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Biology and Distribution Patterns in 1980 for squid, *Illex illecebrosus*, in Nova Scotian waters

by

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INTRODUCTION

In recent years the short-finned squid *Illex illecebrosus* has become an important offshore fishery in SA4 (Amaratunga et al. 1978). Biological information during their offshore residency on the Shelf, has been accumulating. Aspects such as growth and maturation (Amaratunga and Durward 1979; Durward et al. 1979; Amaratunga 1980) and food and feeding (Mercer and Paulmier 1974; Vinogradov and Noskov 1979; O'Dor et al. 1979; Amaratunga 1980). However, little is known of its biology and distribution patterns during its residency in the coastal water (inshore) off Nova Scotia. Although the inshore waters have traditionally supported only a small bait fishery, there have been recent increasing interests in this fishery.

Some of the *Illex* occurring on the Shelf show a late spring and early summer migration into coastal waters and remain inshore until late fall. These inshore aggregations vary in distribution patterns and abundance from one year to the next, as well as vary in biological characteristics from one inshore location to another, within a single year. In this study biological characteristics of squid taken from the various ports along the Nova Scotian coast were examined. Field tagging methods were assessed and an attempt was made to observe squid migration patterns.

MATERIAL AND METHODS

Biological Characteristics

Fresh or frozen squid samples were collected when available from various ports along the coastline of Nova Scotia from Guysborough County to Digby County (Fig. 1). Port samplers were instructed to obtain a weekly random sample of 100 squid from the fisherman. Squid were usually caught in box traps. Standard morphometric analyses (Amaratunga and Durward 1979) were carried out in the laboratory on all samples.

Tagging Studies

This experiment assessed two types of tags: 1) spaghetti, and 2) ribbon. Three tagging sites were initially selected but only the Queensport area (Fig. 2) provided squid in numbers large enough for the study. A commercial box trap (belonging to Mr. Osburn O'Leary) was used to capture squid. The box trap allows squid to enter a netted box and swim freely inside it without damaging themselves. They may then be conveniently removed by pursing the net, corralling them between two boats, and individually dip-netted out. This prevented the squid from entangling themselves in the net and also minimized the time each individual remained out of water. Squid have a tendency to bite when out of the water, and to prevent this they were induced to grab a rounded surface (e.g., net buoy) while being tagged.

Preliminary work at Dalhousie University indicated that the best location for the tags was directly behind the head on the dorsal surface of the mantle (O'Dor et al. 1979). Spaghetti tags were inserted using a Swift Attachment Gun (Dennison Manufacturing Company). In the laboratory this type of tag caused the least amount of skin damage to the squid following their release (O'Dor et al. 1979). Ribbon tags were inserted by hand using a disposable self-threading needle. O'Dor et al. (1979) showed that this tag, once in place, created a sweeping and beating motion, causing large areas of skin damage and resulting in death to laboratory animals. Tagging under field conditions and tag performance of both tags were being assessed in this study.

OBSERVATIONS AND DISCUSSION

Biological Characteristics

Samples were collected between June 28 and October 30, 1980, but availability of squid limited the number of samples to one in June, 2 in July, once a week in August and September, and 2 in October. A total of 1,444 squid were analyzed from 6 statistical districts in Nova Scotia (Fig. 1). Table 1 shows mean lengths and sex ratios by week in each district. While District 14 showed slight decreases in mantle lengths as the weeks progressed, Districts 25 and 30 showed squid size increasing as the season advanced. Mean mantle lengths observed in District 25 showed no significant difference to mean lengths seen offshore (Amaratunga 1981). There were large changes in sex ratio from one week to the next in District 14, while in Districts 25 and 30 relatively consistent ratios were noted. The indications were that in District 14 squid moved into and out of the area, while in Districts 25 and 30 squid aggregations tended to remain in the area for an extended period. Females were significantly predominant in District 25 while males were predominant in District 30 (Table 1). A feature noted is that week 28 in District 30 produced a sample of all males.

No anomalous maturation patterns (Table 2) were noted as compared to the offshore patterns observed in 1979 (Amaratunga 1981). District 25 which had the longest set of observations showed male maturation pattern progressing with more than 50% in stage 1 (Amaratunga and Durward 1979) during weeks 31-34, then stage 2 during weeks 37-39 and in stage 3 during weeks 41-44. Progression of female maturation was not apparent with stages 2 and 3 predominating in the samples throughout.

Samples usually showed only the stomachs (and not the caecum) carrying food material, if food was present. Hence, only stomach fullness is reported here. Close to 90% of all guts were empty (Code 0) and the less than 1/2 full condition (Code 1) occurred in 5% of the squid (Table 2). In food types, fish (Code 2) was the most prevalent, while cannibalism was seen in a few instances (Table 2).

Tagging Studies

Field work indicated that performance and ease of application of the spaghetti tag clearly outweighed the ribbon tag. Spaghetti tagging method was rapid and efficient, allowing for minimal handling period. The method enabled a large number of squid to be tagged. The disadvantages of ribbon tag method included difficulty in piercing the mantle (tags and pins broke easily), and application of these tags was hard on the hands of the tagger. These difficulties also prolonged the handling period. Although no apparent advantage to movement was evident on the squid, the ribbon tag conformed to a more streamline position on the animal. The spaghetti tag remained perpendicular to the animal's mantle, which may cause possible interference and resistence while swimming.

Tagged _Illex_ were initially released over the side away from the trap. Release in this fashion seemed to disorientate the animals, causing them to swim along the water surface, becoming easy prey to sea gulls. To alleviate this, the squid were released between the boat and trap, forcing the animals to swim under the boat. An unknown number of tagged squid (probably in the range of 100-200) were lost to sea gulls immediately after tagging.

Of the 1,845 squid tagged on July 23, 1980, 1,134 were spaghetti tags and 711 were ribbon tags. From July 25 to October 2, 1980, 128 tags were returned, of which 99 were spaghetti tags and 29 were ribbon tags. The number, area, date of return and distance from tagging site are given in Table 3. A total of 7% were returned constituting 9% of the spaghetti tags and 4% of the ribbon tags. Tag returns did not indicate conditions of the squid, so it was not possible to assess possible damage due to tagging. However, low percentage returns of the ribbon tags suggests high mortality similar to laboratory studies (O'Dor et al., 1980).

Possible migration pattern and distances travelled by individual squid before recapture are depicted in Figure 2. Ninety-one percent of the tagged squid recaptured were from within 20 miles of the tagging site (Queensport). Howerer, 3 animals were recovered about 80 miles (minimum distance) southwest of the tagging site (Ecum Secum) and 1 was retrieved from approximately 300 miles in the slope waters of the Scotian Shelf (42°17'N, 65°10'W). These long distance movements were generally in a south/southwestward direction. Tagging studies in Newfoundland in 1979 showed similar directional movements in majority of the the returned tags (Hurley and Dawe 1980). The longest movement reported to date from the northwest Atlantic Illex stock is from the present study, although many returns reported in the Newfoundland study were greater than 100 miles (Hurley and Dawe 1980). The 300 miles travelled in 70 days represented an average distance of 4.3 miles per day. It is also interesting that this is the first record of offshore movement by an inshore tagged Illex.

The biological characteristics, as discussed earlier, indicated that the squid in District 25 tended to remain in the same locality from early August to late October. Similarly, the tagged animals in Queensport tended to remain within a 20 m range for an extended period, longest recorded were 68 days (i.e. late September) (Table 3).

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Table 1. Mean lengths, sex rations and numbers of I. illecebrosus studied from the various statistical districts in Nova Scotia.

District		Week No.	Mean Mantle Length (mm) Male	Female	Ratio M:F	Total No.	Mean Temp. Range C
14	Aug.25	35	220	238	0.39	53	-
		36	217	230	1.06	146	11.2
		38	214	226	0.66	53	9.6-12.9
	Sept.29	39	205	-		2	12.4-13.5
15	Aug.11	33	194	204	0.92	100	-
25	Aug. 4	32	175	187	0.41	99	10.3-12.8
		33	189	202	0.51	103	8.4-11.2
		34	196	198	0.41	100	6.8-15.4
		37	213	236	0.33	80	10.4-17.4
		39	217	239	0.45	113	11.3-13.9
		41	215	253	0.92	48	13.0
	Oct.27	44	228	261	0.17	54	-
28	June 30	27	160	166	1.33	100	-
30	June 23	26	152	160	12.50	27	4.3-5.4
		27	156	160	15.67	100	4.8-5.5
		28	159	-	-	100	5.5-6.3
36	Sept.8	37	221	237	0.08	164	-

Table 2. Summary of biological data collected on I. illecebrosus giving maturity, gut fullness, and food type by Statistical Districts.

District	Code	Maturity Male #	Male %	Female #	Female %	Gut Fullness Code	#	%	Food Type Code	#	%
14	1	5	4.4	21	14.9	0	213	83.9	1	1	3.0
	2	90	79.7	73	51.8	1	26	10.2	2	14	42.4
	3	18	15.9	47	33.3	2	15	5.9	3	7	21.2
										11	33.3
	Total	113		141			254			33	
15	1	17	35.4	12	23.1	0	97	97.0	1	1	33.3
	2	28	58.3	34	65.4	1	3	3.0	3	2	66.7
	3	3	6.3	6	11.5		100			3	
	Total	48		52							
25	1	65	36.7	58	13.9	0	551	92.3	1	3	7.7
	2	66	37.3	185	44.3	1	34	5.7	2	29	74.4
	3	46	26.0	168	40.2	2	11	1.8	3	7	18.0
	4	-	-	7	1.7	3	1	0.2		39	
	Total	177		418			597				
28	1	47	82.5	32	74.4	0	100	100	-		
	2	10	17.5	11	25.6	Code 1 = empty			Code 1 = Crustacean		
	3	-	-	-		Code 2 = ½ full			Code 2 = fish		
						Code 3 = full			Code 3 = Squid		
	Total	57		43							
30	1	219	100	6	75.0	0	220	96.9	1	3	100
	2	-	-	-	-	1	7				
	3	-	-	2	25.0		227				
	Total	219		8							
36	1	-	-	16	10.5	0	140	84.8	-		
	2	6	50	87	57.2	1	14	8.5			
	3	6	50	49	32.2	2	11	6.7			
	Total	12		152			165				

Table 3. Details of tag returns.

Area	Approximate Distance From Tagging Site (Miles)	No. of Days After Tagging	Type of Tag	No. of Tags Returned
Queensport Bay		1	spaghetti	42
		68	ribbon	11
		6	spaghetti	14
			ribbon	11
		18-19	spaghetti	29
			ribbon	6
		-	spaghetti	4
Canso	14 mi	1	spaghetti	1
		2	spaghetti	1
		5	spaghetti	1
		16	spaghetti	1
		22	spaghetti	2
Arichat	16.5 mi	39	spaghetti	1
Ecum Secum	80 mi	20	spaghetti	1
		26	ribbon	1
		-	spaghetti	1
Slope of Scotian Shelf	300 mi	70	spaghetti	1

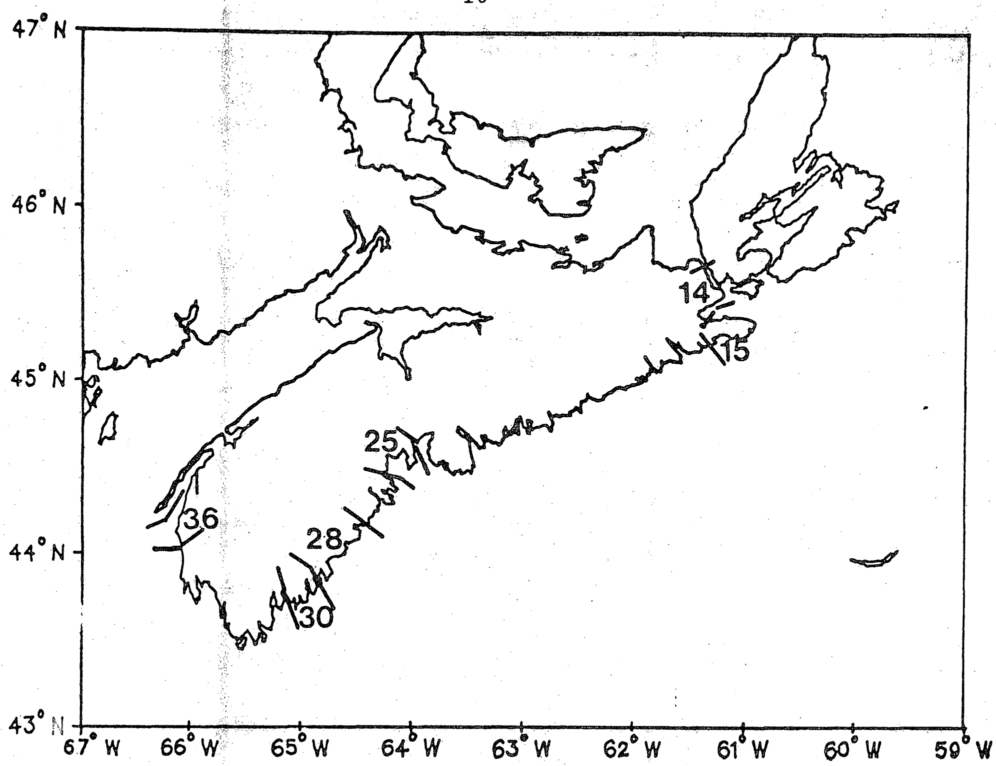

Figure 1. Map showing statistical districts from which squid samples were obtained in 1980.

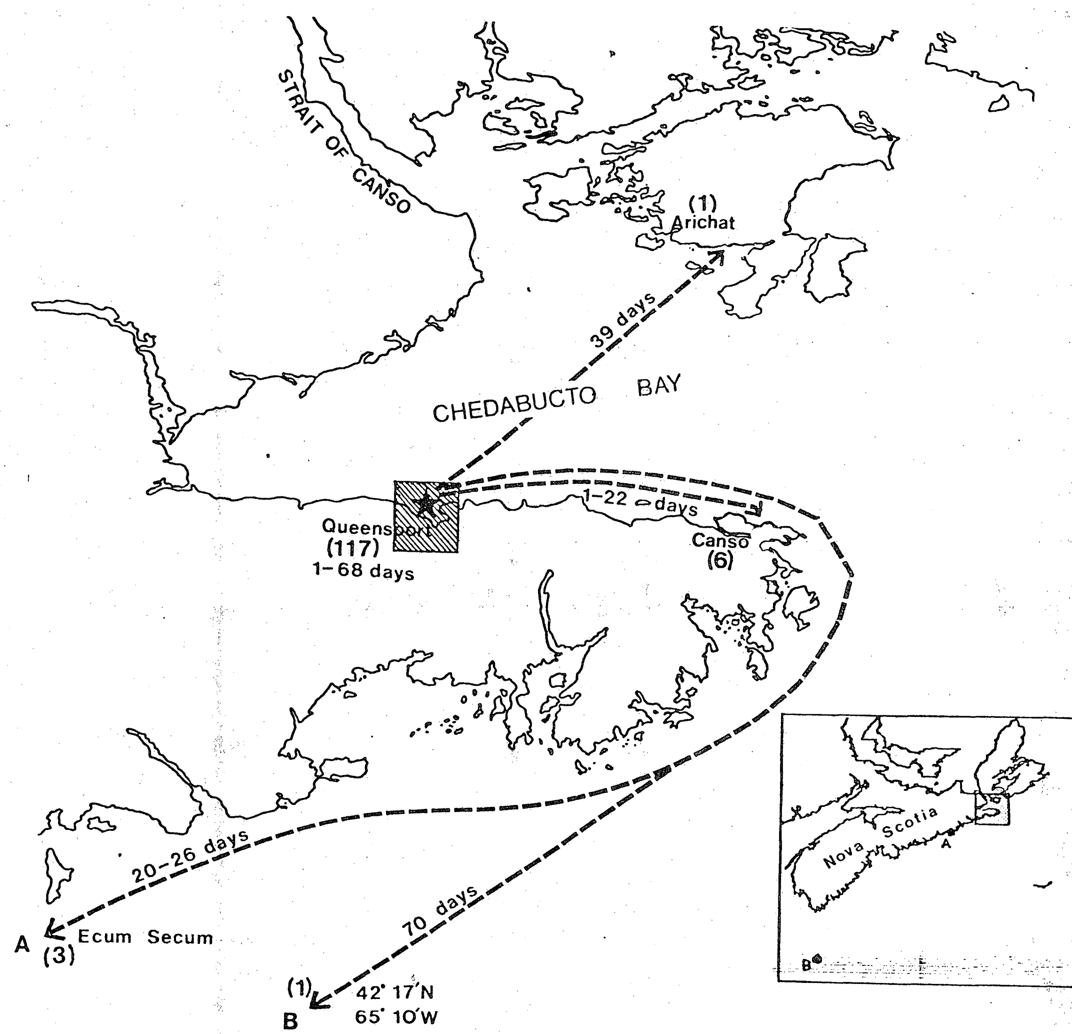

Figure 2. Map showing tagging location and possible migration pattern from returned tags. ★= tagging site; (#) = number of tags returned.