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The Canadian Fishery for Northern Shrimp (Pandalus borealis)

in Division OA, 1988

by

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INTRODUCTION

Quota reports (preliminary to April 26, 1989) show that 5881 t of shrimp were taken in Division OA in 1988, 239 t less than the quota of 6120 t. This was slightly lower than the 1987 catch (6095 t) but maintains the doubling of the catches taken in both 1985 and 1986 (about 3000 t). A total of 14 vessels participated in the 1988 fishery in this area, compared to 15 in 1987 and only 8 in 1986. The fishery began in early June and continued until the end of November when effort was diverted to new exploratory grounds off Cumberland Sound (Division OB) where catch rates were extremely high (see Parsons and Veitch 1989).

Fishing logs from both foreign and domestic vessels were available for 1988, providing data on fleet performance. These were supplemented by observer data, primarily for the foreign vessels. The 1987 data are now complete and have been updated in this paper for comparison with the available 1988 information. Data are presented on catch and effort in 1988, size distributions of shrimp taken in commercial catches, as well as by catches and discards. These data are compared with the information available from previous years and are presented as a supplement to the data from the main fishery in Subarea 1.

MATERIALS AND METHODS

Monthly catch and effort data were compiled from observer reports and vessel logs for the period 1980 to 1988. Fishing effort and CPUE for each month were plotted by Danish statistical square for 1988 from available vessel logs. Size composition of catches sampled by observers were summarized by month and 100 m depth intervals. Data on by catches were compiled as percentages of the total observed catch in each month and catch rates for the major by-catch species were compared for the period 1980 to 1988. Estimates of the proportions of discarded shrimp also were derived from the data sources.

RESULTS

CPUE and Effort

The monthly catch rates (kg per hr) observed in each year of the time series show a characteristic decline over the season (Fig. 1, Table 1). For most years, the decline levelled off later in the

season (September to November) but in 1985, 1986 and 1988 there was a noticeable recovery of catch rates in the latter months. The 1987 pattern is similar to that of the years prior to 1985 when a recovery was not so obvious.

Weighted catch rates for the July to September period based on observers' reports were 315, 344, 409, 330, 338, 320, 352, 690 and 489 kg per hr from 1980 to 1988, respectively. The decrease in catch rate between 1987 and 1988 was 29 %. Data from vessel logs for the same period showed catch rates of 338, 374, 304, 294, 290, 394, 510 and 433 kg per hr from 1981 to 1988, respectively. The decrease between the 1987 and 1988 rates from these data was 15 %. It is noted that, although the 1988 values are lower than those of the previous year, they are the second highest in the time series.

The distribution of fishing effort in 1988 as determined from vessel logs showed that the fishery was concentrated in the area between 58° and 59°W and 67°30' and 68°N from June to September (Fig. 2). This has been the main area fished in previous years. In June, most fishing occurred very close to the international boundary, the available grounds probably being limited due to ice cover. Subsequently, effort increased to the west and northwest and in October and November extended beyond 59°W and 68°30'N. It appears that, in 1988, slightly more of the grounds to the north and west were utilized late in the season compared to most other years, substantially more than in 1986 (Parsons and Veitch 1988). Catch rates in June and July were high throughout the area fished. In August, catch rates were highest close to the international boundary and this pattern appears to have continued into September, with most of the fishing activity concentrated in that area. The grounds to the northwest attracted more effort in October and November due to the higher catch rates obtained. The low catch rates in December might be related to ice conditions or poor weather but the level of effort is low and cannot be considered reliable.

#### Length distributions

Length frequencies for the sampled catches by month and depth interval (Fig. 3) show a prominent mode around 25 - 26 mm CL occurring in all months of the fishery. This size group consists primarily of female shrimp as evidenced in the October and November samples when they are observed as ovigerous. Several modes of smaller, male shrimp are also present in the samples but, in most cases, overlapping is severe and it is difficult to visually separate the components. The largest male size group appears fairly clearly at 22 - 23 mm with indications of other components at 20 - 21 mm and 18 - 19 mm. Smaller components are not well-represented in the commercial catch data. The size composition of shrimp taken in 1988 was very similar to the pattern observed in 1987 (Parsons and Veitch 1988). The only noticeable difference was a slight decrease in the proportion of male shrimp in the catches of June and July, 1988. Catch rates in June were much higher in depths from 300 to 400 m than in shallower water. Large female shrimp were more abundant in the deeper water. During July and August, catch rates were more comparable over the depths fished and this is reflected in the similarity of the length distributions. More small shrimp were prevalent in September and catch rates and sizes of shrimp were similar over all depths. During the last two months of the fishing season, catches were again dominated by the large, ovigerous females and catch rates were generally higher in the deeper waters.

Size compositions of the catches in both 1987 and 1988 were typical in that male shrimp contributed substantially to the catches in all months and several size groups were present. Smaller males were not apparent in the sampling data in either 1985 or 1986 which contrasted the findings of previous years (Parsons et al. 1987).

Shrimp discards

The percentages of shrimp discards as estimated by observers in 1988 (Table 2) show that levels were similar to those observed in the previous two years, averaging just over 2 %. In the years prior to 1986, discard rates were higher, ranging from 3 to more than 5 %. There were no length frequencies of shrimp discards available from the 1988 fishery for interpretation.

By catches

Observer data on catch composition for each month of the 1988 fishery (Table 3) show that percentage by catch by weight increased from about 3 % in May to about 15 to 18 % during the July to October period and to almost 40 % in November. The first increase was due mainly to an increase in redfish (Sebastes spp.) catches whereas the November increase was more related to the increased incidence of Greenland sharks.

Redfish was the most abundant fin fish species in the catches, ranging from about 2 to 16 % of the total weight of all species. Greenland halibut amounted to less than 4 % of the total observed catch in all months. Catch rates from 1980 to 1988 show a decline for redfish during the first four years, followed by a substantial increase to the highest level observed in 1987. The 1988 catch rate of 76 kg per hour is lower than those of the previous two years but remains substantially higher than the values observed prior to 1986. No length frequency data are available to interpret these catch rates in terms of abundance. CPUE's for Greenland halibut have remained low over the same period but show a gradually increasing trend. Four length frequencies from Div. 0A for the month of August, 1988 show that the Greenland halibut by catch is comprised mostly of small animals. The average length of males and females, combined, was 20.4 cm but the dominant mode was 12.5 cm. Additional modes occurred at 18.5, 26.5 - 28.5 and 32.5 - 34.5 cm in decreasing proportions.

Catch per hour (kg)

|              | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 |
|--------------|------|------|------|------|------|------|------|------|------|
| Redfish      | 63   | 32   | 20   | 9    | 16   | 20   | 90   | 107  | 76   |
| Gr1. halibut | 2    | 3    | 4    | 5    | 6    | 4    | 8    | 11   | 13   |

DISCUSSION AND CONCLUSIONS

Catch rates from the Canadian shrimp fishery in Division 0A for the July to September period have shown an increase from 1980 to 1982 followed by apparent stability or a slight decline from 1983 to 1985. A second increase was observed from 1985 to 1987, by 116 % from observer data and 76 % from vessel logs. The 1988 data show a decline in CPUE by 29 % and 15 % from the two sources, respectively. The increase between 1985 and 1986 was considered in relation to improvements in trawl design and changes in market acceptability of small shrimp in 1986 (Parsons et al. 1987), implying that the increase might not reflect an increase in overall stock abundance. Market conditions in 1987 were similar to those in 1986 in that smaller sized shrimp were acceptable. Although it is uncertain what technological improvements were made in 1987 compared to the previous year, the fishing power of vessels was probably not much greater than that of 1986 and the increases observed might have reflected a real increase in abundance in the area (Parsons and Veitch 1988). Markets in 1988 remained strong and it is unlikely that the fishing power of the fleet decreased from 1987. Therefore, the decrease in catch rates from 1987 to 1988 might signify some decline in abundance between the two years. Although the most recent rate remains high compared to those from years prior to 1987, standardization of the series by vessel and month suggest that the 1987/88 rates might be no higher than those of 1981/82 (Savard and Parsons 1989). It is also noted that the catch in Division 0A accounts for only a small portion of the total offshore catch and trends noted in the former might not apply to the whole stock area.

Distribution of fishing effort in 1988 was similar to that observed in most years in that most occurred between 58° and 59°W, 67° and 68°N. Slight differences have been observed between years which appear to be related to optimization of catch rates within the general area. Although no distinct patterns of shrimp migration have been noted either within or between years, the extension of grounds to the north and west in 1988 and the higher catch rates obtained might suggest some concentration in those areas in the latter months. Aside from this, most seasonal changes in the distribution of the fleet likely relate more to the occurrence of ice on the grounds, especially early and late in the season, rather than changes in shrimp distribution.

The sizes of shrimp taken in the catches of 1988 were similar to those of the previous year. There was a high abundance of females in most months, in spite of a very high catch in the offshore area in 1987 (almost 60,000 t). There were no signs of recruitment failure in 1988 as several age groups of smaller male shrimp were present throughout the season. The data, however, are not quantitative and it is still not possible to speculate on year class strength. The fact that small shrimp were being retained again by the commercial fleet, indicates the continued acceptance of small shrimp in the market place. This is also reflected in the low rate of discards reported in 1988 (about 2 % of the total shrimp catch).

By catches of redfish continued to occur at high levels relative to the 1981 - 1985 period. No information is available on the sizes of redfish taken as by catch and it is uncertain as to what effect this incidental fishery might have on the redfish resource. Because the fishery continued later into the season than in 1987, the incidence of Greenland shark increased, accounting for almost 30 % of the observed catch in November.

#### REFERENCES

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Table 1. Catch<sup>1</sup> (t) and CPUE (kg/hr) by month for Div. OA, 1980-88 from A) observer reports and B) vessel logs.

| Month   | 1980  |      | 1981  |      | 1982  |      | 1983  |      | 1984  |      | 1985  |      | 1986  |      | 1987  |      | 1988  |      |
|---------|-------|------|-------|------|-------|------|-------|------|-------|------|-------|------|-------|------|-------|------|-------|------|
|         | Catch | CPUE | Catch | CPUE | Catch | CPUE | Catch | CPUE | Catch | CPUE | Catch | CPUE | Catch | CPUE | Catch | CPUE | Catch | CPUE |
| A. Obs. |       |      |       |      |       |      |       |      |       |      |       |      |       |      |       |      |       |      |
| May     | 1     | 496  |       |      |       |      |       |      |       |      |       |      |       |      |       |      |       |      |
| Jun     | 26    | 481  | 364   | 487  |       |      | 17    | 518  |       |      |       |      |       |      |       |      |       |      |
| Jul     | 13    | 410  | 862   | 413  | 588   | 561  | 547   | 391  | 430   | 451  |       |      |       |      |       |      |       |      |
| Aug     | 177   | 328  | 795   | 322  | 653   | 384  | 503   | 330  | 203   | 314  | 459   | 267  | 441   | 335  | 835   | 615  | 592   | 434  |
| Sep     | 48    | 261  | 728   | 306  | 398   | 317  | 397   | 272  | 399   | 275  | 339   | 235  | 367   | 290  | 756   | 544  | 723   | 423  |
| Oct     |       |      | 784   | 256  | 471   | 287  | 452   | 274  | 419   | 257  | 452   | 328  | 479   | 388  | 923   | 529  | 832   | 777  |
| Nov     | 22    | 671  | 798   | 248  | 421   | 318  | 181   | 261  | 117   | 277  | 262   | 380  | 841   | 532  | 1     | 378  | 55    | 650  |
| Dec     | 74    | 343  | 75    | 161  |       |      |       |      |       |      |       |      |       |      |       |      | 3     | 869  |
| TOTAL   | 361   | 341  | 4406  | 305  | 2531  | 363  | 2097  | 310  | 1568  | 307  | 2542  | 347  | 2973  | 418  | 3407  | 642  | 2878  | 553  |
| B. Logs |       |      |       |      |       |      |       |      |       |      |       |      |       |      |       |      |       |      |
| Jun     |       |      | 347   | 465  |       |      | 9     | 405  |       |      |       |      |       |      |       |      |       |      |
| Jul     |       |      | 756   | 419  | 373   | 603  | 752   | 389  | 379   | 448  | 924   | 369  | 603   | 450  | 505   | 973  | 763   | 642  |
| Aug     | 54    | 445  | 665   | 307  | 650   | 354  | 1241  | 303  | 354   | 260  | 604   | 251  | 363   | 365  | 1157  | 494  | 1284  | 397  |
| Sep     |       |      | 585   | 297  | 458   | 305  | 798   | 253  | 398   | 243  | 414   | 232  | 241   | 331  | 1183  | 436  | 989   | 381  |
| Oct     |       |      | 833   | 258  | 335   | 268  | 992   | 248  | 324   | 237  | 582   | 323  | 242   | 419  | 2252  | 456  | 1294  | 589  |
| Nov     |       |      | 743   | 249  | 249   | 261  | 257   | 239  | 40    | 311  | 255   | 308  | 604   | 507  | 2     | 570  | 531   | 455  |
| Dec     | 62    | 306  | 72    | 149  |       |      |       |      |       |      |       |      |       |      |       |      | 7     | 131  |
| TOTAL   | 116   | 358  | 4001  | 299  | 2065  | 335  | 4049  | 284  | 1495  | 280  | 3069  | 309  | 2362  | 445  | 5244  | 491  | 4910  | 468  |

<sup>1</sup> Catch is total (including discards) recorded in available vessel logs or estimated by observers and does not represent the total catch taken in each year.

Table 2. Shrimp discards (% of total shrimp catch) in Div. 0A, 1980-88, estimated by observers.

| Month                | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 |
|----------------------|------|------|------|------|------|------|------|------|------|
| May                  | 18.0 |      |      |      |      |      |      |      | 0.6  |
| Jun                  | 15.5 | 2.7  |      |      |      | 4.0  | 2.2  | 1.6  | 1.3  |
| Jul                  | 15.7 | 2.6  | 2.4  | 1.6  | 6.5  | 2.9  | 2.3  | 1.7  | 1.7  |
| Aug                  | 6.0  | 4.4  | 3.3  | 3.0  | 4.9  | 3.4  | 2.4  | 3.4  | 1.4  |
| Sep                  | 2.5  | 5.6  | 3.4  | 3.3  | 5.8  | 2.9  | 2.2  | 1.5  | 2.3  |
| Oct                  |      | 5.7  | 3.4  | 4.6  | 2.8  | 3.8  | 1.7  | 1.8  | 3.1  |
| Nov                  | 0.0  | 3.3  | 2.9  | 5.3  | 6.0  | 6.6  | 2.0  | 2.0  | 2.3  |
| Dec                  | 1.3  | 4.2  |      |      |      |      |      |      | 1.2  |
| Average <sup>1</sup> | 5.26 | 4.13 | 3.06 | 3.22 | 5.09 | 3.68 | 2.12 | 2.10 | 2.20 |

<sup>1</sup> Weighted by observed catch in each month.

Table 3. Observed bycatch in Division 0A, 1988.

|                   | May     |        | June    |        | July    |        | August  |        | September |        | October |        | November |        | December |        |
|-------------------|---------|--------|---------|--------|---------|--------|---------|--------|-----------|--------|---------|--------|----------|--------|----------|--------|
|                   | Wt. (t) | %      | Wt. (t) | %      | Wt. (t) | %      | Wt. (t) | %      | Wt. (t)   | %      | Wt. (t) | %      | Wt. (t)  | %      | Wt. (t)  | %      |
| Shark (NS)        |         |        |         |        | 2.85    | 0.37   | 5.95    | 0.86   | 1.95      | 0.22   | 21.75   | 2.20   | 25.25    | 28.85  |          |        |
| Skate (NS)        | 0.04    | 0.25   | 0.10    | 0.46   | 0.66    | 0.09   | 1.74    | 0.25   | 5.31      | 0.60   | 4.35    | 0.44   | 0.24     | 0.27   | 0.01     | 0.28   |
| Cod               |         |        |         |        | 0.25    | 0.03   | 1.07    | 0.15   | 1.71      | 0.19   | 1.49    | 0.15   | 0.16     | 0.18   |          |        |
| Eelpouts          |         |        |         |        | 0.24    | 0.03   | 0.68    | 0.10   | 1.18      | 0.13   | 1.14    | 0.12   | 0.18     | 0.21   | 0.01     | 0.28   |
| Redfish (NS)      | 0.26    | 1.60   | 0.81    | 3.73   | 119.65  | 15.68  | 74.45   | 10.76  | 104.21    | 11.84  | 90.14   | 9.13   | 4.38     | 5.01   | 0.07     | 1.93   |
| American plaice   |         |        |         |        | 0.04    | 0.01   | 1.62    | 0.23   | 4.24      | 0.48   | 6.15    | 0.62   | 0.10     | 0.11   | 0.01     | 0.28   |
| Greenland halibut | 0.10    | 0.62   | 0.02    | 0.09   | 3.03    | 0.40   | 11.07   | 1.60   | 30.50     | 3.46   | 23.46   | 2.38   | 1.78     | 2.03   | 0.02     | 0.56   |
| Other             | 0.03    | 0.18   | 0.03    | 0.14   | 0.51    | 0.06   | 3.70    | 0.54   | 9.00      | 1.03   | 7.04    | 0.70   | 0.75     | 0.87   |          |        |
| Bycatch total     | 0.45    | 2.77   | 0.96    | 4.42   | 127.23  | 16.67  | 100.28  | 14.49  | 158.10    | 17.95  | 155.52  | 15.74  | 32.84    | 37.53  | 0.12     | 3.33   |
| Shrimp (P.b.)     | 15.77   | 97.23  | 20.78   | 95.58  | 635.82  | 83.33  | 591.72  | 85.51  | 722.83    | 82.05  | 832.25  | 84.26  | 54.67    | 62.47  | 3.48     | 96.67  |
| Grand totals      | 16.22   | 100.00 | 21.74   | 100.00 | 763.05  | 100.00 | 692.00  | 100.00 | 680.93    | 100.00 | 987.77  | 100.00 | 87.51    | 100.00 | 3.60     | 100.00 |

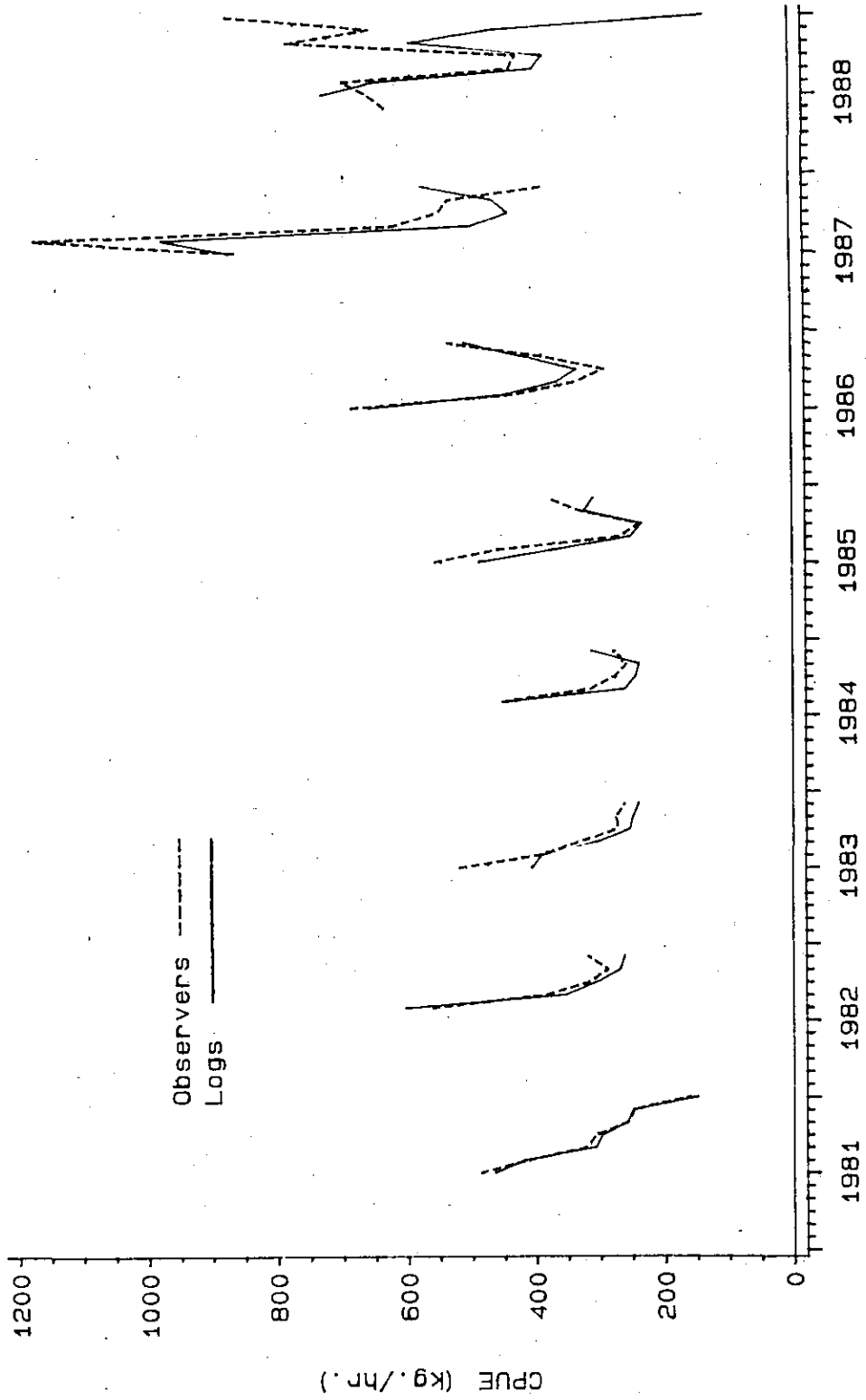


Fig.1 Monthly CPUE (kg/hr) for shrimp vessels of tonnage classes 4, 5 and 6, Div.0A, 1981 - 1988.

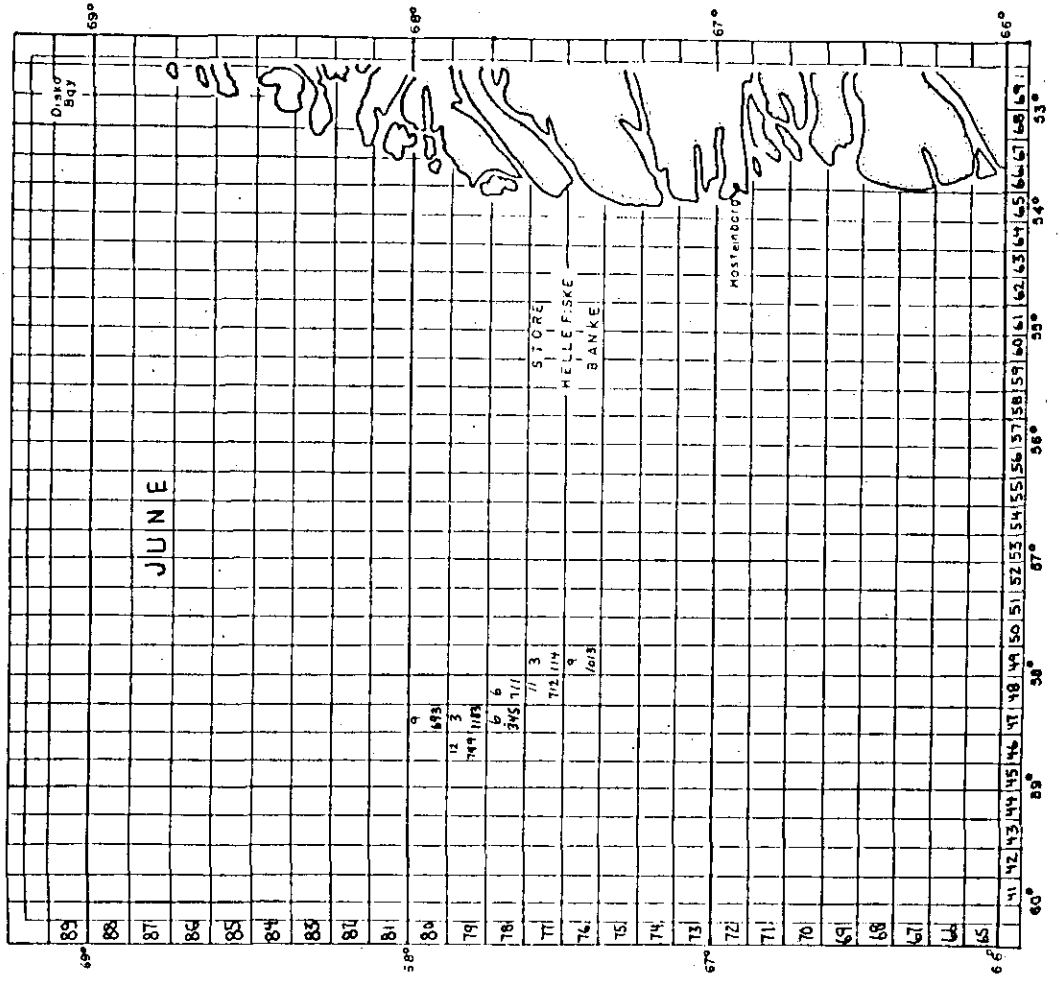
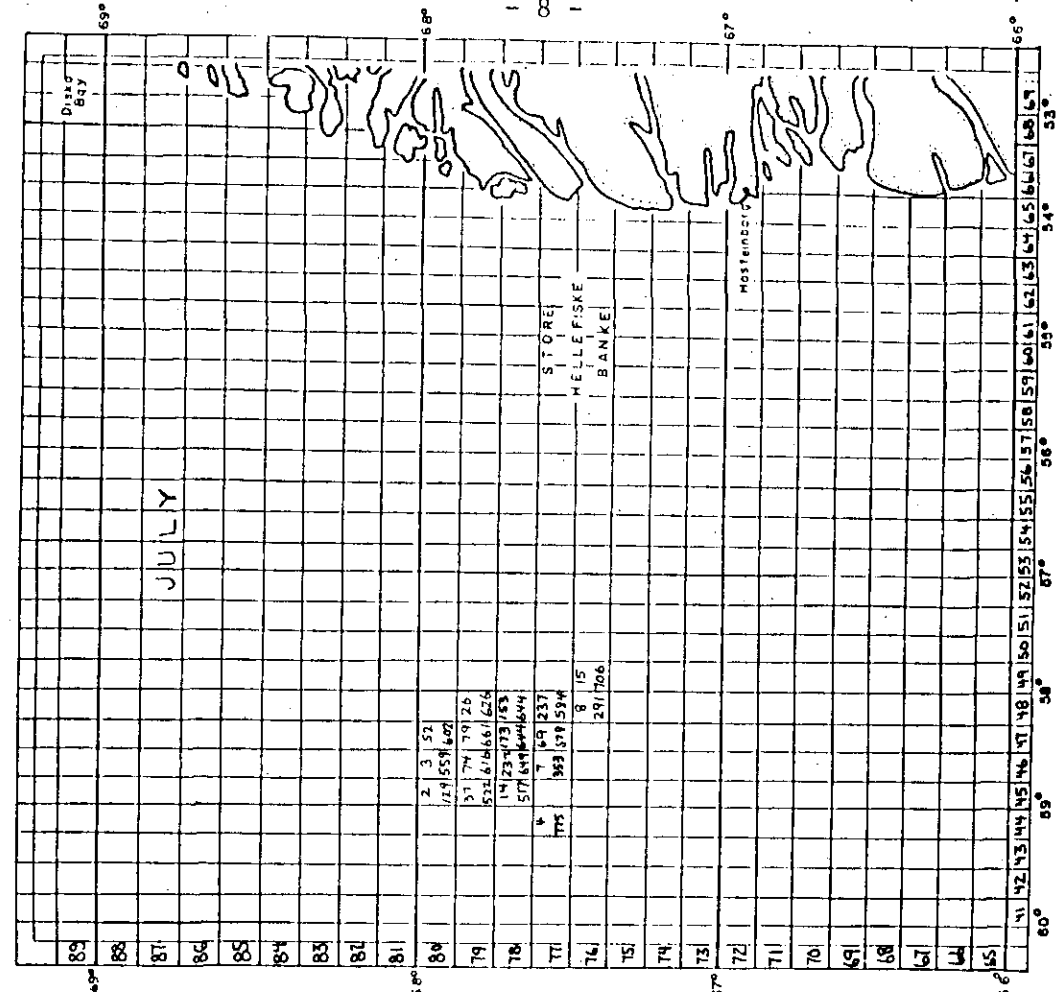


Fig. 2. Hours fished (upper) and kg/hr (lower) from 1988 logs.



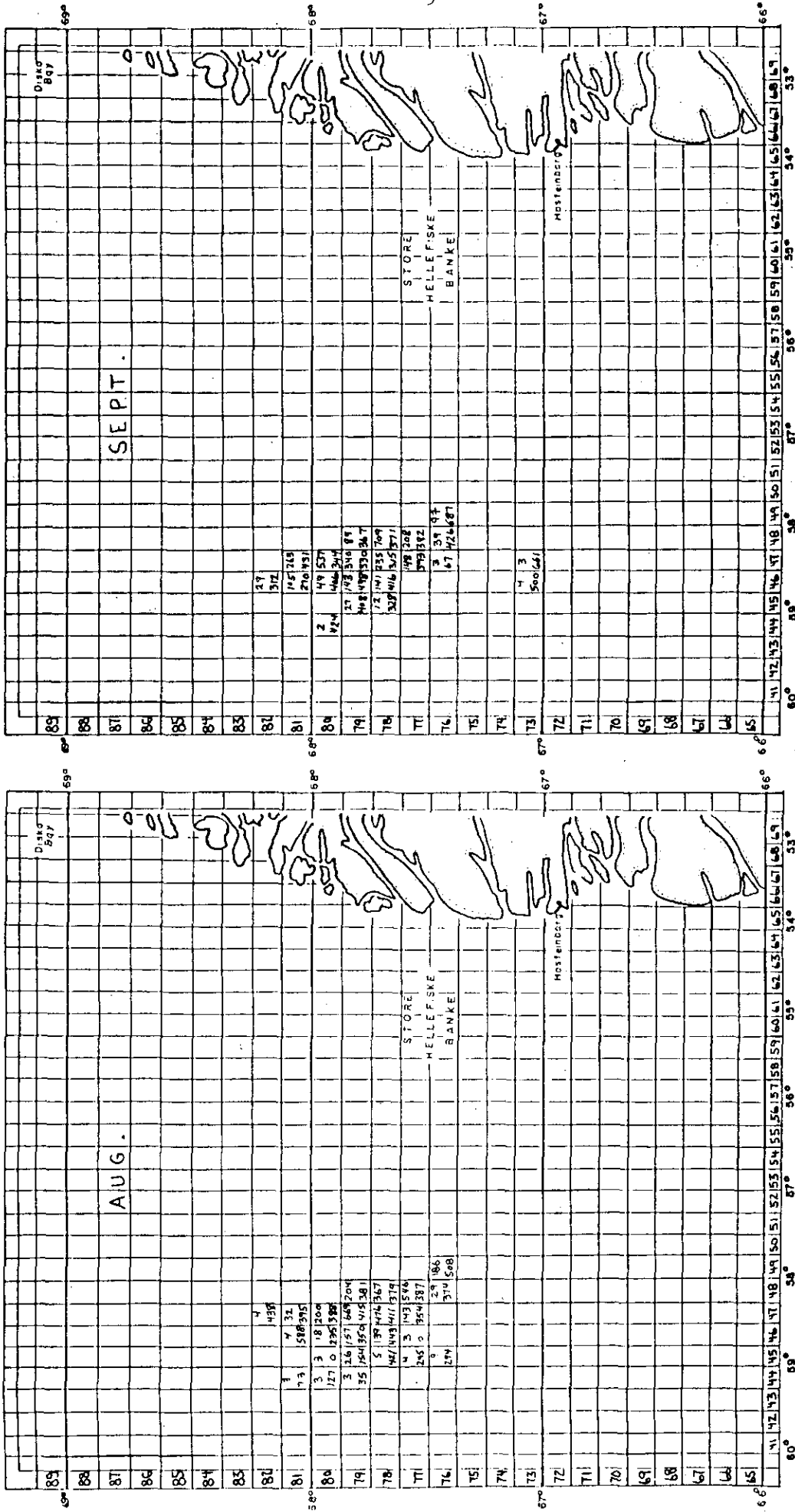


Fig. 2. Continued.

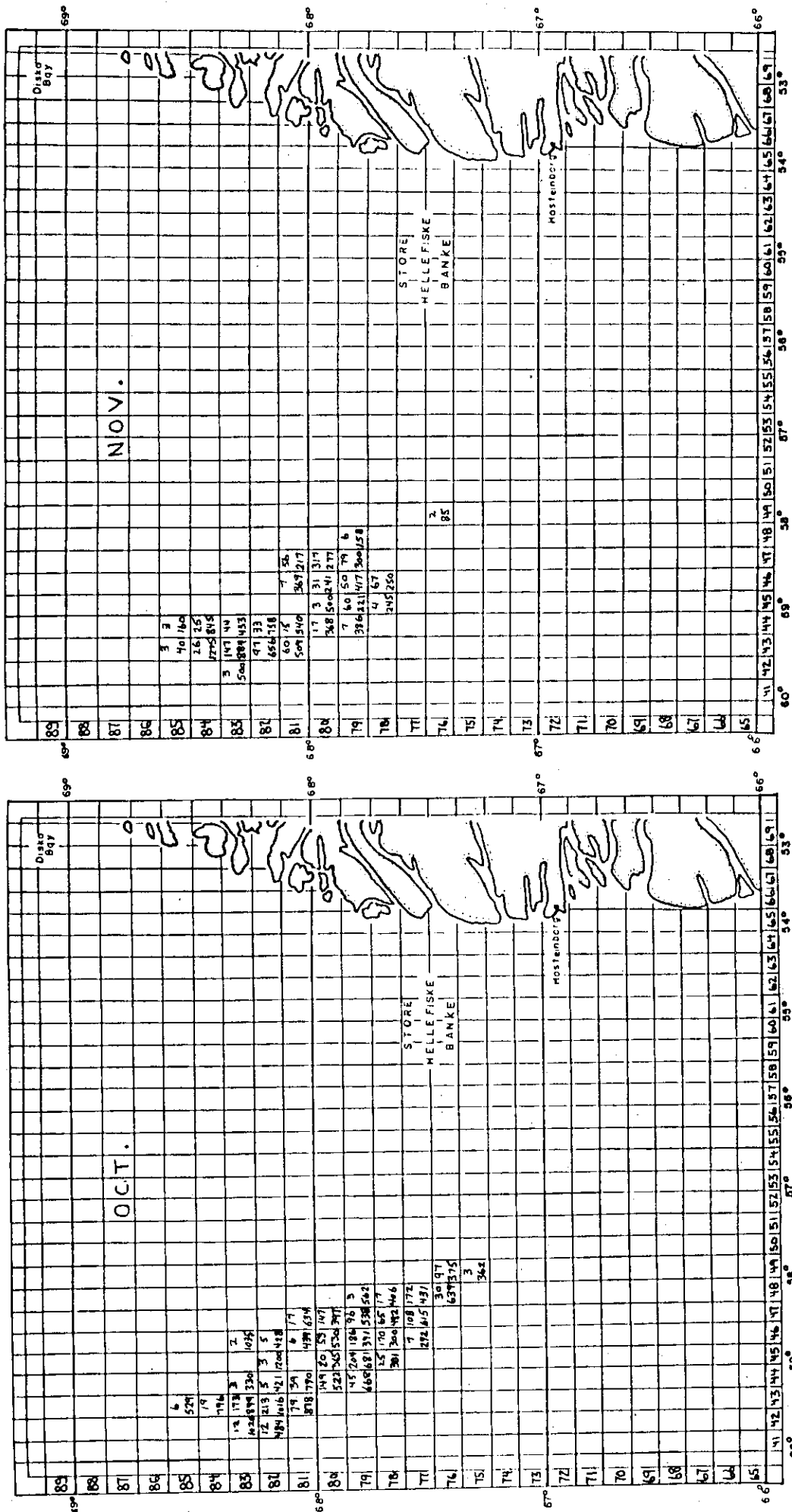


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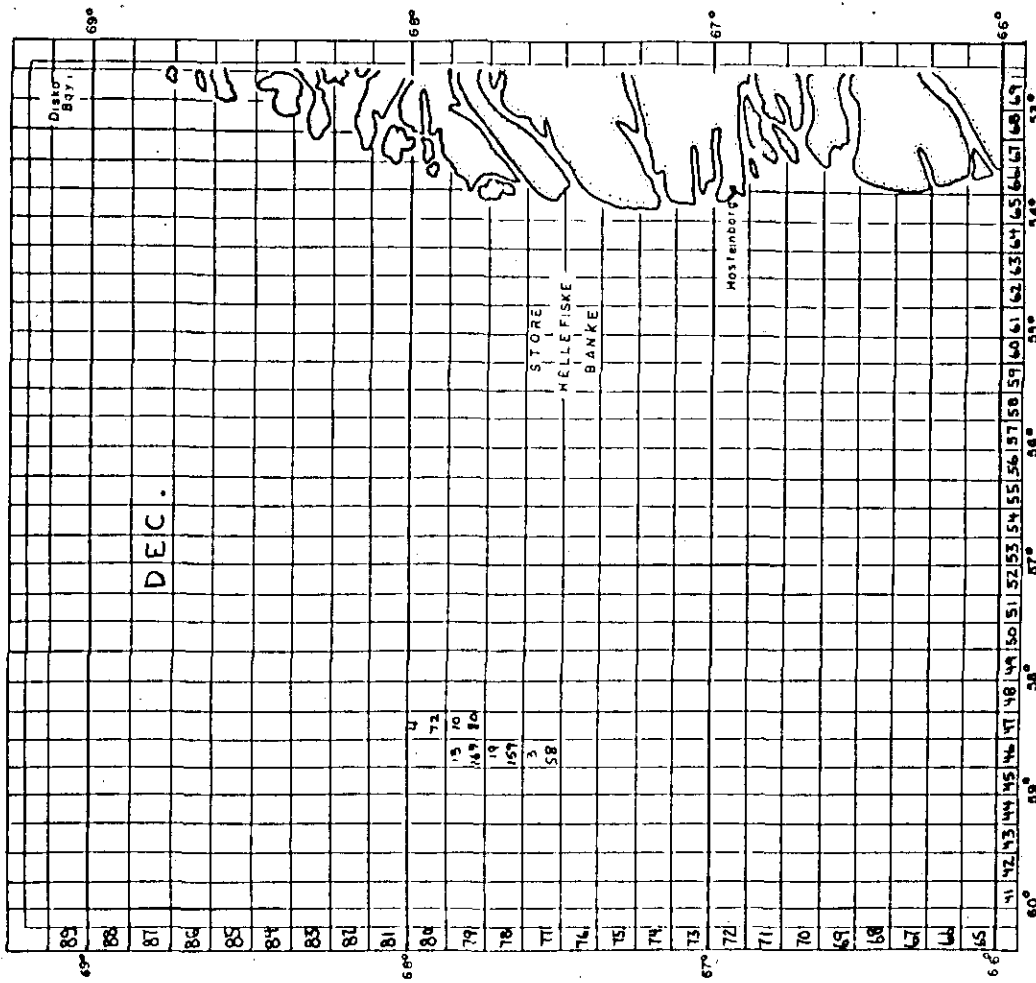


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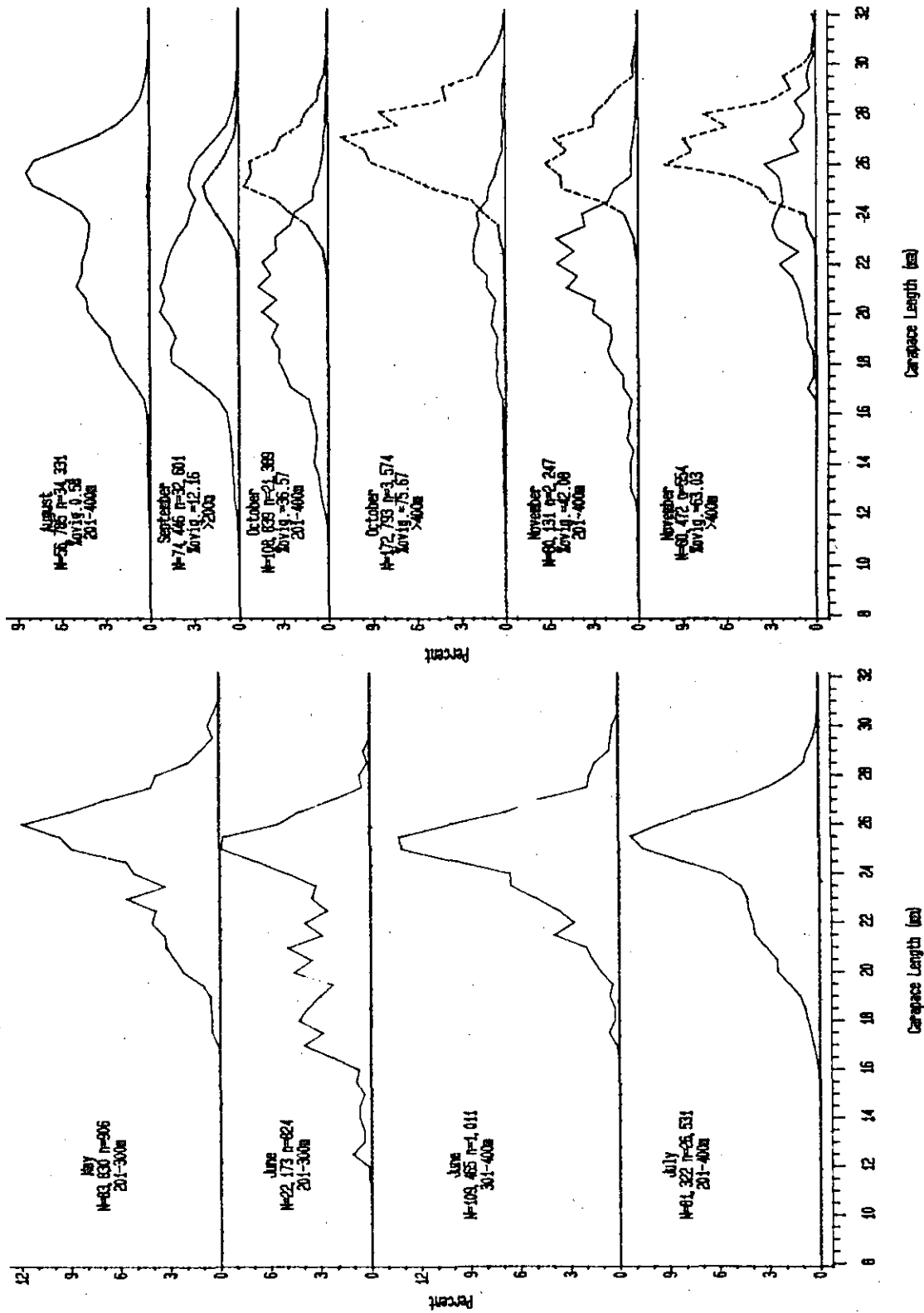


Fig. 3. Commercial length frequencies by month and depth, 1988. (--- = ovigerous, N = number/hour, n = number measured.)