 & 5.82 & 23.9 + 2338 & 0 & 147 & 25(23) & 25.0 & 7.30 & 25.7 + 2878 & 1 \\ 19 & 201 & 24 & 24.0 & 4.48 & 24.4 + 1382 & - & 203 & 26.1 & 7.49 & 26.2 + 2339 & 1 \\ 28 & 220 & 24 & 23.0 & 4.95 & 24.2 + 1374 & - & 185 & 26 & 26.1 & 7.49 & 26.2 + 2333 & 1 \\ 28 & 220 & 24 & 23.5 & 3.97 & 24.7 + 2269 & 0 & 142 & 26 & 26.5 & 5.56 & 26.9 + 2352 & 0 \\ 38 & 99 & 24 & 23.5 & 3.97 & 24.7 + 2269 & 0 & 142 & 26 & 26.5 & 5.56 & 26.9 + 2333 & 1 \\ 18 & 201 & 25 & 25.5 & 3.76 & 25.6 + 1308 & - & 182 & 28 & 28.5 & 5.38 & 28.1 + 2049 & 0 \\ 28 & 201 & 25 & 25.6 & 3.67 & 25.6 + 1308 & - & 182 & 28 & 27.0 & 5.34 & 28.1 + 2049 & 0 \\ 28 & 24.5 & 4.11 & 25.6 + 1308 & - & 182 & 28 & 27.0 & 5.34 & 28.1 + 2049 & 0 \\ 5 & 148 & 25 & 25.5 & 3.67 & 25.6 + 1330 & - & 178 & 28 & 270 & 5.34 & 28.1 + 1022 & - \\ 5 & 205 & 25.5 & 3.67 & 25.6 + 1330 & - & 178 & 28 & 270 & 5.34 & 28.1 + 1022 & - \\ 5 & 205 & 25.5 & 3.67 & 25.6 + 1330 & - & 178 & 28 & 270 & 5.34 & 28.1 + 1022 & - \\ 5 & 205 & 25.5 & 3.67 & 25.6 + 1330 & - & 178 & 28 & 270 & 5.34 & 28.1 + 1022 & - \\ 5 & 205 & 205 & 205 & 206 & - & 1300 & - & 178 & 228 & 270 & 5.34 & 28.1 + 1022 & - \\ 5 & 205 & 205 & 205 & 5.20 & 208.4 + 1719 & - & \\ 5 & 205 & 205 & 205 & 5.20 & 208.4 + 1719 & - & \\ 5 & 205 & 205 & 5.20 & 208.4 + 1719 & - & \\ 5 & 205 & 205 & 206 & - & 178 & - & & \\ 5 & 205 & 205 & 5.20 & 208.4 + 1719 & - & \\ 5 & 205 & 205 & 5.20 & 208.4 + 1719 & - & \\ 5 & 205 & 205 & 5.20 & 208.4 + 1719 & - & \\ 5 & 205 & 205 & 5.20 & 208.4 + 1719 & - & \\ 5 & 205 & 205 & 5.20 & 208.4 + 1719 & - & \\ 5 & 205 & 205 & 5.20 & 208.4 + 1719 & - & \\ 5 & 205 & 205 & 5.20 & 208.4 + 1719 & - & \\ 5 & 205 & 205 & 206 & 200 & 208.4 + 1779 & - & \\ 5 & 205 & 205 & 206 & 206 & 206 & 206 & - & & \\ 5 & 205 & 205 & 206 & 206 & 206 & - & & & \\ 5 & 205 & 205 & 206 & 206 & - & & & & \\ 5 & 205 & 205 & 206 & 206 & - & & & & & \\ 5 & 205 & 205 & 206 & 206 & - & & & & & \\ 5 & 205 & 205 & 206 & 206 & - & & & & & \\ 5 & 205 & 205 & 206 & 206 & - & & & & & & \\ 5 & 205 & 205 & 206 & - & & & & & & \\ 5 & 205 & 205 & 20$	$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	ant l	248	26	0.12	8 57 57	38		1904	1	220	77.	23.4	10 40	+l+ ⊳vo	800	
$ \begin{bmatrix} 19 & 201 & 24 & 24.0 & 4.48 & 24.4 \mp .1382 & - & 203 & 26 & 26.1 & 7.49 & 26.2 \mp .2339 & 1 \\ 28 & 220 & 24 & 23.0 & 4.95 & 24.2 \mp .1374 & - & 185 & 26 & 24.3 & 7.87 & 26.1 \mp .2234 & - \\ 3 & 99 & 24 & 23.5 & 3.97 & 24.7 \pm .2269 & 0 & 142 & 26 & 26.5 & 5.56 & 26.9 \mp .2352 & 0 \\ 18 & 201 & 25 & 25.5 & 3.76 & 25.6 \mp .1286 & 0 & 131 & 28 & 28.5 & 5.38 & 28.2 \mp .2209 & - \\ 23 & 186 & 25 & 24.5 & 4.11 & 25.6 \mp .1308 & - & 182 & 28 & 27.0 & 5.34 & 28.1 \pm .2049 & 0 \\ 6 & 148 & 25 & 25.6 & 3.57 & 25.5 \mp .1337 & 0 & 200 & 28 & 27.0 & 5.34 & 28.1 \pm .2049 & 0 \\ 6 & 148 & 25 & 25.5 & 3.57 & 25.5 \pm .1337 & 0 & 200 & 28 & 27.0 & 5.34 & 28.1 \pm .2049 & 0 \\ 6 & 148 & 25 & 25.5 & 3.57 & 25.5 \pm .1337 & 0 & 200 & 28 & 27.5 & 5.20 & 28.4 \pm .1719 & 0 \\ 6 & 148 & 25 & 25.5 & 3.57 & 25.5 \pm .1337 & 0 & 200 & 28 & 27.5 & 5.20 & 28.4 \pm .1719 & 0 \\ 6 & 148 & 25 & 25.5 & 3.57 & 25.5 \pm .1337 & 0 & 200 & 28 & 27.5 & 5.20 & 28.4 \pm .1719 & 0 \\ 6 & 148 & 25 & 25.5 & 3.57 & 25.5 \pm .1337 & 0 & 200 & 28 & 27.5 & 5.20 & 28.4 \pm .1719 & 0 \\ 6 & 148 & 26 & 26 & 26 & 26 & 26 & 26 & 26 & 2$	19       201 $24$ $24.0$ $4.48$ $24.4\overline{1}$ . 1382       -       203 $26$ 28       220 $24$ $23.5$ $3.97$ $24.2\overline{1}$ . 1374       -       185 $26$ 3       99 $24$ $23.5$ $3.97$ $24.7\overline{1}$ . 2269       0       142       26         18       201 $25.5$ $3.76$ $25.6\overline{1}$ . 1286       0       131       28         23       186       25 $24.7\overline{1}$ $25.6\overline{1}$ . 1286       0       131       28         23       186       25 $24.11$ $25.6\overline{1}$ . 1308       -       182       28         23       186       25 $24.5$ $4.11$ $25.6\overline{1}$ . 1308       -       182       28         26       148 $25.5\overline{6}$ $4.137$ $25.5\overline{6}$ $-11300$ 200       28         15       205 $25.5\overline{6}$ $-1337$ 0 $200$ 28       28         28       28.5 $25.5\overline{6}$ $-1300$ - $1778$ 28       28         29       28.5 $25.5\overline{6}$ $-1477$		125	23	23.5	5.82	5	+ 0	2338	0	147	25(23)	25.0	7.30	+	178	12
28       220       24       23.0       4.95       24.2 ± .1374       -       185       26       24.3       7.87       26.1 ± .2234         3       99       24       23.5       3.97       24.7 ± .2269       0       142       26       26.5       5.56       26.9 ± .2352         18       201       25       25.5       3.76       25.6 ± .1286       0       131       28       5.38       28.5       5.38       28.2 ± .2209         23       186       25       24.11       25.6 ± .1308       -       182       28       28.5       5.38       28.1 ± .2209         23       186       25       24.11       25.6 ± .1308       -       182       28       28.1 ± .2049         26       148       25       25.10       3.54       25.5 ± .1337       0       200       28       28.1 ± .2049         15       205       25.5       2.1337       0       200       28       28.1 ± .1719         26       26.5       3.67       25.6 ± .1300       -       178       28       28.4 ± .1719	28       220       24       23.0       4.95       24.2 ± .1374       -       185       26         3       99       24       23.5       3.97       24.7 ± .2269       0       142       26         18       201       25       25.5       3.76       25.6 ± .1286       0       142       28         23       186       25       24.11       25.6 ± .1286       0       131       28         23       186       25       24.11       25.6 ± .1308       -       182       28         6       148       25       25.5 ± .1308       -       182       28         15       205       25.6 ± .1308       -       178       28         21       25       25.1 3.57       25.6 ± .1300       -       178       28         21       205       25.6 ± .1300       -       178       28       28         23       241       25       25.5 ± .1477       -       245       28       28	-	201	24	24.0	4.48	24	+   +	.1382	•	203	26	26.1	7.49	+  ∾	139	13
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	~	220	24	23.0	4.95	2	+1	-	14	185	26	24.3	7.87	+  	234	
$ \begin{bmatrix} 23 & 186 & 25 & 24.5 & 4.11 & 25.6 + .1308 & - & 182 & 28 & 27.0 & 5.34 & 28.1 + .2049 \\ 6 & 148 & 25 & 25.6 & 3.54 & 25.5 + .1337 & 0 & 200 & 28 & 28.0 & 5.30 & 28.4 + .1719 \\ 15 & 205 & 25 & 25.5 & 3.67 & 25.6 + .1300 & - & 178 & 28 & 27.5 & 5.20 & 28.4 + .1822 \\ \end{bmatrix} $	$ \begin{array}{cccccccccccccccccccccccccccccccccccc$		99 102	24 25	23.5 25.5	3.97	້ຈັດ	+++	.2269	00	142	20 20	20°2	5,56	+  + 5 0	352	0
$ \begin{bmatrix} 6 & 148 & 25 & 25.0 & 3.54 & 25.5 + .1337 & 0 & 200 & 28 & 28.0 & 5.30 & 28.4 + .1719 \\ 15 & 205 & 25 & 25.5 & 3.67 & 25.6 + .1300 & - & 178 & 28 & 27.5 & 5.20 & 28.4 + .1822 \\ \end{bmatrix} $	6       148 $25$ $25.0$ $3.54$ $25.5 + 1337$ $0$ $200$ $28$ 15       205 $25$ $25.5 + 1300$ $ 178$ $28$ 23       241       25 $23.9$ $4.87$ $25.5 + 1477$ $ 245$ $28$		186		24.5	00 11	ă ă	-  +  +	1308	<b>)</b> I	181	800	0.02	5.34	⊦ + v –	501	1 C
. 15 205 25 25.5 3.67 25.6 $\overline{1}$ . 1300 - 178 28 27.5 5.20 28.4 $\overline{1}$ . 1822	. 15 205 25 25.5 3.67 25.6 $\overline{+}$ .1300 - 178 28 . 23 241 25 23.9 4.87 25.5 $\overline{+}$ .1477 - 245 28		148	55	25.0	3.54	121	ן אין אין	.1337	0	200	28	28.0	5.30	·  +	61	0
	. 23 241 25 23.9 4.8/ 25.5 <u>+</u> .14// - 245 28		205	25	25.5	3.67	22	۔ ۱+۱	.1300	•	178	28	27.5	5.20	4+  +	322	ı

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.... Cont'd

Table 1 (Cont'd):

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			MA	MALES					FEM	FEMALES		
Da to	No. examined	Modal	Arith Mi(cm)	^	Adj. <u>ML</u> +95% conf inter	Skew	No. examîned	Modal Class	<u>Ar</u> ith <u>ML(cm</u> )	٨	Adj. <u>ML</u> +95% conf. inter.	Skew
2	1 1			•								
Julv 6	422	17	17.9	7,81	17.3 + 0.1527	+	444	18	18.3	8.49	17.7 + 0.1274	+
Julv 12	344	18	18.5	7.41	-  +	+	281	61	[ 6]	7.71	18.7 ∓ 0,1742	4
	207	Ω Ω	18.3	7 05	17 5 T 0 1192	+	403	18	19.2	8 14	18.4 ∓ 0.1142	+
		2			-  -		26	2 6	20.3		10 5 1 0 3100	٦
July 28	5	ע	17.5	0.33	5	÷	77	3:		0,04	0/10 - 0/61	+ •
Aug. 3	224	<u>6[</u>	19.6	6,92		I	217	21	20.5	7.47		¢
4ug. 10		21	20.8	5.26	I	0	200	22	21.6	5.52		0
Aug. 18		21	21.3	5.29		0	228	22	21.9	5.36		0
Aug. 23		21	2].4	4.55		0	264	22	22.4	5.79	+	+
Nug. 31	237	22	22.0	4.20		0	218	23	22.8	5.88	$22.2 \pm 0.1527^{11}$	+
sept. 10		22	22.4	3.99		0	199	23	23.7	6.75	0  +	+
lov. 1		24	23.9	4.60		0	80	27	26.1	6.93	+	1
Nov. 9-10		24	24.0	4.30		0	140	26	26.4	6.39	с  +	+
4o]yrood	- 1973:			•								
Julv 20	352	6[	19.3	5.70	+	+	457	19	19.8	6.63	19.0 + 0.1742	+
	66	20	20.2	6.87	19.8 7 0.2538	+	601	2	21.1	7.85	20.6 + 0.2722	+
Aug. 22	232	22	21.8	6.82	+	ı	240	22	22.3	6.67	$22.9 \pm 0.1999$	1
					ł							
<sup>1</sup> Al thoug	<sup>1</sup> Although positive skew in distribution, range	skew in c	listributio	n, range	extends farther at lower end than in previous and subsequent samples.	lower end	than in pre	evious and	subsequen	it samples	. Plot from high end	

Although positive skew in distribution, range extends farther at lower and than in previous and subsequent samples. Flot from high and

gives curve. <sup>2</sup>St line fit very poor - left arm of curve very steep. <sup>2</sup>St line fit very poor - left arm of curve very steep. <sup>4</sup>The smaller mean from plot of cumm. freq. from upper end. Better fit to st line than other which is plotted from lower end. <sup>4</sup>The smaller mean is that of a second group in a bimodal distribution, comprising 61.6% of the sample. <sup>5</sup>Lower mean from plot beginning at smaller sizes where skew present. Higher from plot from higher sizes - better fit here. <sup>5</sup>Flower mean from plot of only 3 points - comprises only 13.8% of total. <sup>7</sup>Smaller means are those of a second group in a bimodal distribution comprising 57.5% of the males and 44.7 of the females. <sup>9</sup>Not plotted since appears to be a mixture of two size groups. <sup>10</sup>Calculated: mode = 3 median - 2X. <sup>11</sup>Log-prob plot. <sup>12</sup>See Fig. for possible second modal class.

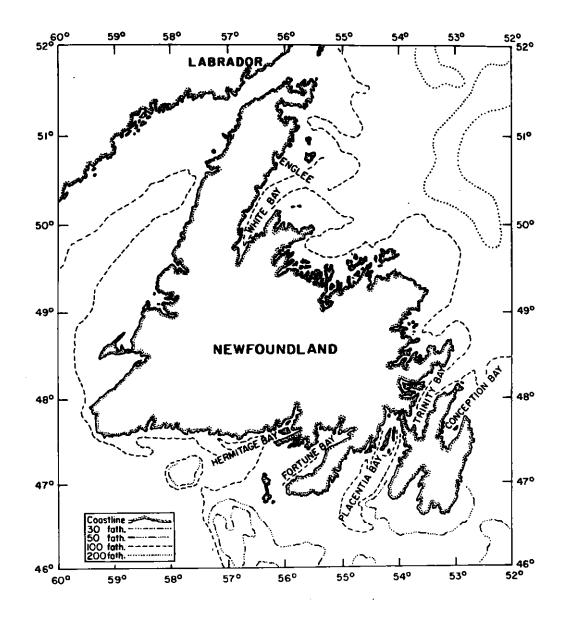


Fig. 1. Place names at Newfoundland mentioned in the text.

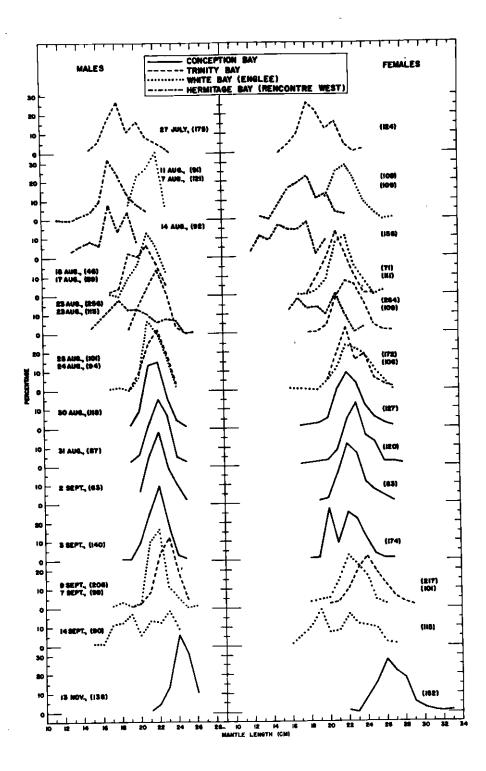


Fig. 2. Length distributions of <u>Illex illecebrosus</u> samples taken at Newfoundland in 1965. Numbers indicate sample sizes.

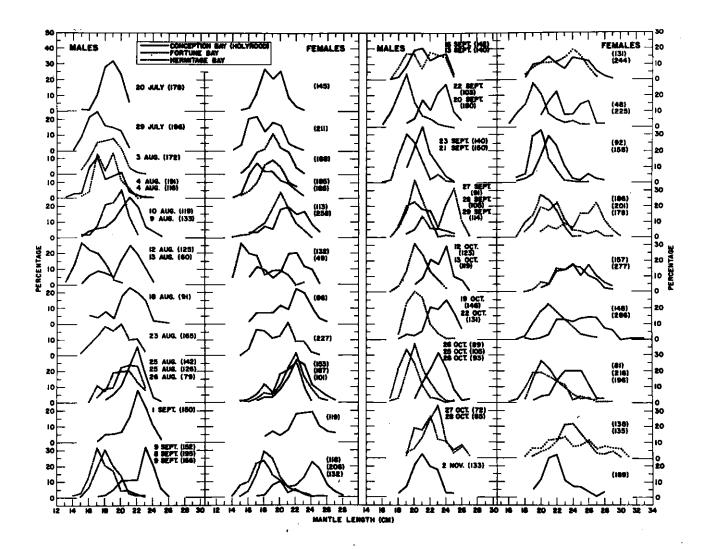


Fig. 3. Length distributions of <u>Illex</u> <u>illecebrosus</u> samples taken at Newfoundland in 1966. Numbers indicate sample sizes.

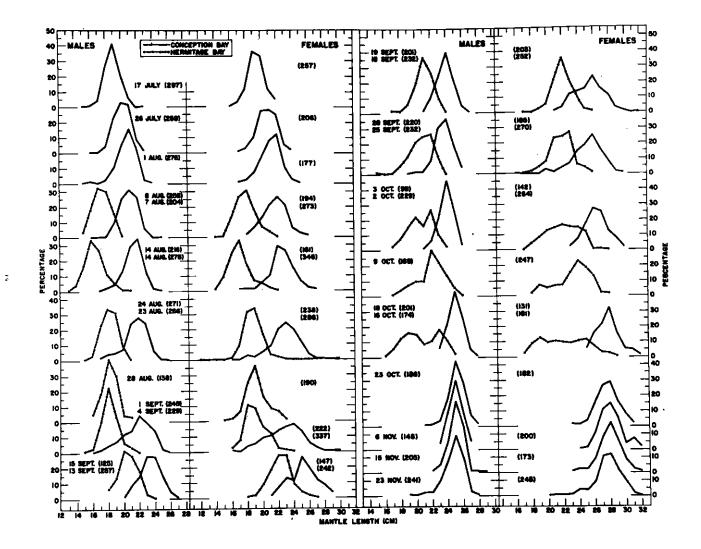


Fig. 4. Length distributions of <u>Illex</u> <u>illecebrosus</u> samples taken at Newfoundland in 1967. Numbers indicate sample sizes.

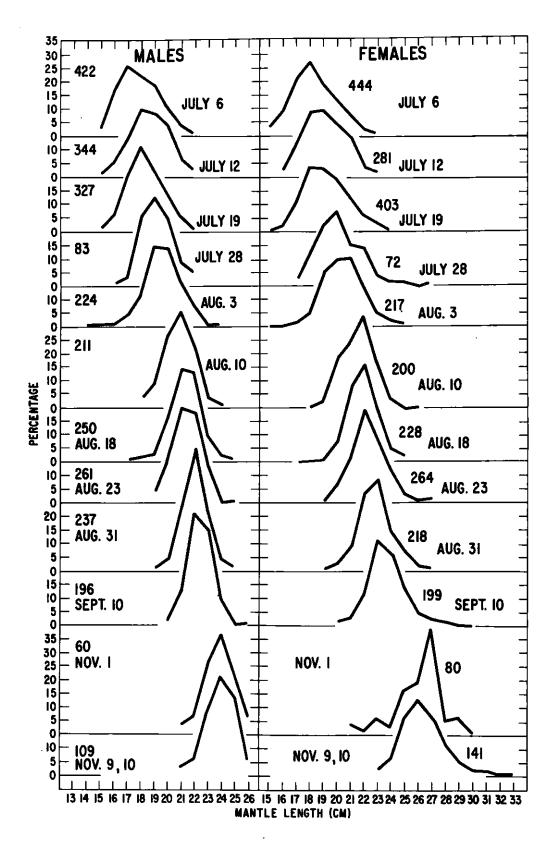


Fig. 5. Length distributions of <u>Illex</u> <u>illecebrosus</u> samples taken at Newfoundland in 1971. Numbers indicate sample sizes.

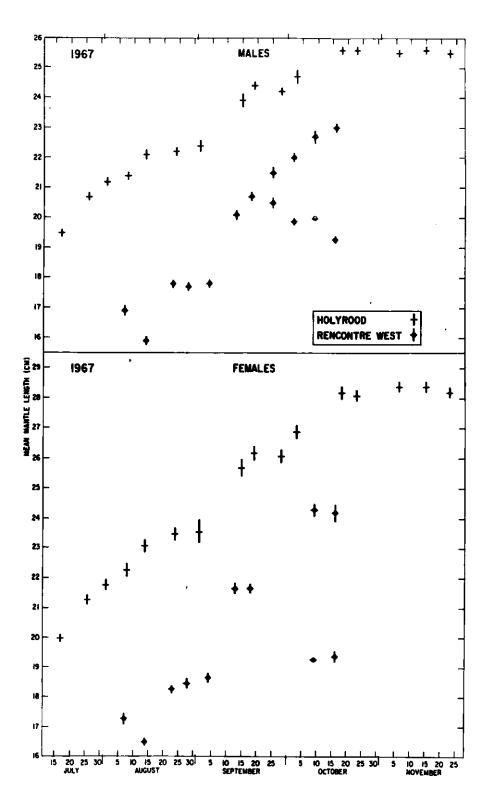


Fig. 6. Adjusted mean mantle lengths of <u>Illex illecebrosus</u> from samples obtained at Newfoundland in 1967. The vertical bar indicates twice the standard error of the mean on each side of the mean.