STATUS OF THE SQUID (Loligo pealei and Illex illecebrosus) POPULATIONS OFF THE NORTHEASTERN USA

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Anne M. T. Lange

National Marine Fisheries Service
Northeast Fisheries Center
Woods Hole Laboratory
Woods Hole, Massachusetts 02543

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INTRODUCTION

This document presents information regarding the current status of the *Loligo pealei* and *Illex illecebrosus* squid stocks, from the mid-Atlantic to the Gulf of Maine (Figure 1). USA and foreign commercial and USA research survey information are presented, including: catches, length frequency and foreign by-catch samples from the 1979 fishery and 1979 Autumn abundance and pre-recruit indices. This is an update of the July 1979 stock status report (Lange, NEFC, Lab. Ref. No. 79-30).

RESULTS AND DISCUSSION

Commercial Fishery

Provisional 1979 USA squid catches totaled 5,379 MT (Table 1), compared with 1,676 MT reported in 1978. This total was comprised of an estimated 4,252 MT of *L. pealei* and 1,086 MT of *I. illecebrosus*. The *L. pealei* catches represent a 3 fold increase over both the 1978 and 10 year (1969-1978) average catches; while *I. illecebrosus* catches were more than twice the 1978 level, and greater than the 10 year average.

Catches of squid, by the distant water fleet totaled 29,564 MT (preliminary) in 1979, with 13,138 MT of *L. pealei* and 16,426 MT of *I. illecebrosus*. This represents a 41% increase in *L. pealei* and a 4% decline in *I. illecebrosus* catches, from 1978 levels. Compared with the 1969-78 average, *L. pealei* catches were down 40.2% while *I. illecebrosus* catches were up 14.5%. Countries participating in this fishery were Italy, Japan, Spain, and Mexico.

It should be noted that the management of these stocks has been based on a fishing year of 1 April to 31 March, since 1979. On this basis,
through March 8, 1980, 55.8% of the *L. pealei* and 79% of the *I. illecebrosus* total allowable levels of foreign fishing (TALFF's), for fishing year 1979-80, had been taken. However, redistribution of unutilized portions of USA allocations of each species, late in the year, are reflected in these TALFF levels. Catches by some countries may have been more restricted in the early part of the year, by initial TALFF's than if the final allocations had been in effect from the start of the fishery. For example, catches of *L. pealei* by Japan and Mexico through 8 March 1980, were 67% and 136% greater than their initial allocations.

Monthly length frequency distributions from the distant water fleet squid fisheries (USA observer samples) are presented in Tables 2 and 3 for *L. pealei* and *I. illecebrosus*. Individual length samples were expanded to represent the total number of individuals, at length, taken in the sampled tows. These weighted distributions were then summed for the entire fleet, over each month, to represent the overall monthly length distribution in the squid fishery.

Mean size of *L. pealei* in the distant water fleet catch generally increased from January through March, as the recruits from the previous year grew and became the main component of the catch. Mean lengths decreased from October through December, reflecting recruitment of spring-summer hatches individuals.

*Illex illecebrosus* length samples reveal the general increase in mean size of individuals of the 1978 year class, through the year, with indications of partial recruitment of the 1979 year class by November.

Mean lengths of *L. pealei* from the USA inshore fishery (Table 4) are generally greater than those from the offshore fishery. The January-February samples may reflect small numbers of mature individuals which have already
begun onshore migrations. By May, while the offshore foreign fishery is closed, spawning migrations begin, and large individuals are taken inshore, in all areas. Mean lengths decreased in June, as individuals greater than 30 cm had probably already spawned and died, and were no longer available to the fishery. Also, by June, great numbers of small individuals, probably hatched late in 1978, were present in the inshore catches. These individuals dominated the samples through October and their growth can be observed as the mean length of the samples increased, from 12.4 cm in June to 18.3 cm in October. The mean length in the November sample dropped to 15.0 cm as individuals spawned early in 1979 were recruited to the fishery.

Length frequencies of *L. illecebrosus* from the USA commercial fishery in the Gulf of Maine (Table 5) show the general increase in mean length of a single group of squid, ranging from 17.8 cm in June to 24.6 cm in September (24.0 cm in October). These monthly mean sizes agree fairly well with those taken further south, in the offshore *L. illecebrosus* fishery (Table 3), though the mode during September-October is somewhat larger for the inshore Gulf of Maine samples.

Major components of the by-catch in the directed offshore squid fisheries were tabulated (percentage) by country, area (Figure 2), and season, from summarized 1979 USA foreign fishery observer trip reports (Table 6). It is assumed that vessels participating in the squid fishery between January and March were directing their effort towards *L. pealei*; and those in June (the area was opened to fishing on June 15) through September were fishing for *L. illecebrosus*. From October through December, both species move from the shallow areas of the shelf to the slope waters and are susceptible to the fishery, though in the later part of this season most *L. illecebrosus* are probably in deep waters beyond the area of the fishery.
By-catches from this observer data were much greater during the *L. pealei* fishery (January-March) than the *I. illecebrosus* fishery, with percents of the total catch attributed to species other than squid, ranging from 15.1% (Japan, area 2) to 43.9% (Spain, area 4) during 1979. *Illex illecebrosus* accounted for between 1.3% and 28% of these catches. Major by-catch species in this fishery were butterfish (.1% to 13.0%); silver hake (.4% to 21.3%); and spiney dogfish (.2% to 19.7%). These wide ranges in by-catch percentages reflect differences in the gear used, and the area and time of capture. Mackerel and red hake were also consistent (though small) components of the catch during this fishery.

In most areas, the summer *I. illecebrosus* fishery produced very little by-catch, generally amounting to less than 1% of the total of those catches which were sampled. Insignificant amounts of butterfish, and silver and red hake were taken in most areas, however, in Area 5, a substantial amount of the total catch was attributed to these species for both Spain and Italy (though the samples represented only a small amount of the total catch in that area).

Butterfish was the prime by-catch in the October-December, 1979 mixed squid fishery; with catches ranging from .1% to 83.3% of the total catch, by area and country. Generally, *I. illecebrosus* and/or *L. pealei* made up the major portion of the catch depending on the area fished and country fishing.

**Research Vessel Surveys**

Minimum biomass and abundance estimates for *L. pealei* and *I. illecebrosus*, are calculated from areal expansion of stratified mean weight and numbers per tow from USA autumn bottom trawl surveys (Table 7). *Loligo pealei* estimates have been adjusted to account for day-night differences,
as noted by Sissenwine and Bowman (1978), as this species is more available to the trawl during daylight than night time hours. The biomass estimate for *L. pealei* (19,333 MT) was 2.8% greater in 1979 than 1978, though it was still well below (42%) the 1968-78 average. Minimum estimated total number of this species was up 69% (at 2113.6 million individuals) compared to the 1978 level, while it also was below (29%) the 11 year average. The biomass estimate for *I. illecebrosus* was the second highest of the time series (1968-1979), at 41,455 MT, up 57% from the 1978 level. The numbers estimate for this species was the highest on record (144 million individuals), 19% greater than in 1978 and 7.5% greater than in 1976, the previous high.

As noted in 1979 (Lange 1979), the apparent great abundance of pre-recruit sized *I. illecebrosus* in autumn 1978, may have been indicative of an increase in abundance of larger individuals to be seen in 1979. In fact, this seems to be the case, with the total abundance index, in 1979, (Table 8) the largest of the time series (1967-79). A similar situation can be noted in 1976 when the high pre-recruit index of 1975, was followed by a great increase in total abundance.

The greater increase in weight, than in numbers of *I. illecebrosus*, between 1978 and 1979, indicates that the average size of the individuals was larger in 1979. In fact, the ratio of stratified mean number per tow of pre-recruit sized (≤10 cm) individuals to all sizes, decreased in 1979, from 18% of the total to 8%, possibly reflecting dominance of the large number of pre-recruits seen in autumn 1978. The reverse was the case for *L. pealei*; where although the 1978 ratio of pre-recruits to total numbers was well below the previous average (65% vs. 89%), the increase in 1979 in the number of pre-recruits was greater than the total increase. This proportion was above any seen since 1976 (73%).
CONCLUSIONS

The downward trend in *L. pealei* abundance, since 1975, appears to have leveled off, in 1979. Though both commercial catches and research vessel survey indices are still well below the 1967-1978 average, they are above those observed in 1978. For survey catch indices (numbers) this is the first increase since 1975. Also, a greater portion of these numbers were of pre-recruited sizes, than has been evidenced since 1976. These individuals will be contributing to both the US and the foreign fishery over the next year or so.

The autumn 1979, *I. illecebrosus* abundance index was again well above historical levels and was, in fact, the greatest on record (since 1967). The number of pre-recruit sized individuals declined from the 1978 level, but was still well above the past 12 year average. Restrictions imposed by initial 1979 TALFF's may account, in part, for low levels of *I. illecebrosus* taken by the distant water fleet, in 1979 (the lowest since 1972) since each of the countries in the directed squid fisheries (Japan, Italy, Spain, and Mexico) have taken more than initial 1979 allocations permitted. However with only 3 weeks remaining in the 1979-1980 fishing year, 20% of the final 19,880 MT TALFF remained to be taken. Catches of *I. illecebrosus* off Canada are expected to have increased dramatically from 1978 to 1979, with reported catches from the Canadian fishery alone totalling 111,005 MT, compared with the 1978 total for all countries of 94,343 MT.

LITERATURE CITED


Table 1. Annual squid (L. pealei and I. illecebrusos) catches (in Metric Tons) from the Northwest Atlantic (Cape Hatteras to Gulf of Maine), by the USA and the distant water fleet (DWF), 1963-1979.

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\(^1\)Provisional.
Table 2. *Loligo pealei* length frequency distributions\(^1\) (per mile), by month, from USA foreign fishery observer samples, 1979.

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\(^1\)From samples taken by US observers, expanded over the total sampled catch, and summed over all countries, vessels and areas.

\(^2\)Estimated total number in sampled catch, in thousands of squid.

\(^3\)Total weight of squid in sampled catches, in metric tons.
Table 3. *Illex illecebrosus* length-frequency distributions\(^1\) (per mile), by month, from USA foreign fishery observer samples, 1979.

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Total Weight in Catch\(^3\) 5.7 0.7 167.6 301.0 167.8 99.2 159.6 73.6 17.8
Mean Length (cm) 14.4 13.8 18.9 20.6 21.2 21.6 22.9 23.2 22.8

\(^1\) From samples taken by US observers, expanded over the total sampled catch, and summed over all countries, vessels, and areas.
\(^2\) Estimated total number in sampled catch, in thousands of squid.
\(^3\) Total weight of squid in sampled catches, in metric tons.
Table 4. Length frequency distributions (per mile) of *Loligo pealei*, from the 1979 USA Fishery, by Area and Month.

<table>
<thead>
<tr>
<th>Georges Bank April</th>
<th>Southern New England</th>
<th>Mid-Atlantic May</th>
</tr>
</thead>
<tbody>
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<td>Feb</td>
</tr>
<tr>
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<td></td>
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</tr>
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</tr>
<tr>
<td>41</td>
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</tr>
</tbody>
</table>

| Total Number Measured | 102 | 149 | 100 | 1378 | 1085 | 100 | 50 | 50 | 59 |
| Total Number of Samples | 1   | 2   | 1   | 8    | 3    | 1   | 1  | 1  | 1  |
| Mean Length (cm)       | 18.4| 14.5| 15.1| 19.7 | 12.4 | 14.5| 18.3| 15.0| 23.5|
Table 5. Length Frequency distributions (per mile) for *Illex illecebrosus*, from the 1979 USA fishery, in the Gulf of Maine, by month.

<table>
<thead>
<tr>
<th>Length (cm)</th>
<th>June</th>
<th>July</th>
<th>August</th>
<th>September</th>
<th>October</th>
</tr>
</thead>
<tbody>
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</tr>
<tr>
<td>17</td>
<td>350.0</td>
<td>18.2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>216.7</td>
<td>127.3</td>
<td></td>
<td></td>
<td></td>
</tr>
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<td>19</td>
<td>150.0</td>
<td>327.3</td>
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</tr>
<tr>
<td>20</td>
<td>116.7</td>
<td>254.5</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>90.9</td>
<td>215.0</td>
<td></td>
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</tr>
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<td>22</td>
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<td>158.9</td>
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</tr>
<tr>
<td>23</td>
<td>16.7</td>
<td>54.5</td>
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<td>24</td>
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<td>138.6</td>
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<td>26</td>
<td>192.8</td>
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<td>32</td>
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<td></td>
</tr>
</tbody>
</table>

Total Number | 1000 | 1000 | 1000 | 1000 | 1000 |
Number Measured | 60   | 55   | 102  | 166  | 108  |
Number of Samples | 1   | 1    | 2    | 3    | 2    |
Mean Length (cm) | 17.8 | 19.6 | 21.2 | 24.6 | 24.0 |
Table 6. Percents of major bycatch species in the directed squid fisheries, by season, area, and country, from USA foreign fishery observer data, 1979.

<table>
<thead>
<tr>
<th>Season</th>
<th>NWA Area</th>
<th>Country</th>
<th>Total Sampled Catch (MT)</th>
<th>Percent of Sampled Catch</th>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>L. pealei</td>
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<td>57.9</td>
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<td>75.7</td>
<td>70.9</td>
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<td>Spain</td>
<td>124.4</td>
<td>79.7</td>
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<td>50.0</td>
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<td>3</td>
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<td>Mexico</td>
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<tr>
<td>Jun 15-Sept</td>
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<td>Japan</td>
<td>783.3</td>
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<td>7.6</td>
<td>1.9</td>
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<td>Japan</td>
<td>195.0</td>
<td>1.5</td>
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Table 6 (cont.)

<table>
<thead>
<tr>
<th>Season</th>
<th>NWA(^2) Area</th>
<th>Country</th>
<th>Total Sampled Catch (MT)</th>
<th>L. pealei</th>
<th>I. illecebrosus</th>
<th>Butterfish</th>
<th>Mackerel</th>
<th>Silver Hake</th>
<th>Red Hake</th>
<th>Spiny Dogfish</th>
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<tr>
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<td>Japan</td>
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<td>48.7</td>
<td>32.7</td>
<td>39.6</td>
<td>24.7</td>
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<td>1.0</td>
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<tr>
<td>5</td>
<td>Japan</td>
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<td>5.5</td>
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<td>1.9</td>
<td>--</td>
<td>12.1</td>
<td>3.3</td>
<td>73.1</td>
</tr>
</tbody>
</table>

\(^1\)In general, January-March, and October-December are considered the L. pealei fishery; while 15 June-September are regarded as the I. illecebrosus fishing season.

\(^2\)Northwest Atlantic fishery areas, authorized for fishing.
Table 7. *L. pealei* and *I. illecebrus*: Minimum biomass (Metric tons) and abundance (Numbers x 10^6) Estimates\(^1\) for the Middle-Atlantic to Gulf of Maine, 1968-1979.

<table>
<thead>
<tr>
<th>Year</th>
<th>L. pealei Biomass</th>
<th>L. pealei Abundance</th>
<th>I. illecebrus Biomass</th>
<th>I. illecebrus Abundance</th>
</tr>
</thead>
<tbody>
<tr>
<td>1968</td>
<td>29,114</td>
<td>1,212</td>
<td>1,845</td>
<td>10</td>
</tr>
<tr>
<td>1969</td>
<td>48,053</td>
<td>2,393</td>
<td>419</td>
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<tr>
<td>1970</td>
<td>19,640</td>
<td>1,946</td>
<td>1,524</td>
<td>15</td>
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<tr>
<td>1971</td>
<td>14,050</td>
<td>1,106</td>
<td>2,024</td>
<td>10</td>
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<tr>
<td>1972</td>
<td>21,039</td>
<td>1,533</td>
<td>1,716</td>
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<tr>
<td>1973</td>
<td>44,252</td>
<td>3,092</td>
<td>1,862</td>
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<tr>
<td>1974</td>
<td>46,442</td>
<td>4,757</td>
<td>2,500</td>
<td>18</td>
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<tr>
<td>1975</td>
<td>48,636</td>
<td>7,789</td>
<td>8,306</td>
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<tr>
<td>1976</td>
<td>51,436</td>
<td>4,372</td>
<td>42,929</td>
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<tr>
<td>1977</td>
<td>27,421</td>
<td>3,157</td>
<td>21,747</td>
<td>73</td>
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<tr>
<td>1978</td>
<td>18,800</td>
<td>1,251</td>
<td>26,455</td>
<td>121</td>
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<tr>
<td>1979</td>
<td>19,533</td>
<td>2,114</td>
<td>41,455</td>
<td>144</td>
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</table>

\(^1\)From areal expansion of stratified mean weights (kg) and numbers per tow, by strata set. For *L. pealei* night-time catch data was expanded to account for diel differences in catch (Sissenwine and Bowman 1979).
Table 8. Total abundance and pre-recruit indices of squid. (Stratified mean number per tow of Loligo and Illex of all sizes and of Loligo ≤ 8-cm and Illex ≤ 10-cm mantle length in autumn bottom trawl survey, Middle Atlantic to Georges Bank.)

<table>
<thead>
<tr>
<th>Year</th>
<th>Loligo (#/tow)</th>
<th>Illex (#/tow)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>All sizes</td>
<td>≥8 cm</td>
</tr>
<tr>
<td>1967</td>
<td>134.5</td>
<td>126.9</td>
</tr>
<tr>
<td>1968</td>
<td>176.5</td>
<td>159.9</td>
</tr>
<tr>
<td>1969</td>
<td>237.3</td>
<td>217.4</td>
</tr>
<tr>
<td>1970</td>
<td>85.6</td>
<td>79.3</td>
</tr>
<tr>
<td>1971</td>
<td>163.3</td>
<td>161.5</td>
</tr>
<tr>
<td>1972</td>
<td>271.4</td>
<td>258.5</td>
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<tr>
<td>1973</td>
<td>372.0</td>
<td>353.9</td>
</tr>
<tr>
<td>1974</td>
<td>251.7</td>
<td>233.3</td>
</tr>
<tr>
<td>1975</td>
<td>614.4</td>
<td>593.3</td>
</tr>
<tr>
<td>1976</td>
<td>410.9</td>
<td>302.5</td>
</tr>
<tr>
<td>1977</td>
<td>388.5</td>
<td>297.7</td>
</tr>
<tr>
<td>1978</td>
<td>144.2</td>
<td>93.4</td>
</tr>
<tr>
<td>1979</td>
<td>193.7</td>
<td>156.5</td>
</tr>
</tbody>
</table>
Figure 1. A. USA bottom trawl survey strata and ICNAF Subareas 4 and 5 and statistical area 6. B. Geographical areas off the Northeast coast of the United States.
Figure 2. Fishing windows (1-5) of the Northwest Atlantic.