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The 1983 Fishery for *Illex illecebrosus* in SA4 and Biological Characteristics of the Stock

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T. W. Rowell and F. Budden

Invertebrates Division, Department of Fisheries and Oceans P. O. Box 550, Halifax, Nova Scotia B3J 2S7

INTRODUCTION

The SA4 fishery for *Illex illecebrosus* has been summarized for previous years by Waldron (1979a, 1979b), Amaratunga and Roberge (1981), Amaratunga et al. (1982) and Rowell and Budden (1983). This paper describes the 1983 fishery as well as the biological characteristics of *Illex* as derived from both the international observer program and research survey data.

MATERIALS AND METHODS

The FLASH information system provided statistical information on the international offshore fishery, including for each participating country, area fished, squid by-catch, directed squid catch, and directed effort days. Information on the Canadian offshore fishery and the inshore fishery were obtained from quota management reports and sales slip data summaries respectively.

Biological data from the international offshore fishery were obtained from random samples by international observers. Research cruises also provided biological and hydrographic data for the offshore areas. Morphometric measurements were taken at sea by international observers on samples of 100 squid as described by Amaratunga and Durward (1979). Measurements on research survey samples and on samples from the IOP processed in the lab were taken on 50 squid. These data were used to describe size and weight composition, growth, and the progression of maturity stages throughout the on-shelf residency sampling period.

International Offshore Fishery

Four countries (Cuba, Italy, Japan, & USSR) reported catches of *Illex* in 1983 although only Italy, with 4 days, and Japan, with 57 days, participated in the directed international offshore fishery (Table 1).

The distribution of fishing effort in the years 1980-1983, based on the locations from which international observer samples were taken, are presented in Fig. 1. In 1983, the fishery operated largely between 62° and 64°w along the small mesh gear line with most of the effort between 62° and 63°w; the same area in which fishing effort was concentrated in 1982.

A total of 408.6 tons were landed in the 1983 international offshore fishery; all from SA4 (Table 1, Fig. 2). This amounts to 81% of the previous years catch and marks the fourth year of successive decline in squid landings since the 1979 peak. Although the total catch was less than that of 1982, directed squid catches were up from 1982 and non-directed catches were much reduced. The directed fishery accounted for 332.6 tons (81%) of the total in 1983 compared with 210.9 tons (42%) of the total in 1982. The remaining 75.7 tons of the 1983 fishery were taken as by-catch in the silver hake fishery. Squid landings as by-catch in 1983 were only 26% the level of 1982.

The sharp decline in non-directed catch in 1982 reflects the early cessation of Cuban and USSR effort in the silver hake fishery.

Squid were first reported as by-catch during week 26 (3rd week of June), five to six weeks later than in any year since the period of rapid development of the international fishery in the mid-1970's. Catches remained low until the 2nd week of August (week 33) when Japan commenced a directed fishery (Table 1, Fig. 3). The directed fishery peaked in week 34 and then declined until week 38 when landings again increased slightly and the directed fishery ended.

Catches in the non-directed fishery were greatest in weeks 36-37. This was solely due to Japanese activity in the silver hake fishery.

Total 1983 effort (directed fishing days) was on a similar scale to 1982 effort (61 and 88 days respectively) and well below the average effort of 2488 days for the years 1978-80.

Overall the 1983 CPUE was only about half the level achieved during the 1978-81 period, but almost double that of 1982. The average CPUE for 1983 was 5.45 tons per day as compared to 2.40 tons per day in 1982.

The weekly mean weights of squid, weighted by sex ratio, have been used to determine numbers of squid landed in each week of the fishery and the catch rate for directed effort days (Table 2). Numbers of squid landed per day in 1983 were much lower than in the years 1977-81 but slightly greater than in 1982.

Canadian Domestic Fishery

There was no participation in the Canadian offshore fishery in 1983.

Catch by month and by gear type in the 1983 inshore fishery in SA4 are presented in Table 3. A total of 8 tons were taken, a considerable decrease from inshore landings of 1130 tons in 1982 and the 1978-82 mean of 1684 tons. Inshore landings in 1983 were greatest in June and July, whereas in 1982 they peaked in August.

Biological Characteristics

Mean mantle lengths obtained by averaging the first two weeks of data from the international observer program indicate that first arrivals in 1983 were considerably smaller than those arriving between one and two months earlier in previous years (Table 4).

Data on mean weight of squid in each week from international observer and research surveys are presented for the years 1977-1983 in Table 5. Mean weights early in the season (weeks 24-33) were considerably below those of previous years. After week 33 mean weights were comparable to those for the same period in 1982 but still significantly lower than values for 1977-81. In 1982, the mean weights after week 32 had been depressed by the influx of smaller squid to the shelf areas; this was not the case in 1983 where length-frequency data up to week 38 show no evidence of significant numbers of smaller squid (Fig. 4). Mean weights did however decrease in weeks 44 and 45. This same pattern with mean weights levelling off and declining was observed in weeks 32-36 in 1982 (Table 5). The mid-season levelling off of mean weights has generally been attributed to the arrival on the Shelf area of increasing numbers of small squid. However, in 1983 this levelling off appears more likely to result from emigration of larger animals from the Shelf.

The growth pattern during the period of on-shelf residency, for male and female *Illex* in 1983, as determined from research survey and observer sample data, is presented in Fig. 5. These data again suggest that in 1983 squid captured early in the season (week 32) were considerably smaller than in the previous year and it was not until weeks 38-40 that mean mantle lengths approached those of 1982.

Cumulative percentage of squid at each maturity stage and mantle length are presented in figure 6. In males, maturity stages 1 and 2 predominated with only a few stage 3 specimens appearing after week 36. Female maturity stages 1, 2, 3 and 4 were found along with one fully mature stage 5. In general, female

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maturity stages 1 and 2 predominated until week 36, after which small numbers of stage 3 animals were regularly observed.

* ~ 0

The maturation process in 1983 appears to have been very similar to that of 1982 and considerably slower than that observed in 1981 (Amaratunga et al., 1982). The percentage of males having reached stage 2 was particularly low and may be a reflection of the small proportion of males (31% at week 38) having achieved a mantle length >200 mm. Fifty percent maturity has not generally been observed for males under roughly 200 mm mantle-length.

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| pori | ed to FLASH. | | | | | | | | | | | | | | | | | |
|--|---|---------|-------------------|-------------------------|--------------|----------------------|-------------------------|---------------------------|--------------|----------------|--------------|----------------------|-------------------|------|-------------------------|-------------------------|--------------------|----------------------|
| Week ending | CUBA By- Dir. Dir. catch catch days | CPUE | By- Di atch ca | ITALY - Di tch da | r. /s CPU | E at B | ch cat | JAPAN ir. Di tch da | r. Iys Cl | - A | By- atch | USS Dir. catch | R Dir. days | CPUE | By. catch | Dir. catch | AL Dir. days | CPUE |
| Jun 24 (26)* | 0.20 | | | | | | | | - | | | | | | 0.20 | | | 1 |
| Jul 01 (27) Jul 01 (27) Jul 08 (28) Jul 15 (29) Jul 22 (30) Jul 29 (31) | 3.00 0.30 0.10 | | | | | | | | | | 2.70 1.80 | | | | 5.70 2.10 0.10 | | | |
| Aug 05 (32) Aug 12 (33) Aug 19 (34) Aug 26 (35) | | | |). 70 | 4 0.1 | ົນ ຜິຍ ຜ | 20 6 70 211 10 81 | 200 200 200 | 4 N Q | 50 30 30 | | | | | 6.20 8.70 5.10 | 6.00 211.30 82.40 | 4 25 23 | 1.50 8.45 3.58 |
| Sep 02 (36) Sep 02 (36) Sep 16 (38) Sep 23 (39) Sep 23 (40) | | | | | | 10 11 12 20 | 30 13 20 1 10 17 | 800 800 800 | 40W | 45 60 97 | | | | | 20.30 17.20 10.10 | 13.80 1.20 17.90 | 400 | 3.45 0.60 5.97 |
| Oct 07 (41) Oct 14 (42) | | | | 1 1 2 1 1 | | O | 30 | | | | | | | | 0.30 | | | |
| Total | 3.60 | | | 0.70 | 4 0.1 | 8 67. | 90 331 | 90 | .7 5. | .82 | 4.50 | | | | 76.0 3 | 32.60 | 61 | 5.45 |
| * Numbers | in parenthesis re | efer t(| o conse | cutive | e week | . with | in yea | ar. | | | | | | | | | | |

Table 1. Catch (t) of *Illex*, directed effort (days), and CPUE (directed) of countries participating in the 1983 international fishery in SA4 as re-

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| Week | | | Directed catch (t) | Effort | Mean WGT (g) | 5 No. Squid x 10 Landed per week | No. Squid x 10 ⁴ landed per day | LN Squid (Squid x 10 [°] /dy) |
|------|------|--------|-----------------------|--------|-----------------|--|---|---|
| Aug | 12 / | (33) | 6.00 | 4 | 86.0 | 0.70 | 1 7 A | |
| Aug | 19 (| (34) | 211.30 | 25 | 121.3 | 17.41 | 1.74 6.97 | 4.24 |
| Aug | 26 (| (35) | 82.40 | 23 | 121.3* | 6.79 | 2.95 | 3.38 |
| Sept | 2 (| (36) | 13.80 | 4 | 120.9 | 1.14 | 2.85 | 3.35 |
| Sept | 9 (| (37) | 1.20 | 2 | 131.6 | 0.09 | 0.45 | 1.52 |
| Sept | 16 (| (38) | 17.90 | 3 | 189.4 | 0.95 | 3.15 | 3.45 |

Table 2. Estimate of number of Illex removed in the International Directed Fishery in 1983.

* Where mean weights were not available, previous week's mean was used to calculate number of squid landed per week.

Table 3. Catch of Illex in the 1983 Canadian Fishery in SA4

| 왕 영상은 가지를 받는 것을 같은 모두 같은 것을 가지를 받는다. | Gear | Month | Catch (t |
|---|---|---|--|
| Inshore | | | |
| a) <u>By month</u> | | May June July August September October November | < 1 5 2 1 1 1 1 1 1 1 1 1 |
| b) <u>By Gear Type</u> | Trap Set Gill Net Weirs Handlines Unspecified | | 8 < 1 < 1 3 < 1 |

* No Canadian offshore landings in 1983

| Mal e | Femailes |
|----------------------------------|---|
| 145.29 (17-19) | 148.86 (17-19) |
| 134.16 (19-21) | 140.25 (19-21) |
| 155.56 (20-22) | 164.40 (20-22) |
| 140.55 (20-22) | 149.68 (20-22) |
| 145.81 (22-24) 108-22 (24-25) | 151.53 (22-24) 113 78 (27 25)* |
| | Maile 145.29 (17-19) 134.16 (19-21) 155.56 (20-22) 140.55 (20-22) 145.81 (22-24) 108.22 (24-25) |

Table 4. Mean Squid Length at arrival on Shelf.

* Numbers in brackets refer to consecutive week within year. Means are obtained by averaging first three weeks of data from the observer program. (Data from first two weeks only was available for 1983).

Table 5. Mean weight (g) of <u>Illex</u> from international observer samples and research surveys. Survey means are presented in parenthesis.

| | | | | Year | | | | s tagi kata Tatu tatu |
|------|------|---------|-------|--------------|-----------------------------|-------|----------|--------------------------|
| Week | 1977 | 1978 | 1979 | 1980 | 1981 | 1982 | 1983 | |
| 16 | 37 | | | | | | | |
| 17 | | | | | | | | |
| 18 | 56 | | | | | | | |
| 19 | | | | | | 67.5 | | |
| 20 | 70 | | | | (31.1) | | | |
| 21 | | | | 150.0 (97.9) | 76.2 | | | 아이와 운영 |
| 22 | 101 | | | 90.1 | 54.8 (51.0) | 57.9 | | |
| 23 | | | | 97.8 | (59.9) | 58.6 | | |
| 24 | 123 | | | 103.9 (96.3) | (63.3) | 80.7 | 15.6 | |
| 25 | | 문 문화가 걸 | | 11.2 (86.5) | 120.1 | 74.5 | 38.4 | |
| 26 | 165 | | | 85.9 (70.9) | 112.6 | 68.0 | | |
| 27 | | 137.9 | 137.1 | 136.5(103.3) | 150.5 | | | |
| 28 | 189 | 134.8 | 134.0 | 141.5 | 172.8 | | | (42.1) |
| 29 | | 138.4 | 138.1 | 92.5 | 192.8 | 94.4 | | |
| 30 | 197 | 189.6 | 149.9 | 104.3 | 174.5 | 112.5 | ata di t | (39.3) |
| 31 | | 159.9 | 159.8 | 130.3 | | | | |
| 32 | 213 | 171.1 | 169.7 | 101.7 | 203.5 | 132.8 | 86.1 | |
| 33 | | 179.8 | 179.5 | 205.7 | 206.2 | | 86.0 | |
| 34 | 240 | 189.8 | 189.4 | 215.3 | 209.8 | 130.0 | 121.3 | |
| 35 | | 199.3 | 199.3 | 138.4 | 231.4 | 109.9 | | |
| 36 | 251 | 209.4 | 209.2 | 196.5 | 248.8 | 117.5 | 120.9 | (124.9) |
| 37 | | 219.3 | 219.1 | 183.6 | 237.2 | 127.2 | 131.6 | (137.8) |
| 38 | 265 | 229.2 | 228.9 | 303.3 | 234.8 | 157.2 | 189.4 | (156.2) |
| 39 | | 239.1 | 238.8 | 217.1 | 이 승규는 것이 같이 많이 많이 많이 많이 했다. | | | (158.5) |
| 40 | 278 | 248.8 | 248.7 | 233.5 | 영양 두려가 있는 것 | | | (170.4) |
| 41 | | 258.7 | 258.6 | 249.2 | | | | |
| 42 | 289 | 268.7 | 268.5 | 225.7 | - | | | |
| 43 | | 309.0 | 308.2 | 264.2 | | | | |
| 44 | 305 | 312.3 | 311.5 | 292.1 | - | | | (113.56) |
| 45 | | 314.5 | 313.8 | 240.0 | | | | (108.38) |
| 46 | 286 | 277.5 | 275.5 | 243.4 | - | | | |
| 47 | | 292.2 | 291.8 | 285.1 | | | | |



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Fig. 2. Annual catches of *Illex illecebrosus* by the international fishery in SA 4.



Fig. 3. Directed and non-directed squid catches and effort as reported to FLASH for 1983 for Subarea 4.



Fig. 4. Percent length frequency distribuiton of *Illex* from international observer samples.

4 9 G

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Fig. 5. Mean mantle lengths of *Illex* in 1983 from research and international observer data.

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Fig. 6. Cumulative percentage of squid at each maturity stage by week and mantle length. Immature stage l's are not shown. Data if from research survey and laboratory sampled international observer data.

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