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Status of the Short-finned Squid (*Illex illecebrosus*) off the Northeastern USA

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by

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SUMMARY

Research survey biomass and abundance indices for the squid, *Illex illecebrosus*, off the northeastern USA are updated for 1982 and 1983. Commercial catch data are also updated for 1982 and January - September 1983. Distant-water-fleet (DWF) catches decreased significantly in 1982 to the lowest level observed since 1971, while domestic catches were almost four times their previous annual high. Through September 1983, domestic catches were already 65% higher than in 1982, while no DWF catches had been reported for the 1983-84 fishing year (initial DWF allocations were reduced from 8,600 metric tons (mt) at the beginning of the 1982-83 fishing year to 500 mt for 1983-84).

Population abundance estimates for *I. illecebrosus* based on the autumn 1982 bottom trawl survey (primarily the 1981 year class) were the lowest since 1974, while pre-recruit abundance was greater than in 1979 and 1980 and greater than the 1967-81 median, indicating that the large 1980 year class, observed in the 1981 autumn survey, may have produced an average year class. Preliminary estimates based on the 1983 autumn survey indicate a further decline in population size. The 1983 estimate is comparable to those observed during 1968-74 and indicates that the stock should be able to support the present optimum yield of 30,000 mt. However, any further reduction in stock size estimates would require reevaluation of optimum yield.

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INTRODUCTION

This document updates information regarding the status of the *Illex illecebrosus* squid stock (Lange 1982) in the area from the Mid-Atlantic to the Gulf of Maine. Information presented includes catch and length frequency data from the 1982 and early 1983 USA and distant-water-fleet (DWF) fisheries, and minimum biomass and abundance estimates and pre-recruit abundance indices for 1982 and 1983 (preliminary) from NEFC autumn bottom trawl survey data.

BIOLOGY

Illex illecebrosus, the short-finned or summer squid, is generally distributed between Newfoundland and Florida, with fishable concentrations between Newfoundland and Cape Hatteras. This species undergoes seasonal migrations, moving into shallow waters from New England to Newfoundland and onto the continental shelf in the Mid-Atlantic area in the summer to feed. In late autumn, short-finned squid begin an offshore migration to the edge of and beyond the continental shelf where they spawn during the winter (Figure 1). *Illex illecebrosus* is a short lived species which is assumed to die after spawning at about 12-24 months.

The relationship between *I. illecebrosus* located off the USA coast and those off the Canadian coast has not been fully determined, although there is strong evidence that these squid may represent two components of a single stock (Dawe et al, 1982).

COMMERCIAL CATCH

The provisional international catch off the northeastern USA in 1982 was 18,250 metric tons (mt) (Table 1), nearly a 20% increase from 1981 and the highest since 1977. The projected maximum for 1983 is about 14,600 mt which assumes that the DWF takes the entire remainder of the 1983-84 fishing year allocation during October-December. The provisional 1982 USA catch. taken primarily between July and September, totaled 5,900 mt (Table 1), representing a 10-fold increase both from 1981 and from the 1967-81 average (since the first reported DWF offshore squid catches). This amount included about 2,350 mt taken in joint ventures with foreign companies. The USA catch during January - September 1983 (9,761 mt) was much greater than for all of 1982. This increase was due to continued development of the joint venture fishery which accounted for 8,347 mt in the Mid-Atlantic area during January - September 1983, compared with 2,338 mt during all of 1982. The projected total USA catch for 1983 is about 10,000 mt.

Catches by Japan, Italy, and Spain (Table 1) totaled 12,350 mt (preliminary) in 1982, down 16% from 1981 and the lowest since the directed offshore fishery began in 1972. This fishery takes place offshore, primarily between July and October.

The international catch of I. illecebrosus in Canadian waters has decreased sharply each year from the 1979 high of 162,100 mt to 12,800 mt in 1982. In spite of these reductions in catch, the annual total allowable catch (TAC) has remained at 150,000 mt since 1980. The decreased catches have been attributed to lower availability and a consequent reduction in directed fishing effort (NAFO 1983).

MANAGEMENT

The squid stocks in USA waters are currently managed on an April 1 - March 31 fishing year. Domestic and DWF allocations and catches of I. illecebrosus for the 1982-83 fishing year and preliminary values for the 1983-84 fishing year are presented in Table 2. Sixty-one percent of the allocated portion of the final total allowable level of foreign fishing (TALFF) and 71% of the domestic annual harvest (DAH) were taken during the 1982-83 fishing year (118% of the DAH when joint venture catches are included). Allocations of reserve amounts to the DWF late in the fishing year (1 October

1982) are reflected in the final TALFF. DWF catches might have been higher had reserve amounts been allocated at the start of the fishing year, since allocations from the initial TALFF may have been restrictive for some countries. In fact, total catches by Japan, Italy, and Spain were 48% greater than their initial allocations (8,366 mt) and catches during January - March 1983 were greater than from the same period in most years since 1978 when the DWF was restricted to fishing windows.

The *Illex* fishery continues to change toward an entirely domestic fishery with 90% of the optimum yield for the 1983-84 fishing year allocated to the domestic fishery (74% allocated for joint ventures) compared to only 17% in the 1982-83 fishing year. Thirty-four percent of the domestic allocation had been taken through September, with 86% of that in joint ventures.

LENGTH FREQUENCY OF COMMERCIAL CATCH

Length frequencies were pooled by month over all otter trawl catches sampled from the 1982 USA summer-autumn fishery for *I. illecebrosus* conducted in the Gulf of Maine, on Georges Bank, and in the Mid-Atlantic area (Figure 2) Catches in each area were, as expected, dominated by the 1981 year class which had moved onto the continental shelf during

the summer to feed. This year class began to move offshore to its spawning areas in October. Catches in the Gulf of Maine during July and August consisted primarily of a single mode at 17 and 18 cm, respectively. On Georges Bank during July and August, a single mode was also dominant at 18 cm, although a smaller mode occurred at 15 cm. Samples from the Mid-Atlantic area during June, July, August, and October were also dominated by a single mode ranging from 20 to 22 cm.

Length frequencies collected by USA observers in 1982 from the distant-water-fleet fisheries were also characterized in most months by a single mode representing the 1981 year class (Figure 3). There was a general increase in modal length from about 10-14 cm during the first quarter of the year to 20-23 cm during July - December. In August and December, a second mode at 13-14 cm was also evident, indicating recruitment of the 1982 year class. This second mode was most apparent in Foreign Fishing Areas 2, 3, and 4 (Figure 4) and in the catches of Spain and Japan. The individuals of the larger mode (23-25 cm, 19-23 months of age) probably made up the bulk of the spawning stock in the winter-spring of 1983.

Length frequencies were also obtained from May - September shoreside and joint venture landings in 1983 (Figure 5). As in 1982, catches in most months were dominated by a single size group representing the 1982 year

class. In Division 6B, dominant modes occurred at 13 cm in May, 14 cm in June and July, and at 19 cm in August and September.

Peaks in length distributions in Division 6C were at 17 cm in June and July and at 18-19 cm in August, again representing the bulk of the 1982 year class. Smaller modes at 10 and 13 cm during June may reflect significant summer spawning during 1982.

BIOMASS AND ABUNDANCE

Minimum biomass and abundance estimates for *I. illecebrosus* in USA waters were derived by areal expansion of stratified mean weight and numbers per tow calculated from NEFC autumn bottom trawl survey data (Table 3). These estimates were made using the equation:

$$B = WA / a$$

where B = estimate of biomass or abundance, W = stratified mean weight or number per tow, A = strata area (Figure 6) sampled (in square miles), and a = area swept by each tow (0.011 square miles). The 1982 estimates (3.319 mt and 21 million individuals) were 95% and 90% below the 1981 record high levels (68,611 mt and 219 million individuals) and were the lowest since 1974,

60% and 65% below the 1967-81 medians. Substantial decreases in both survey and commercial abundance indices were also observed in Canadian waters in 1981 and 1982 (NAFO 1983).

The strong 1980 year class observed during the 1981 autumn survey at about 19 months of age may have spawned an average year class during the winter-spring of 1982. Although the overall abundance index from the 1982 autumn survey (4.3/tow - Table 4) was the lowest since 1974, the same proportion of individuals (23%) were of pre-recruit size compared to the 1967-81 median. Abundance of pre-recruits ($\leq$10 cm and about 9 months old) in autumn 1982 was 43% above the median during 1967-81.

Preliminary minimum biomass and abundance estimates for 1983 were even lower than in 1982 (1,237 mt and 10 million individuals). Pre-recruit abundance in 1983 was also down (80%) from the 1982 level with only about 10% of the 1983 abundance index attributed to individuals $\leq$10 cm (Table 4). Years with high recruitment indices tend to be followed by years with high adult abundance indices. However, some of the highest adult indices have been preceded by very low levels of pre-recruit abundance.

CONCLUSION

The autumn 1983 *I. illecebrosus* survey abundance index (all sizes) from USA waters was the lowest since 1973, representing the second year of markedly reduced biomass and abundance indices. Pre-recruit abundance in 1983 also was below any level since 1970, and may forecast reduced availability to the 1984-85 fishery. However, this autumn recruitment index is not always indicative of adult abundance in the following summer - autumn fishery.

The total catch during 1982 was the highest since 1977 and comparable to the 1972-81 average, while DWF catches were the lowest since 1971. Domestic catches in 1982 were about four times greater than past levels, while catches during January - September 1983 were 65% greater than for all of 1982. However, USA catches for that period were only 34% of allocated amounts. with joint ventures taking only 38% of their allocation.

Based on 1982 and 1983 autumn research survey estimates, abundance of *Illex* appears to be significantly reduced from recent (1975-81) high levels, with the 1983 estimate being the third lowest of the time series (1968-83). The inability of some USA joint ventures to catch allocated amounts during autumn 1983 and the sharp declines in both catch and abundance estimates off Canada in 1979-82, also indicate substantial reductions in abundance of this stock.

The current optimum yield is based on analyses (Sissenwine and Tibbetts 1977) which indicated that a catch of 42,000 mt would be reasonable, given the stock size estimates available at that time (for the southern Scotian Shelf/Georges Bank areas in 1971). Uncertainty in those estimates and in the magnitude of annual fluctuations in population size prompted a reduction in optimum yield to 30,000 mt to protect the stock during years of reduced abundance. Minimum population size, estimated from the 1982 NEFC autumn research survey (21 million individuals), was more than twice the comparable estimate for 1971, while the 1983 estimate equalled that for 1971. Assuming the NEFC survey estimates to be a consistent measure of relative population size, then the current abundance is similar to that in 1971 and should be adequate to support the present 30,000 mt optimum yield during the 1984-85 fishing year. However, any further reduction in stock size estimates would require reevaluation of optimum yield.

LITERATURE CITED

Dawe. E.G., M.C. Mercer and J.W. Thelfall. 1982. On the stock identity of short-finned squid (*Illex illecebrosus*) in the Northwest Atlantic. NAFO SCR Doc. 82/IX/91. Ser. No. N600, 17pp.

Lange, A.M.T. 1982. Stock status of the squid (*Illex illecebrosus*) populations off the northeastern USA. NMFS, NEFC, Woods Hole Lab. Ref. Doc. No.82-27, 20 p.

NAFO, 1983. Provisional report of Scientific Council, 8-23 June 1983. NAFO SCS Doc. 83/VI/21. Ser. No. N730:35-37.

Sissenwine, M.P. and A.M. Tibbetts. 1977. Simulating the effect of fishing on squid (*Loligo* and *Illex*) populations off the Northeastern United States. Int. Comm. Northw. Atlant. Fish. Sel. Pap, No. 2:71-84.

Table 1. Annual short-finned squid (*I. illecebrosus*) catches (in metric tons) from the Northwest Atlantic (Cape Hatteras to Gulf of Maine) by the USA and the distant-water-fleet (DWF), 1963-1983.

Year	USA	DWF	Total
1963	810	0	810
1964	358	2	360
1965	444	78	522
1966	452	118	570
1967	707	285	992
1968	678	2,593	3,271
1969	562	975	1,537
1970	408	2,418	2,826
1971	455	159	614
1972	472	17,169	17,641
1973	530	18,625	19,155
1974	148	20,480	20,628
1975	107	17,819	17,926
1976	229	24,707	24,936
1977	1,024	23,771	24,795
1978	385	17,310	17,695
1979	1,780	15,742	17,522
1980	349	17,529	17,878
1981	631	14,723	15,354
1982[1]	5,900	12,350	18,250
1983[2]	10,000	4,580	14,580

1 Provisional
2 Projected, assuming DWF takes entire 1983-84 allocation during October - December 1983.

Table 2. Total domestic and distant-water-fleet (DWF) allocations and catches of the squid, *Illex illecebrosus*, in the 1982-83 and 1983-84 (preliminary) fisheries (metric tons).

Item	1982-83	1983-84 [1]
Optimum yield	30,000	30,000
Domestic annual harvest	5,000	27.100
Initial reserve	13.000	2,900
Initial TALFF	12,000	500
Final TALFF	22,777	2,900
Final DWF allocation	21,100	557
Domestic landings	5,900	9,761
Shoreside	3.562	1,414
Joint venture	2,338	8,347
DWF catch	12,940	3

[1] Values as of 1 October 1983.

Table 3. *Illex illecebrosus* minimum biomass (metric tons) and abundance (in millions) estimates[1] for the Mid-Atlantic to Gulf of Maine, 1968-1982.

Year	Biomass	Abundance
1968	1.845	10
1969	419	4
1970	1.524	15
1971	2,024	10
1972	1.716	15
1973	1.862	8
1974	2,500	18
1975	8,306	60
1976	42,929	134
1977	21,747	73
1978	26,435	121
1979	41,455	144
1980	18,729	80
1981	68,611	219
1982	3.319	21
1983	1.237	10

[1] From areal expansion of stratified mean weights (kg) and numbers per tow by strata set.

Table 4. Total abundance and pre-recruit indices[1] for the short-finned squid, *Illex illecebrosus*, 1967-82.

Year	All sizes	≤ 10 cm
1967	2.1	0.7
1968	2.3	0.6
1969	0.8	0.3
1970	3.4	0.2
1971	1.9	0.6
1972	3.5	1.8
1973	1.3	0.3
1974	3.0	2.1
1975	12.4	9.6
1976	28.7	0.6
1977	15.8	1.1
1978	28.4	5.1
1979	32.1	2.6
1980	17.0	0.7
1981	54.8	0.5
1982	4.3	1.0
1983	2.0	0.2

[1]Stratified mean number per tow of all sizes and of individuals ≤ 10 cm mantle length from autumn bottom trawl surveys, Mid-Atlantic to Georges Bank.

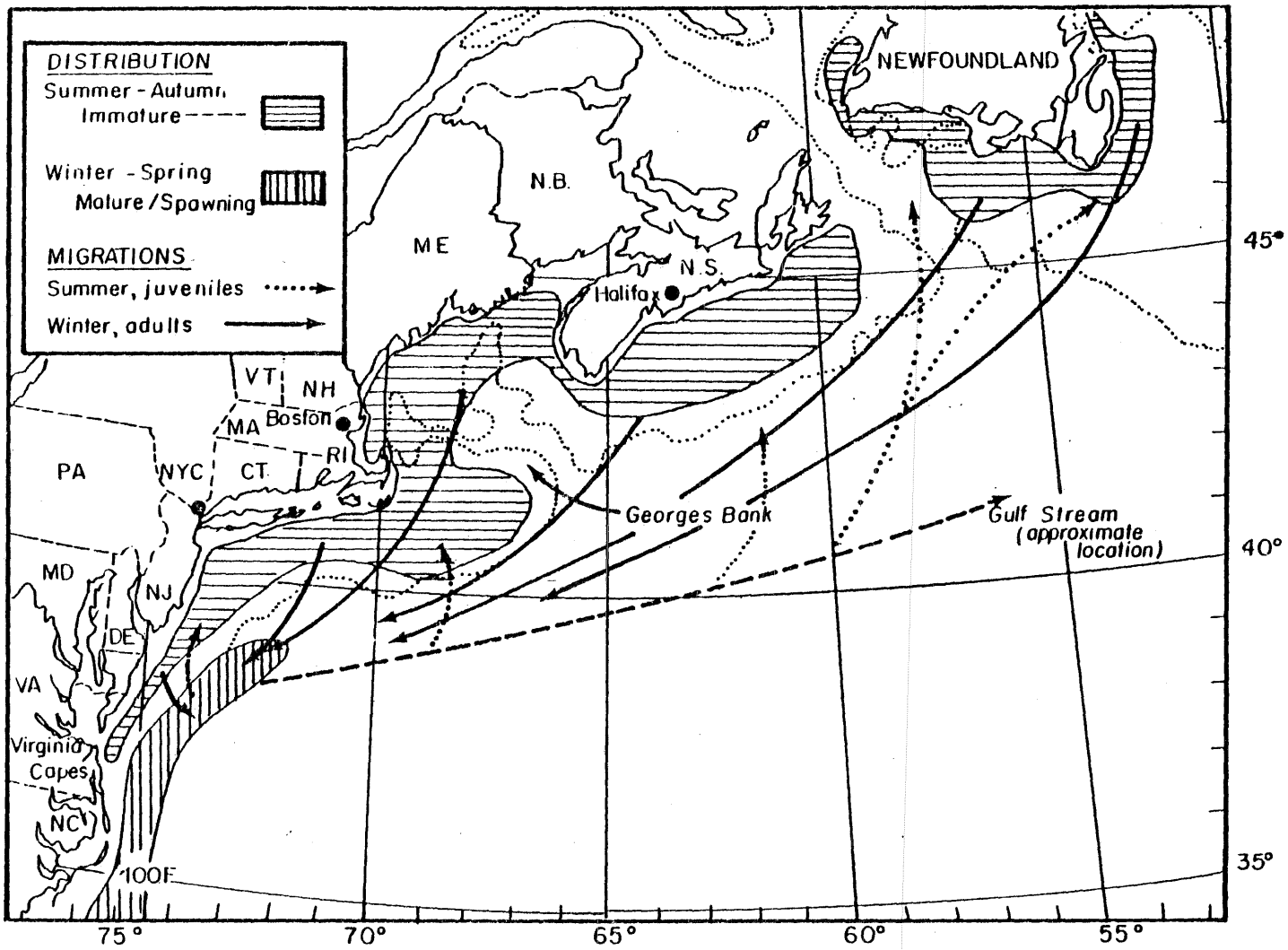

Figure 1. Migration patterns of the short-finned squid (Illex illecebrosus), including inshore feeding and offshore spawning locations.

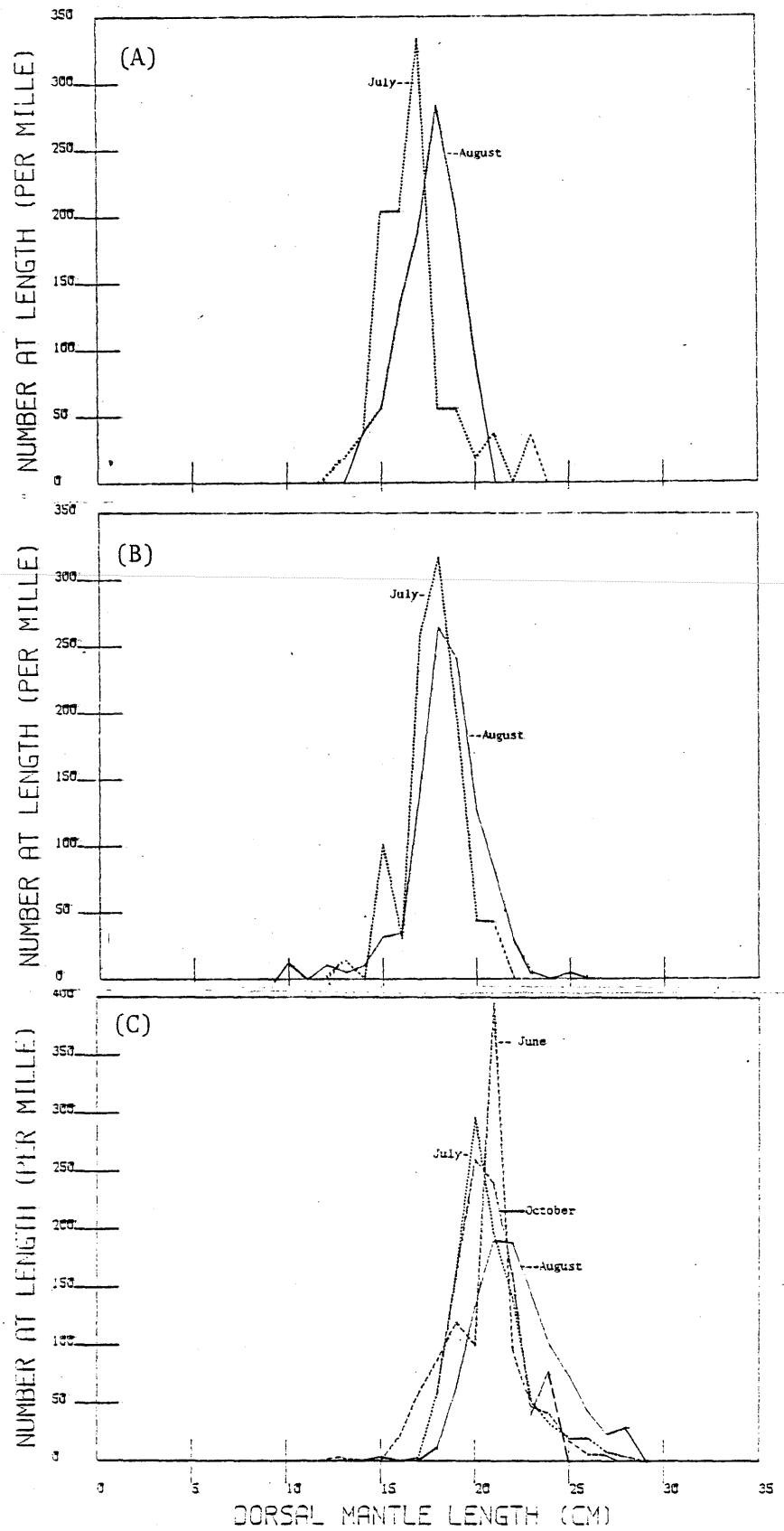

Figure 2. Length frequency distributions of the short-finned squid (Illex illecebrosus), from the 1982 USA fishery in the Gulf of Maine (A), Georges Bank (B), and the mid-Atlantic (C) areas.

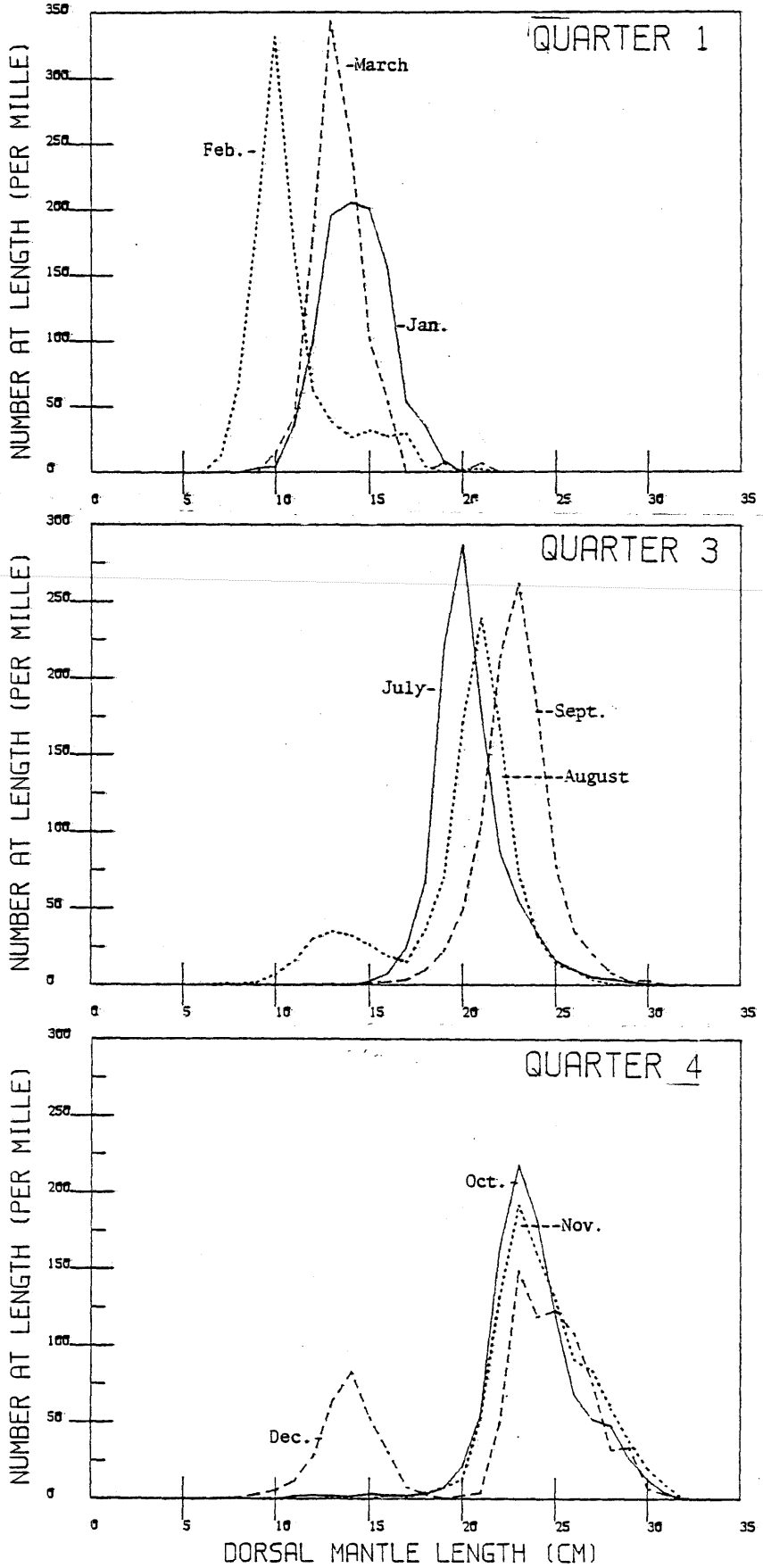

Figure 3. Length frequency distributions of the short-finned squid (Illex illecebrosus), from the 1982 DWF fishery based on NMFS Foreign Fishery Observer data.

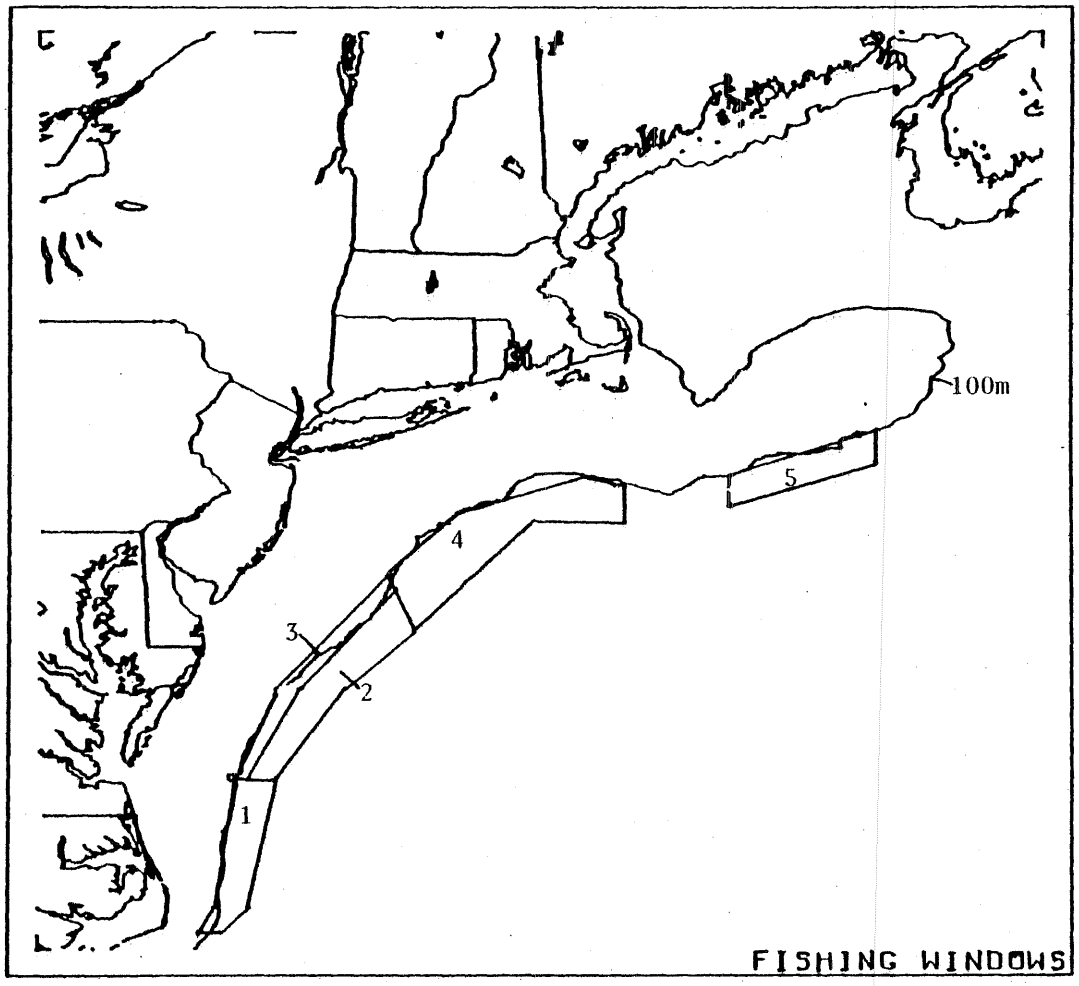

Figure 4. Areas of the Northwest Atlantic off the United States designated for foreign fishing.

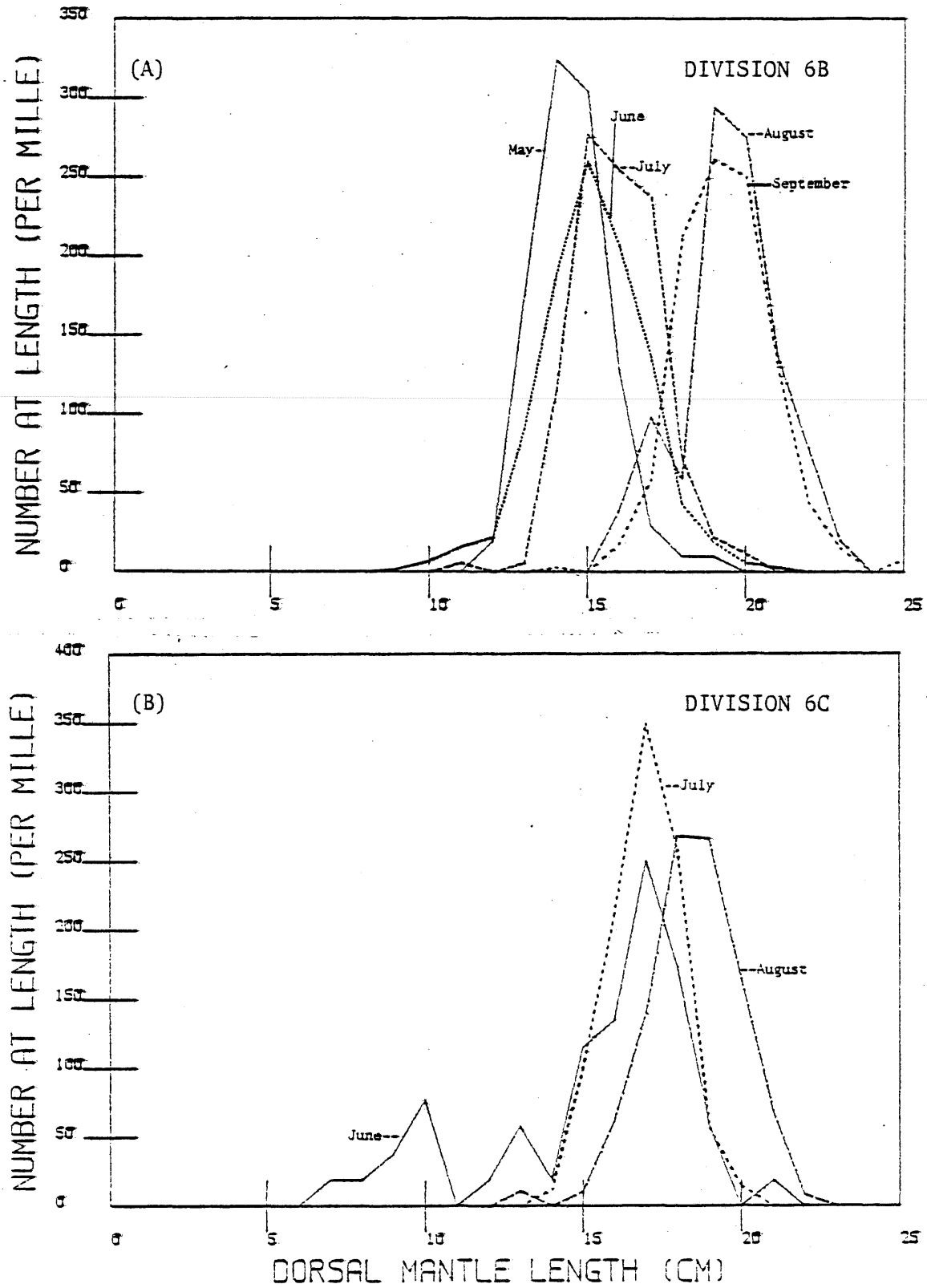

Figure 5. Length frequency distributions of the short-finned squid (Illex illecebrosus) from the 1983 USA fishery in the Mid-Atlantic area (Divisions 6B and 6C).

A

B

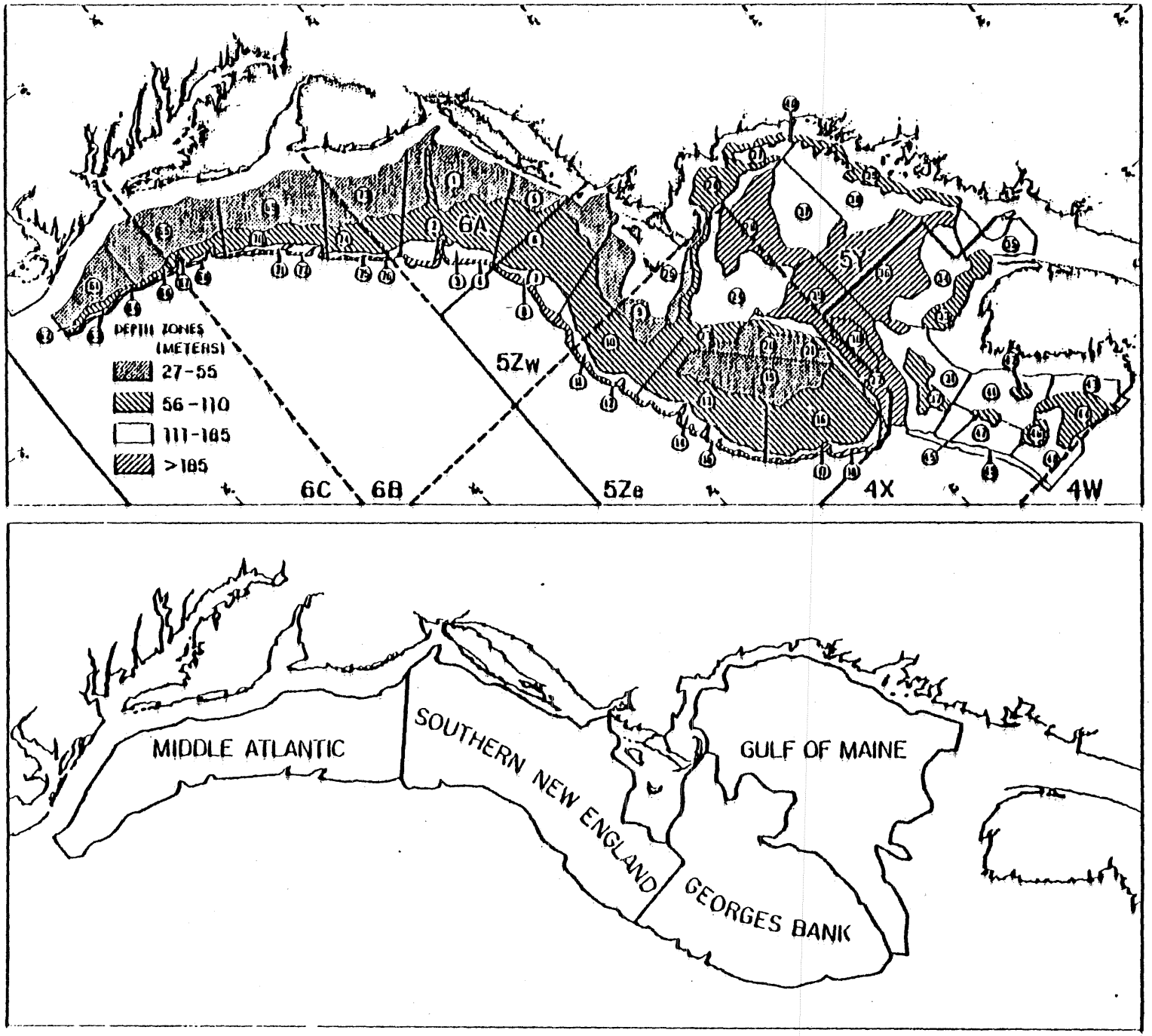

Figure 6. A. USA bottom trawl survey strata and NAFO Subareas 4-6.
B. Geographical areas off the Northeast coast of the United States.