79-30

# Squid (*Loligo pealei* and *Illex illecebrosus*)

Stock Status Update: July 1979

by

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## INTRODUCTION

This document presents recent information regarding the squid stocks *Loligo pealei* and *Illex illecebrosus* from the Gulf of Maine to the Middle Atlantic area (ICNAF areas 5 + 6, Figure 1). It is an update of the squid stock status report of June 1978 (Lange, NEFC, Lab. Ref. No. 78-36) and provides 1978 USA and foreign commercial catches and length frequency samples by month and USA monthly catch per effort indices; current 1979 USA and foreign commercial catches; 1978 spring, summer, and autumn USA research bottom trawl survey results, including autumn abundance and pre-recruit indices; and 1979 USA spring survey results.

## RESULTS AND DISCUSSION

### Commercial Fishery

Provisional USA squid catches totaled 1,861 MT (Table 1) in 1978, compared with 2,553 MT reported in 1977. This total consisted of 1,476 MT of *Loligo* and 385 MT of *Illex*. *Illex* catches decreased 67% from the 1977 level while *Loligo* catches increased about 8%. Though some squid were caught in every month, the greatest USA catches occurred in May and June, while *Loligo* were inshore to spawn and *Illex* were in shallow waters to feed. Through April 1979, preliminary USA squid catches totaled 258 MT of *Loligo* and 20 MT of *Illex*.

US catch per effort of each squid species, based on vessel trips where 50% or more of the catch was *Loligo* or *Illex*, is presented in Table 2. In 1978, overall catch per effort, especially in the southern New England area, decreased for all vessel types from the 1976 and 1977 values.

Preliminary 1978 squid catches for other countries totaled 26,666 MT: 9,356 MT of *Loligo* and 17,310 of *Illex*. This represents a 43% decline in

Loligo and a 27% decline in Illex catches when compared to 1977 values (1977 total--41,237 MT). These preliminary estimates show only 42.1% of the foreign allocation for Loligo and 54.6% of the Illex quota were taken in 1978. Even when considering only the catches and allocations of those countries with a directed squid fishery (Italy, Japan, Mexico, and Spain), only 45.8% and 76.5% of the Loligo and Illex quotas, respectively, were caught. It should be noted, however, that Japanese and Italian catches may have been restricted by limits on bycatch (97% and 71%, respectively, of their butterfish allocations were taken).

Preliminary catches in the foreign fishery through June 1979, however, totaled 9,707 MT of Loligo (53% of the TALFF) and 3,804 MT of Illex (20% of the TALFF). This is about twice the catch of Loligo and about the same catch of Illex for the same time period in 1978. Based on vessel activities information reported to the NMFS for January and February 1979, there was also a 64.7% increase in the number of vessel-days on the fishing grounds for the directed squid fishery compared with January and February 1978. Therefore, overall catch per effort (MT per vessel days on grounds) increased about 1.5 times the January-February 1978 value.

Length frequency samples for Loligo from the US commercial fishery are summarized in Table 3. Length frequencies from the foreign squid fisheries, obtained by US observers throughout the fishing year, are presented in Tables 4a and 4b for Loligo and Illex, respectively. The mean lengths for Loligo from the inshore US fishery, directed primarily at mature spawning individuals, are generally larger than those from the offshore fishery, which is focused on this species prior to inshore spawning migrations. Mean length of Illex from the offshore fishery increased through the year (January through December) from 15.1 to 23.7 cm.

Research Vessel Surveys

Results of US bottom trawl surveys, conducted during the springs of 1977 and 1978, indicated great reductions in catch per tow of Loligo (Table 5) when compared with previous years since 1968. Stratified mean catches per tow of Illex were also well below the 10 year average in all but the southern New England area. However, great variability in spring Illex catches may reflect changes in availability to the survey rather than fluctuations in total population size, since this species ranges to depths beyond the scope of the survey during that time of year.

Decreased catch per tow in the 1978 US autumn bottom trawl survey indicated a great decline in Loligo abundance (Lange and Sissenwine, 1979). Overall abundance, as indicated by stratified mean number per tow, of all sizes from the Middle Atlantic through Georges Bank strata (Figure 1) decreased from a 7 year (1971-1977) average of 353.2 to 144.2 in autumn 1978 (Table 6). This was due primarily to a great drop in the pre-recruit index (mean number per tow of individuals less than 9 cm) from a 7 year average of 314.4 to 93.4. This represented a decrease in the pre-recruit portion of the population from an average of 89% to 65%, while the index for recruited individuals was above average. Stratified mean number of Illex per tow (Table 6) increased from 1977 to 1978 to a level comparable to that of 1976, when high abundance of this species was observed. However, the mean weight per tow was about 39% less than the 1976 level, indicating smaller individuals. In fact, the proportion of those taken which were of pre-recruited size in 1978 was the second highest in the time series, indicating the possibility of a good age group entering the fishery in 1979.

Stock size estimates, based on stratified mean number per tow from the autumn survey, are presented in Tables 7 and 8 for Loligo and Illex,

respectively. The estimated population size for Loligo (1,251 x $10^6$) is the lowest since 1971, while that for Illex is the second highest since 1968, the first year that estimates were available for these species.

Preliminary analysis of spring 1979 USA survey results indicate a significant increase in the mean catch (in kilograms) per tow of Loligo (Table 5) when compared to the spring 1977-1978 mean (2.72 vs. 1.49). Though this is below the high 1975-1976 levels, it is comparable to other years in the time series. There was also a decrease in the mean length of Loligo in the 1979 spring survey compared with all other years from about 5 to about 6 cm. This may indicate the presence of a late (autumn 1978) spawned brood which was not available at the time of the autumn survey. Catches of Illex during the spring survey were comparable to the 1968-1978 average.

## CONCLUSIONS

The continued downward trend in Loligo abundance in 1978 from recent (1973-1976) levels was evidenced in both commercial fishery and US bottom trawl survey data. The directed foreign fishery only caught 46% of its 1978 allocation, while US inshore catches and catch per effort were well below the 1976 and 1977 values. Research vessel survey results indicated a possible 59% drop in the abundance of Loligo in autumn 1978 (even though there were more recruited (greater than 8 cm) individuals than the 7 year average). This was primarily the result of a 70% decline in pre-recruit sized individuals which would be contributing to the fishery through next autumn. Catches thus far in 1979 are above those for the same time period in 1978, but estimates of effort applied to obtain this catch were also greater than in 1978. The USA spring 1979 survey results indicate a level

of Loligo biomass comparable to the long-term average, with mean lengths smaller than normally found at that time of year. The high number of small squid appear to be from the brood which would normally have appeared in the autumn survey and will probably contribute to the fishery for the remainder of this year. Late appearance of these individuals may account for the apparent decrease in abundance noted in autumn 1978.

The autumn 1978 Illex survey abundance index was again well above historic levels and comparable to the 1976 "record" level. There was also a great increase in pre-recruit sized individuals, second only to the 1975 level which preceded the great abundance in 1976. If a relationship exists between this index and availability to the fishery, Illex may be very abundant in 1979. In fact, catches of Illex thus far in 1979 are running above the historical average. While Illex ranges into Canadian waters, the relationships between the stocks in these two areas is as yet unknown. Catches off Canada in 1978 totaled 98,600 MT, less than the allowable level of 100,000 MT but a 23% increase over the 1977 level and more than twice the 1976 catch.

## LITERATURE CITED

Lange, A. M. T. MS, 1978. Squid (*Loligo pealei* and *Illex illecebrosus*) stock status: June, 1978. NMFS, NEFC. Lab. Ref. No. 78-36.

Lange, A. M. T. and M. P. Sissenwine. 1979. Decreased Abundance of Long-finned Squid off the Northeastern United States. Coastal Oceanog. and Climat. News. Vol. 1 (2):18.

Table 1. USA 1978 monthly squid landings[1] in metric tons, by area.

| | 5Y | 5Ze | 5Zw | 6 | Total |
|---|---|---|---|---|---|
| | | | Loligo | | |
| Jan | | | 9.2 | 76.5 | 85.7 |
| Feb | | | 2.2 | 59.7 | 61.9 |
| Mar | | 1.3 | 1.9 | 80.5 | 83.7 |
| Apr | | 0.2 | 34.5 | 98.6 | 133.3 |
| May | | 2.1 | 157.4 | 118.8 | 278.3 |
| Jun | | 0.4 | 81.5 | 177.4 | 259.3 |
| Jul | | 0.1 | 19.9 | 98.8 | 118.8 |
| Aug | | | 10.3 | 44.6 | 54.9 |
| Sep | 1.0 | | 28.9 | 11.2 | 41.1 |
| Oct | 4.5 | 2.7 | 64.6 | 26.7 | 98.5 |
| Nov | 5.8 | 0.9 | 80.5 | 81.2 | 168.4 |
| Dec | 1.2 | 0.5 | 25.1 | 64.2 | 91.0 |
| Total | 13.5 | 8.2 | 516.0 | 938.2 | 1,475.9 |
| | | | Illex | | |
| Jan | | | | 3.2 | 3.2 |
| Feb | | | | 6.6 | 6.6 |
| Mar | | | | | |
| Apr | | | | | |
| May | | | 0.1 | | 0.1 |
| Jun | 3.5 | 0.5 | 189.9 | | 193.9 |
| Jul | 16.0 | 29.4 | 0.1 | | 45.5 |
| Aug | 6.5 | 7.5 | 1.2 | | 15.2 |
| Sep | 6.8 | 93.5 | | | 100.3 |
| Oct | 7.4 | 2.1 | 0.4 | | 9.9 |
| Nov | 9.7 | 0.4 | | | 10.1 |
| Dec | 0.3 | | | | 0.3 |
| Total | 50.2 | 133.4 | 191.7 | 9.8 | 385.1 |

1/ Preliminary landings, non-specified squid catches prorated to species by month and area.

Table 2. Monthly and annual catch per effort (metric tons per days fished) in the US directed[1] squid fisheries, by area and vessel size,[2] 1976-1978, including total annual number of days fished.

| Area | Vessel size | Year | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Total | Total days |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | *Illex* | | | | | | | | | |
| Gulf of Maine | Small | 1976 | | | | | | | | 4.55 | 6.66 | 13.61 | 5.63 | | 9.30 | 10.0 |
| | | 1977 | | | | | | | 1.76 | 0.78 | 1.81 | 7.43 | 9.85 | | 3.85 | 4.5 |
| | | 1978 | | | | | | | 0.68 | | | | | | 0.68 | 0.3 |
| | Medium | 1977 | | | | | | | | 2.83 | 7.62 | 15.31 | 11.83 | | 7.77 | 3.5 |
| So. New England | Small | 1977 | | | | | | | 2.59 | | | | | | 4.06 | 2.3 |
| | Medium | 1976 | | | | | | | 6.39 | | | | | | 6.39 | 1.2 |
| | | | | | | | *Loligo* | | | | | | | | | |
| Georges Bank | Small | 1978 | | | | | 1.59 | | | | | | | | 1.59 | 0.8 |
| | Medium | 1977 | | | | | 1.51 | | 4.27 | | | | | | 2.50 | 7.0 |
| So. New England | Small | 1976 | | | | | 6.66 | 7.33 | | 3.44 | 0.76 | | | | 6.62 | 41.6 |
| | | 1977 | | | | | 5.31 | 3.53 | | 0.59 | 1.24 | 1.24 | 0.23 | 6.89 | 4.57 | 35.0 |
| | | 1978 | | | | | 2.59 | 1.67 | 2.36 | 1.07 | | 1.13 | 1.56 | | 2.21 | 52.5 |
| | Medium | 1976 | | | | 1.56 | 7.79 | 5.34 | | | | | | | 6.41 | 58.8 |
| | | 1977 | | | | 1.00 | 6.33 | 2.49 | 4.57 | | | 0.50 | 4.66 | | 4.57 | 55.7 |
| | | 1978 | | | | | 2.71 | 1.19 | | | 1.39 | 1.89 | | 1.59 | 1.61 | 15.1 |
| Mid-Atlantic | Small | 1976 | | | 1.84 | 14.97 | | | 1.33 | | 2.10 | | | | 3.38 | 2.4 |
| | | 1978 | | | | | | | | 1.40 | | | | | 1.40 | 0.3 |
| | Medium | 1976 | | | 1.41 | 1.48 | | | | | | | | | 1.47 | 4.0 |
| | | 1978 | | | | | | | | | | 2.89 | 0.89 | | 1.11 | 1.8 |

[1] Individual trips with *Loligo* or *Illex* composing 50% or more of the total catch.
[2] Small vessels = 0.0-49.9 gross registered tons; medium vessels = 50.0-149.9 gross registered tons.

Table 3.

1978 USA commercial Loligo length frequencies[1], from the Southern New England area, by ICNAF Subdivision, and month.

| Length (cm) | 5Zw Apr | May | June | July | Sept | Oct | 6A May |
|---|---|---|---|---|---|---|---|
| 1 | | | | | | | |
| 2 | | | | | | | |
| 3 | | | | | | | |
| 4 | | | | | | | |
| 5 | | | 3 | | | | |
| 6 | | | 12 | | | | |
| 7 | | | 6 | 10 | | 30 | |
| 8 | | | 12 | 30 | | 60 | |
| 9 | 10 | | 33 | 30 | | 120 | |
| 10 | 20 | | 12 | 40 | | 260 | |
| 11 | 25 | | 24 | 120 | | 230 | |
| 12 | 45 | | 93 | 150 | 10 | 120 | |
| 13 | 40 | | 102 | 100 | 30 | 80 | 13 |
| 14 | 40 | 10 | 108 | 100 | 60 | 60 | |
| 15 | 95 | 10 | 81 | 100 | 80 | 30 | 13 |
| 16 | 65 | 59 | 75 | 50 | 150 | 10 | |
| 17 | 104 | 49 | 78 | 50 | 150 | | 38 |
| 18 | 104 | 59 | 69 | 50 | 150 | | 38 |
| 19 | 65 | 147 | 72 | 50 | 40 | | 64 |
| 20 | 119 | 137 | 48 | 10 | 40 | | 115 |
| 21 | 40 | 98 | 21 | 40 | | | 64 |
| 22 | 45 | 78 | 33 | 20 | 10 | | 77 |
| 23 | 65 | 88 | 21 | 10 | 10 | | 77 |
| 24 | 30 | 29 | 18 | 10 | 30 | | 38 |
| 25 | 25 | 49 | 33 | 20 | 20 | | 38 |
| 26 | 10 | 20 | 15 | - | 90 | | 90 |
| 27 | 25 | 20 | 6 | 10 | 10 | | 51 |
| 28 | | 29 | 12 | | 40 | | 77 |
| 29 | 10 | 39 | 3 | | 70 | | 64 |
| 30 | 5 | 39 | 3 | | | | 26 |
| 31 | 5 | 29 | 9 | | 10 | | 13 |
| 32 | | 10 | | | | | 38 |
| 33 | | | | | | | 26 |
| 34 | | | | | | | - |
| 35 | 5 | | | | | | - |
| 36 | 5 | | | | | | 13 |
| 37 | | | | | | | - |
| 38 | | | | | | | 13 |
| 39 | | | | | | | 13 |
| 40 | | | | | | | |
| Total | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 |
| No. Fish Measured | 201 | 102 | 334 | 100 | 100 | 100 | 78 |
| Landed Weight (MT) | 26.4 | 155.4 | 81.5 | 19.6 | 20.8 | 60.9 | 9.3 |
| Est. No. Landed ($x10^3$) | 188.3 | 800.1 | 726.6 | 244.9 | 138.1 | 1205.9 | 37.3 |
| Mean Length (cm) | 18.4 | 21.8 | 16.4 | 14.5 | 19.5 | 10.8 | 24.4 |
| Mean Weight (g) | 141 | 195 | 113 | 82 | 150 | 50 | 250 |

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Table 4a. 1978 *Loligo* length frequencies[1] (per mille) from the foreign squid fishery.

| Length (cm) | Month | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Jan | Feb | Mar | Apr | May | June | July | Aug | Sept | Oct | Nov | Dec |
| 1 | | | | | | | | | | | | |
| 2 | | - | | | | | | | | | | |
| 3 | | - | .4 | | | | | | | | | |
| 4 | 1.2 | .5 | 2.8 | 6.9 | | | | | 93.3 | | .7 | |
| 5 | 7.1 | 4.2 | 10.5 | 18.1 | | | | | | | 5.8 | 6.6 |
| 6 | 19.0 | 13.5 | 21.6 | 26.2 | | | | | 186.7 | .9 | 11.0 | 47.4 |
| 7 | 39.9 | 41.1 | 35.6 | 31.9 | | | | | 124.5 | 5.2 | 19.7 | 28.8 |
| 8 | 64.4 | 69.0 | 58.7 | 34.8 | | | | | 31.1 | 28.3 | 48.1 | 51.6 |
| 9 | 102.6 | 102.7 | 49.8 | 28.1 | | | | | 14.3 | 60.4 | 103.5 | 97.2 |
| 10 | 119.3 | 138.1 | 72.1 | 33.6 | | | | | 220.0 | 110.7 | 149.0 | 124.8 |
| 11 | 108.2 | 138.6 | 83.1 | 40.2 | | | | | 241.6 | 154.0 | 160.5 | 203.9 |
| 12 | 94.7 | 127.3 | 94.2 | 34.9 | | | | | 20.5 | 154.6 | 143.9 | 137.5 |
| 13 | 79.3 | 99.0 | 86.8 | 85.4 | | | | | 28.8 | 155.5 | 90.7 | 84.3 |
| 14 | 59.2 | 87.0 | 88.3 | 93.8 | | | | | 39.0 | 101.1 | 61.5 | 55.6 |
| 15 | 48.6 | 59.2 | 103.3 | 164.5 | | | | | | 61.0 | 55.0 | 45.7 |
| 16 | 43.7 | 36.3 | 82.7 | 103.3 | | | | | | 52.9 | 40.9 | 22.2 |
| 17 | 40.6 | 26.7 | 65.9 | 75.6 | | | | | | 37.7 | 39.9 | 32.7 |
| 18 | 30.2 | 16.5 | 38.1 | 66.1 | | | | | | 26.6 | 22.6 | 25.8 |
| 19 | 25.6 | 12.7 | 33.6 | 32.2 | | | | | | 18.3 | 14.7 | 7.8 |
| 20 | 22.7 | 10.8 | 29.1 | 67.6 | | | | | | 13.6 | 11.5 | 7.6 |
| 21 | 19.0 | 6.4 | 15.1 | 12.5 | | | | | | 6.4 | 10.5 | 7.4 |
| 22 | 17.1 | 2.5 | 8.7 | 11.9 | | | | | | 5.0 | 4.9 | 2.8 |
| 23 | 9.4 | 2.1 | 10.3 | 14.1 | | | | | | 1.6 | 2.7 | 2.8 |
| 24 | 9.6 | 2.4 | 3.6 | 7.3 | | | | | | 3.5 | 1.1 | 2.0 |
| 25 | 6.8 | .9 | 1.7 | 4.4 | | | | | | 1.1 | .4 | .7 |
| 26 | 6.0 | .6 | .5 | | | | | | | .2 | .1 | 2.0 |
| 27 | 3.5 | .4 | 1.3 | 6.8 | | | | | | .8 | 1.3 | .4 |
| 28 | 4.5 | .5 | .7 | | | | | | | | | 1.6 |
| 29 | 4.6 | .4 | .3 | | | | | | | | | .3 |
| 30 | 4.6 | | .6 | | | | | | | .6 | | .2 |
| 31 | 3.2 | .1 | - | | | | | | | | | |
| 32 | 1.1 | .2 | .2 | | | | | | | | | |
| 33 | 2.1 | | .5 | | | | | | | | | |
| 34 | 1.0 | .1 | - | | | | | | | | | |
| 35 | .4 | | - | | | | | | | | | |
| 36 | .3 | .2 | | | | | | | | | | |
| 37 | .1 | | | | | | | | | | | |
| 38 | .1 | | | | | | | | | | | |
| 39 | .1 | | | | | | | | | | | |
| 40 | .2 | | | | | | | | | | | |
| Total Number | 1000 | 1000 | 1000 | 1000 | | | | | 1000 | 1000 | 1000 | 1000 |
| Total Number in Catch[2] | 807.2 | 366.7 | 362.6 | 20.7 | | | | | 11.0 | 198.4 | 180.5 | 58.4 |
| Total Weight in Catch[3] | 97.6 | 21.2 | 27.3 | 1.9 | | | | | .4 | 13.2 | 10.8 | 3.3 |
| Mean Length (cm) | 13.18 | 11.87 | 13.38 | 14.52 | | | | | 8.77 | 12.84 | 12.20 | 11.66 |

[1] From samples taken by U.S. observers, expanded over the total sampled catch, and summed over all countries and vessels

[2] Estimated total number in sampled catch, all countries and vessels, in thousands of squid

Table 4b.
1978 Illex length frequencies[1] (per mille) from US observer samples during the foreign squid fishery

| Length (cm) | Month | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Jan | Feb | Mar | Apr | May | June | July | Aug | Sept | Oct | Nov | Dec |
| 1 | | | | | | | | | | | | |
| 2 | | | | | | | | | | | | |
| 3 | | | | | | | | | | | | |
| 4 | | | | | | | .90 | | | | | |
| 5 | | | | | | - | 1.80 | | | | | |
| 6 | | | | | | | | .2 | | | | |
| 7 | | | | | | - | .9 | .2 | | | | |
| 8 | .5 | | | | | | 2.7 | 2.5 | | | .1 | |
| 9 | .5 | | | | | | | 12.4 | | | 9.7 | |
| 10 | 57.4 | 35.0 | | 10.1 | | | 1.8 | 23.1 | 16.8 | .9 | .1 | |
| 11 | 71.6 | 35.0 | | 31.9 | | .12 | 1.0 | 12.2 | 14.5 | .1 | | .1 |
| 12 | 75.0 | 259.2 | 117.2 | 124.2 | | .4 | .4 | 5.0 | 42.7 | | | |
| 13 | 97.9 | 194.4 | 25.5 | 208.1 | | 1.00 | 3.4 | 1.7 | 114.2 | | | .4 |
| 14 | 188.4 | 229.4 | 165.9 | 251.7 | | 4.3 | 2.3 | 1.3 | 120.8 | | | .1 |
| 15 | 99.5 | 190.9 | 162.2 | 182.9 | | 16.8 | 13.0 | 1.9 | 38.0 | 1.6 | .4 | 1.2 |
| 16 | 67.8 | | 223.6 | 117.5 | | 75.4 | 30.0 | 4.2 | 44.9 | 4.0 | | .1 |
| 17 | 88.7 | 56.0 | 176.8 | 58.7 | | 229.3 | 84.0 | 10.0 | 20.5 | 7.0 | .4 | .3 |
| 18 | 117.2 | | 67.5 | 25.2 | | 314.1 | 206.6 | 58.5 | 16.9 | 7.2 | 1.4 | .1 |
| 19 | 63.5 | | 61.3 | | | 167.7 | 281.9 | 188.1 | 40.6 | 21.5 | 11.8 | 4.0 |
| 20 | 27.4 | | | | | 81.1 | 193.4 | 280.1 | 121.2 | 105.0 | 33.9 | 12.7 |
| 21 | 16.4 | | | | | 65.8 | 92.0 | 177.1 | 152.1 | 231.1 | 116.0 | 105.2 |
| 22 | 14.2 | | | | | 24.4 | 40.0 | 94.8 | 113.2 | 271.0 | 186.6 | 106.8 |
| 23 | 8.8 | | | | | 16.1 | 20.8 | 47.3 | 87.0 | 151.0 | 203.6 | 237.7 |
| 24 | 6.2 | | | | | 2.3 | 14.0 | 31.9 | 33.4 | 77.0 | 157.5 | 235.2 |
| 25 | | | | | | 1.1 | 6.0 | 26.1 | 15.2 | 63.6 | 128.4 | 139.0 |
| 26 | | | | | | | 3.1 | 13.2 | 6.9 | 36.4 | 73.1 | 78.2 |
| 27 | | | | | | | .8 | 5.0 | 1.0 | 18.2 | 51.7 | 47.8 |
| 28 | | | | | | | .1 | 1.9 | | 4.3 | 18.4 | 21.1 |
| 29 | | | | | | | | .5 | | .2 | 2.6 | 8.9 |
| 30 | | | | | | | | .5 | | | 3.0 | |
| 31 | | | | | | | | .1 | | | 1.1 | 1.1 |
| 32 | | | | | | | | | | | .3 | |
| 33 | | | | | | | | | | | | |
| 34 | | | | | | | | | | | | |
| 35 | | | | | | | | | | | | |
| 36 | | | | | | | | | | | | |
| 37 | | | | | | | | | | | | |
| 38 | | | | | | | | | | | | |
| 39 | | | | | | | | | | | | |
| 40 | | | | | | | | | | | | |
| Total Number | 1000 | 1000 | 1000 | 1000 | | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 |
| Total Number in Catch[2] | 126.2 | 0.6 | 12.4 | 0.6 | | 1075.2 | 1294.5 | 1384.5 | 251.2 | 393.0 | 160.5 | 170.6 |
| Total Weight in Catch[3] | 10.78 | 0.03 | 1.06 | 0.04 | | 142.60 | 194.05 | 244.27 | 36.26 | 87.71 | 41.25 | 45.75 |
| Mean Length (cm) | 15.12 | 13.40 | 15.46 | 14.10 | | 18.27 | 19.06 | 19.97 | 18.23 | 22.14 | 23.26 | 23.72 |

[1]Expanded over total catch which was sampled and summed over all countries and vessels

[2]Estimated total number in sampled catch, all countries and vessels, in thousands of squid

[3]Total weight of catches which were sampled, in metric tons

Table 5. *Loligo* stratified mean weight (kilograms) per tow from USA spring bottom trawl surveys (1968-1979).

| Year | Area (Strata) | | |
|---|---|---|---|
| | Mid-Atlantic (61-76) | Southern New England (1-12) | Southern Georges Bank (13-15) |
| 1968 | 2.5 | 1.2 | 1.1 |
| 1969 | 1.7 | 0.3 | 5.3 |
| 1970 | 1.5 | 1.1 | 0.7 |
| 1971 | 2.8 | 1.4 | 1.8 |
| 1972 | 3.6 | 5.9 | 2.8 |
| 1973 | 2.8 | 4.9 | 3.4 |
| 1974 | 2.8 | 1.0 | 0.1 |
| 1975 | 4.9 | 7.6 | 2.0 |
| 1976 | 7.2 | 7.6 | 0.9 |
| 1977 | 1.0 | 1.2 | 0.6 |
| 1978 | 2.4 | 1.8 | 0.4 |
| 1979 | 1.7 | 3.4 | 4.8 |

Table 6. 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.)

| Year | *Loligo* (#/tow) | | *Illex* (#/tow) | |
|---|---|---|---|---|
| | All sizes | ≤8 cm | All sizes | ≤10 cm |
| 1967 | 134.5 | 126.9 | 2.1 | 0.7 |
| 1968 | 176.5 | 159.9 | 2.3 | 0.6 |
| 1969 | 237.3 | 217.4 | 0.8 | 0.3 |
| 1970 | 85.6 | 79.3 | 3.4 | 0.2 |
| 1971 | 163.3 | 161.5 | 1.9 | 0.6 |
| 1972 | 271.4 | 258.5 | 3.5 | 1.8 |
| 1973 | 372.0 | 353.9 | 1.3 | 0.3 |
| 1974 | 251.7 | 233.3 | 3.0 | 2.1 |
| 1975 | 614.4 | 593.3 | 12.4 | 9.6 |
| 1976 | 410.9 | 302.5 | 28.7 | 0.6 |
| 1977 | 388.5 | 297.7 | 15.8 | 1.1 |
| 1978 | 144.2 | 93.4 | 28.4 | 5.1 |

Table 7. Loligo biomass estimates (mean weights in kg and numbers per tow by strata set).

| Year | Area | Total # tows | Total $\overline{Wt}$/tow | Total #/tow | Day # tows | Day $\overline{Wt}$/tow | Day #/tow | Night # tows | Night $\overline{Wt}$/tow | Night # tow | $B_1$ Wt MT | $B_1$ # x10$^6$ | $B_2$ Wt MT | $B_2$ # x10$^6$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1968 | SNE/Mid-Atl | 124 | 10.86 | 267.57 | 40 | 16.23 | 362.60 | 43 | 2.51 | 30.58 | 28,073 | 692.6 | 29,114 | 1,211.9 |
| | Geo. Bank | 69 | 0.40 | 10.73 | 22 | 0.77 | 17.13 | 25 | 0.02 | 0.12 | | | | |
| | Gulf Maine | 50 | 0.01 | 0.09 | 18 | 0.01 | 0.10 | 15 | 0.00 | 0.11 | | | | |
| 1969 | SNE/Mid-Atl | 119 | 13.99 | 347.50 | 38 | 27.32 | 777.30 | 39 | 3.29 | 51.29 | 37,643 | 931.6 | 48,053 | 2,393.1 |
| | Geo. Bank | 73 | 1.56 | 36.70 | 25 | 2.49 | 60.37 | 32 | 0.54 | 9.70 | | | | |
| | Gulf Maine | 51 | 0.03 | 0.40 | 17 | 0.06 | 0.90 | 16 | 0.00 | 0.00 | | | | |
| 1970 | SNE/Mid-Atl | 122 | 4.13 | 105.40 | 38 | 5.55 | 168.10 | 40 | 2.98 | 63.70 | 12,095 | 337.9 | 19,640 | 1,946.2 |
| | Geo. Bank | 70 | 1.12 | 49.40 | 23 | 2.99 | 133.73 | 24 | 0.22 | 6.40 | | | | |
| | Gulf Maine | 53 | 0.05 | 1.46 | 18 | 0.06 | 1.55 | 16 | 0.00 | 0.00 | | | | |
| 1971 | SNE/Mid-Atl | 125 | 4.04 | 234.20 | 43 | 8.55 | 515.70 | 41 | 0.27 | 11.29 | 11,752 | 641.4 | 14,050 | 1,106.1 |
| | Geo. Bank | 73 | 1.06 | 34.10 | 27 | 1.51 | 63.75 | 24 | 0.51 | 9.69 | | | | |
| | Gulf Maine | 55 | 0.03 | 0.57 | 16 | 0.08 | 1.08 | 20 | 0.01 | 0.42 | | | | |
| 1972 | SNE/Mid-Atl | 114 | 9.41 | 398.90 | 31 | 13.14 | 524.90 | 40 | 1.24 | 31.25 | 25,400 | 1,065.1 | 21,039 | 1,533.3 |
| | Geo. Bank | 73 | 1.13 | 39.30 | 29 | 1.70 | 68.71 | 21 | 0.28 | 5.08 | | | | |
| | Gulf Maine | 55 | 0.00 | 0.20 | 18 | 0.00 | 0.00 | 18 | 0.00 | 0.02 | | | | |
| 1973 | SNE/Mid-Atl | 111 | 14.20 | 542.90 | 38 | 17.47 | 817.10 | 35 | 3.68 | 66.94 | 42,338 | 1,460.9 | 44,252 | 3,092.0 |
| | Geo. Bank | 73 | 4.53 | 60.90 | 27 | 7.16 | 96.15 | 28 | 2.31 | 30.44 | | | | |
| | Gulf Maine | 54 | 0.05 | 0.91 | 16 | 0.08 | 1.56 | 21 | 0.02 | 0.48 | | | | |
| 1974 | SNE/Mid-Atl | 108 | 11.41 | 355.90 | 33 | 16.33 | 886.10 | 38 | 5.38 | 130.00 | 32,014 | 989.0 | 46,442 | 4,757.0 |
| | Geo. Bank | 74 | 2.21 | 62.07 | 20 | 2.67 | 96.20 | 26 | 2.93 | 22.10 | | | | |
| | Gulf Maine | 57 | 0.03 | 0.78 | 19 | 0.03 | 0.63 | 21 | 0.03 | 0.23 | | | | |
| 1975 | SNE/Mid-Atl | 115 | 15.55 | 895.50 | 41 | 20.27 | 1,548.40 | 36 | 6.11 | 115.20 | 41,912 | 2,412.0 | 48,636 | 7,789.0 |
| | Geo. Bank | 73 | 1.80 | 102.56 | 23 | 1.64 | 142.70 | 25 | 0.47 | 1.82 | | | | |
| | Gulf Maine | 65 | 0.81 | 0.81 | 19 | 0.03 | 1.56 | 23 | 0.02 | 0.40 | | | | |
| 1976 | SNE/Mid-Atl | 123 | 15.79 | 579.79 | 37 | 22.05 | 979.90 | 40 | 3.65 | 90.74 | 44,935 | 1,632.0 | 51,436 | 4,372.0 |
| | Geo. Bank | 67 | 3.14 | 103.52 | 27 | 5.82 | 207.53 | 19 | 2.18 | 54.94 | | | | |
| | Gulf Maine | 55 | 0.36 | 12.67 | 14 | 0.51 | 16.00 | 21 | 1.37 | 8.58 | | | | |
| 1977 | SNE/Mid-Atl | 119 | 11.92 | 577.89 | 46 | 14.20 | 729.54 | 35 | 1.89 | 94.67 | 31,600 | 1,526.0 | 27,421 | 3,157.0 |
| | Geo. Bank | 101 | 0.95 | 43.76 | 38 | 1.34 | 84.06 | 33 | 0.23 | 7.31 | | | | |
| | Gulf Maine | 71 | 0.06 | 0.81 | 23 | 0.04 | 0.48 | 22 | 0.02 | 0.11 | | | | |
| 1978 | SNE/Mid-Atl | 134 | 5.68 | 198.36 | 41 | 8.93 | 362.00 | 52 | 1.37 | 23.26 | 16,583 | 566.0 | 18,800 | 1,251.0 |
| | Geo. Bank | 156 | 1.57 | 45.63 | 53 | 4.04 | 116.10 | 50 | 0.41 | 11.01 | | | | |
| | Gulf Maine | 120 | 0.01 | 0.18 | 39 | 0.06 | 2.08 | 45 | 0.00 | 0.01 | | | | |

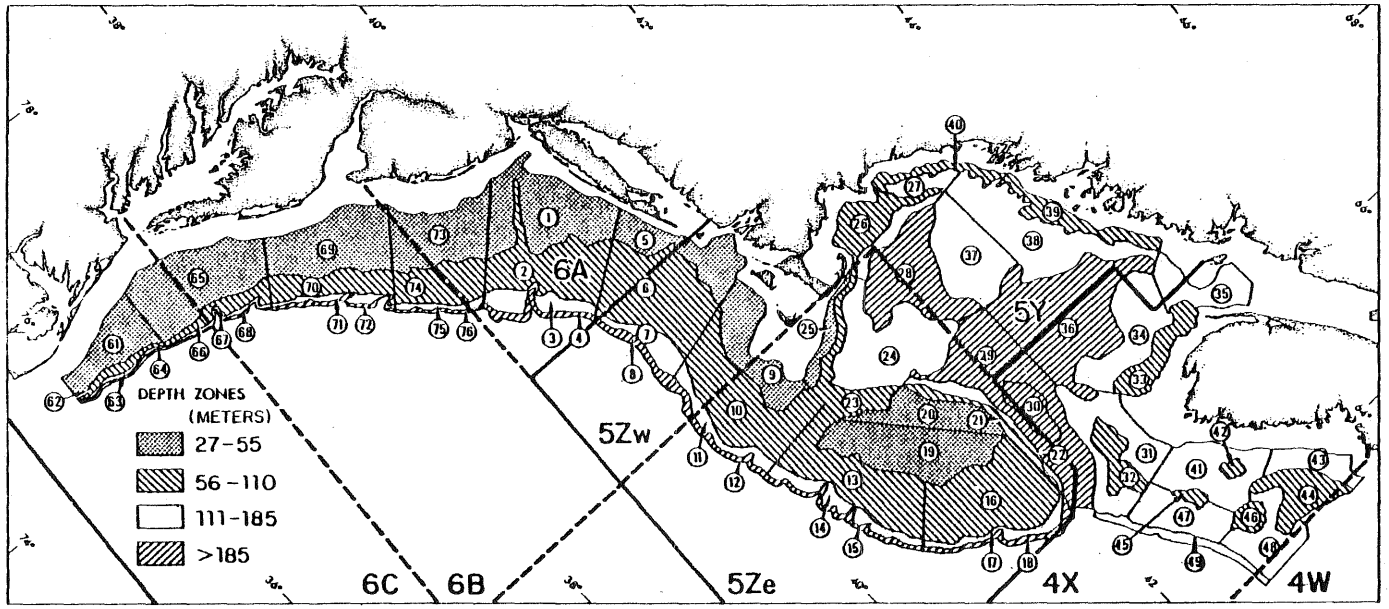
Table 8. *Illex* biomass estimates (mean weights in kg and numbers per tow by strata set).

| Year | Area | Total # tows | Total $\overline{Wt}$/tow | Total #/tow | Day # tows | Day $\overline{Wt}$/tow | Day #/tow | Night # tows | Night $\overline{Wt}$/tow | Night # tow | $B_1$ Wt MT | $B_1$ # x10$^6$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1968 | SNE/Mid-Atl | 124 | 0.48 | 2.62 | 40 | 0.28 | 1.69 | 43 | 0.13 | 0.60 | 1,845.4 | 9.70 |
| | Geo. Bank | 69 | 0.34 | 1.68 | 22 | 0.72 | 2.35 | 25 | 0.04 | 0.26 | | |
| | Gulf Maine | 50 | 0.10 | 0.46 | 18 | 0.18 | 1.49 | 15 | 0.04 | 0.25 | | |
| 1969 | SNE/Mid-Atl | 119 | 0.10 | 0.98 | 38 | 0.17 | 1.64 | 39 | 0.06 | 0.50 | 418.8 | 3.60 |
| | Geo. Bank | 73 | 0.04 | 0.48 | 25 | 0.04 | 0.57 | 32 | 0.06 | 0.43 | | |
| | Gulf Maine | 51 | 0.07 | 0.27 | 17 | 0.14 | 0.51 | 16 | 0.00 | 0.07 | | |
| 1970 | SNE/Mid-Atl | 122 | 0.29 | 3.83 | 38 | 0.21 | 4.53 | 40 | 0.14 | 1.54 | 1,523.6 | 14.60 |
| | Geo. Bank | 70 | 0.24 | 2.62 | 23 | 0.60 | 4.89 | 24 | 0.05 | 0.56 | | |
| | Gulf Maine | 53 | 0.29 | 0.82 | 18 | 0.50 | 1.36 | 16 | 0.02 | 0.11 | | |
| 1971 | SNE/Mid-Atl | 125 | 0.28 | 1.95 | 43 | 0.24 | 1.94 | 41 | 0.13 | 0.71 | 2,024.1 | 10.10 |
| | Geo. Bank | 73 | 0.46 | 1.70 | 27 | 0.55 | 2.23 | 24 | 0.25 | 0.93 | | |
| | Gulf Maine | 55 | 0.43 | 1.81 | 16 | 1.21 | 4.44 | 20 | 0.16 | 0.85 | | |
| 1972 | SNE/Mid-Atl | 114 | 0.45 | 4.86 | 31 | 0.42 | 8.12 | 40 | 0.27 | 1.57 | 1,716.1 | 15.00 |
| | Geo. Bank | 73 | 0.20 | 1.07 | 29 | 0.15 | 0.83 | 21 | 0.15 | 0.72 | | |
| | Gulf Maine | 55 | 0.19 | 0.75 | 18 | 0.34 | 1.50 | 18 | 0.04 | 0.09 | | |
| 1973 | SNE/Mid-Atl | 111 | 0.07 | 0.62 | 38 | 0.08 | 0.66 | 35 | 0.03 | 0.30 | 1,862.0 | 8.20 |
| | Geo. Bank | 73 | 0.50 | 2.51 | 27 | 0.70 | 2.51 | 28 | 0.44 | 3.29 | | |
| | Gulf Maine | 54 | 0.63 | 2.02 | 16 | 1.57 | 5.19 | 21 | 0.09 | 0.26 | | |
| 1974 | SNE/Mid-Atl | 108 | 0.18 | 4.07 | 33 | 0.11 | 7.98 | 38 | 0.20 | 1.23 | 2,500.0 | 18.02 |
| | Geo. Bank | 74 | 0.16 | 1.12 | 20 | 0.22 | 1.19 | 26 | 0.09 | 0.58 | | |
| | Gulf Maine | 57 | 1.16 | 3.92 | 19 | 1.76 | 5.88 | 21 | 0.46 | 1.41 | | |
| 1975 | SNE/Mid-Atl | 115 | 0.99 | 15.74 | 41 | 1.11 | 23.08 | 36 | 0.23 | 1.58 | 8,306.0 | 60.25 |
| | Geo. Bank | 73 | 1.11 | 6.41 | 23 | 1.85 | 13.01 | 25 | 0.76 | 2.03 | | |
| | Gulf Maine | 65 | 2.71 | 7.31 | 19 | 3.34 | 9.17 | 23 | 0.29 | 0.60 | | |
| 1976 | SNE/Mid-Atl | 123 | 6.23 | 19.79 | 37 | 2.60 | 11.23 | 40 | 3.90 | 10.49 | 42,929.0 | 134.34 |
| | Geo. Bank | 67 | 14.78 | 45.03 | 27 | 8.06 | 23.83 | 19 | 3.54 | 9.82 | | |
| | Gulf Maine | 55 | 4.20 | 13.75 | 14 | 5.25 | 16.83 | 21 | 1.35 | 3.47 | | |
| 1977 | SNE/Mid-Atl | 119 | 4.46 | 15.79 | 46 | 3.93 | 16.21 | 35 | 2.32 | 7.71 | 21,747.0 | 73.34 |
| | Geo. Bank | 101 | 5.02 | 15.81 | 38 | 4.09 | 15.23 | 33 | 5.31 | 16.23 | | |
| | Gulf Maine | 71 | 2.21 | 7.24 | 23 | 4.26 | 14.82 | 22 | 0.40 | 1.29 | | |
| 1978 | SNE/Mid-Atl | 134 | 2.57 | 19.50 | 41 | 2.53 | 24.66 | 52 | 1.97 | 8.54 | 26,435.0 | 120.68 |
| | Geo. Bank | 156 | 12.17 | 44.67 | 53 | 34.25 | 109.75 | 50 | 2.68 | 12.56 | | |
| | Gulf Maine | 120 | 1.91 | 5.84 | 39 | 3.75 | 11.25 | 45 | 0.41 | 1.41 | | |

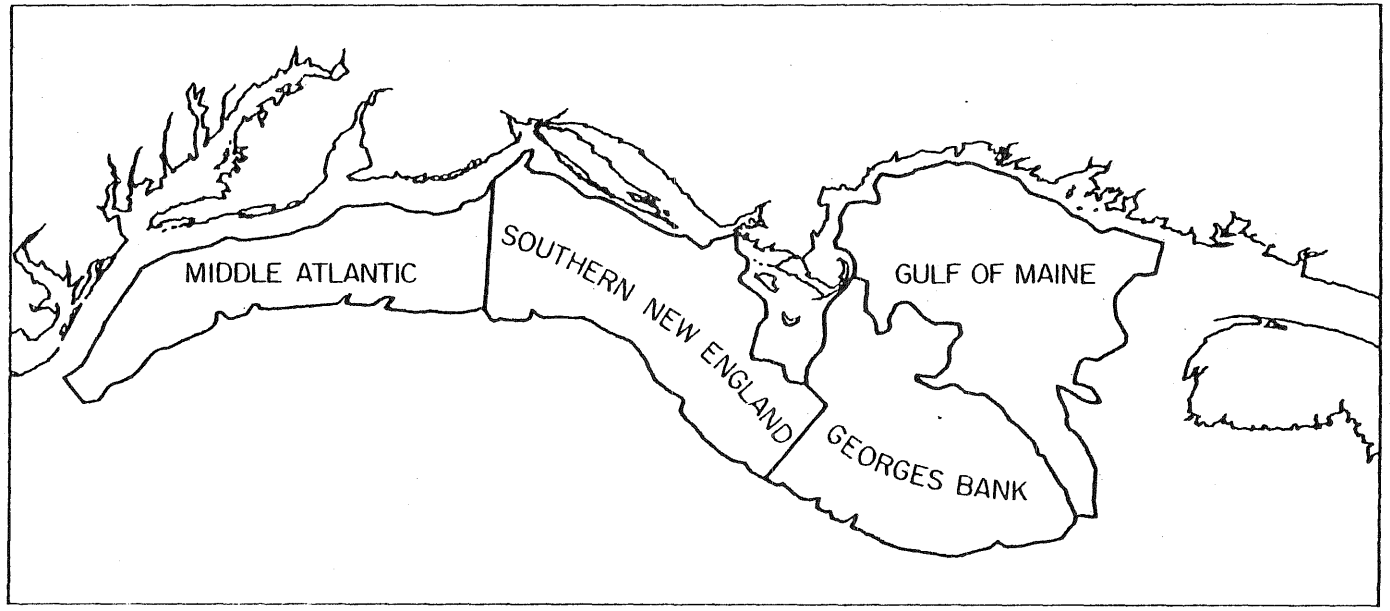
Figure 1. A. US bottom trawl survey strata and ICNAF Subareas 4 and 5 and Statistical Area 6.

B. Geographical areas off the Northeast coast of the US.

A


DEPTH ZONES
(METERS)
27-55
56-110
111-185
>185
6C
6B
6A
5Zw
5Ze
5Y
4X
4W

B


MIDDLE ATLANTIC
SOUTHERN NEW ENGLAND
GULF OF MAINE
GEORGES BANK