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Notes on the Spawning Biology of the Longfinned Squid (*Loligo pealei*)

by

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INTRODUCTION

The longfinned squid (*Loligo pealei*) migrates into shallow coastal waters in the spring (May-June) to spawn, and portions of the stock are found there through the summer. During the spring and summer of 1979 trawl samples and diver observations were made on the longfinned squid in Vineyard Sound, (Figure 1) in an attempt to monitor spawning activities of this species. Items of primary interest in this study were observations of: post spawning mortality; feeding activity on the spawning site; extent of spawning; size of egg masses and number of eggs per egg capsule, plus physical measurements of collected specimens. Much of the intended work was hampered by the great number of commercial draggers which were fishing for squid in the area where the study was to have taken place (in the areas of greatest spawning concentration). This report presents the results of the work that was completed.

METHODS and MATERIALS

Samples were collected with an otter trawl equipped with a fine mesh liner and towed by the R/V PHALAROPE. Trawls were made in Vineyard Sound, generally in the Falmouth Beach area, in depths ranging from 10-20 meters. Species collected are listed in Table 1. Of the 14 tows made, longfinned squid were taken in 7. Sampling began on 1 May, but the first squid were not taken until 8 May. The last tow was made on 27 June, squid were taken.

A total of 17 observation dives were made in depths ranging from 2 to 20 meters, adult squid were observed on 5 dives. Squid were observed resting on the sand bottom off Falmouth Beach during night

dives, other diver observations were of squid in the area of the NEFC laboratory dock, during daylight hours. Egg masses were observed attached to or resting on the bottom, during many of the dives.

RESULTS and DISCUSSION

Perhaps the most fruitful observation dive was made off the NEFC dock on 22 June, when a group of longfinned squid was sighted. The *L. pealei* seemed to be paired (there were about five pairs) with some unpaired individuals also in the aggregate. Size dimorphism seemed to play a role in the pairing with large (probably male) and a small (female) individuals swimming together, maintaining contact. Additionally, a frequent display was the holding of one tentacle in a raised position. Often, upon the intrusion of another individual, the larger (male) squid of the pair would blanch (as if in warning) and fan its tentacles out to cover/shield the smaller one (female). If the intruder continued to advance it would be chased away, usually by the larger individual. The squid in general, seemed curious about us, swimming cautiously, but not timorously, up to and between us. During a series of night dives on 22 May six solitary squid were spotted laying passively on the sand bottom off Falmouth. Observations were of singular squid with no aggregates seen. On 1 June two squid were observed by divers resting on the seabed in the shadow of a docked fisheries vessel. Other diver observations were of occasional squid "jetting" past divers in the vicinity of the fisheries dock.

Pods of squid eggs, about the size and shape of a little finger, were found in aggregates beginning on 8 May. Egg pods were clustered

by one end to a central point of attachment with the aggregate resembling a mop. On 16 May four egg mops were collected by divers in 8 m of water off Nobska Point. The four mops were examined for a count of pods per mop and for the number of eggs within a pod. The 4 mops contained a total of 5,733 pods ($\bar{X}$ = 1,433 pods/mop). Examination of 70 pods produced an average of 124 eggs per pod (range 65 to 165), for an estimated 710,892 eggs in the 4 mops.

The egg masses had a slight negative buoyancy and could be moved about by the current until they became either settled in a depression or in the lee of rock and boulders. A stranding of nine egg mops on Falmouth Heights Beach occurred after heavy sea conditions on 22 May. Undoubtedly a strong attachment of an egg mass to the sea bottom is necessary to prevent strandings from storm surge. Egg masses on flat sand bottom such as off Falmouth would be particularly susceptible to beaching during storms.

At attempt was made to hatch and raise squid in aquaria. Successful hatching occurred from collected egg masses but the young squid suffered high mortality; probably from an improper food supply. Raising squid beyond one week would be a difficult and time-consuming task.

The only observed feeding on eggs was by numerous small waved welks (*Buccinum undatum*) grazing on egg pod surfaces. This feeding did not penetrate the encasing membrane and seemed not to damage the egg cases themselves.

A total of 81 squid were collected by trawl for measurement, stomach analysis, and sex ratio on 4 tows from 15 May to 31 May. A

total of 33 males (41%) averaging 13.1 cm mantle length (range 5-23.5 cm) and 48 females (59%) averaging 13.2 cm (range 5.5-22.0 cm) were collected. Squid collected were generally in good condition, although two specimens had obvious bite marks on their mantles.

Results of examination of stomach contents are given in Table 2. Of the 81 stomachs examined 39 (48%) were empty. The most common food items by incidence of occurrence were crab larvae (21% total) and green algae fragments (16%), fish, squid, and crab pieces were also noted.

Adult and juvenile longfinned squid were observed in the Vineyard Sound area through 1 October, indicating *L. pealei* remains here, possibly to feed a substantial portion of the year, even after spawning has declined. Longfinned squid also contributed significantly to the commercial fishery of the area during the summer of 1979. The commercial catch during May and June in Vineyard and Nantucket Sounds area was 1,915 metric tons.

CONCLUSIONS

Observations on concentrations of spawners was not possible, since the commercial fishery occurred on these sites. Consequently many of the questions related to spawning and possible related mortality of the longfinned squid remain unanswered. Estimates of the number of eggs per egg capsule, and the number of capsules per egg mass are now available for *L. pealei* in the area of Cape Cod. There are also indications that feeding occurs on the spawning sites, but closer observations of this activity are necessary to determine if

individuals involved in spawning actually feed. Excellent direct diver observations were made of paired squid including behavior and physical contact between pairs, and behavior upon the incursion of a lone squid in the immediate vicinity of paired individuals.

Table 1.--Species list of by-catch taken while otter trawling for squid (*Loligo pealei*) in Vineyard Sound.

Fish	
Blackback flounder	*Pseudopleuronectes americanus*
Windowpane flounder	*Scophthalmus aquosus*
Sea robin	*Prionotus carolinus*
Little skate	*Raja erinacea*
Scup	*Stenotomus versicolor*
Summer flounder	*Paralichthys dentatus*
Cunner	*Tautogolabrus adspersus*
Cod	*Gadus morhua*
Big skate	*Raja binoculata*
Fourspot flounder	*Paralichthys oblongus*
Butterfish	*Peprilus triacanthus*
Grubby	*Myoxocephalus aenaeus*
Pipefish	*Syngnathus fuscus*
Tautog	*Tautoga onitis*
Invertebrates	
Brittlestars	----------
Jonah crab	*Cancer borealis*
Spider crab	*Labinia* sp.
American lobster	*Homarus americanus*
Moon snail	*Polinices heros*
Waved welk	*Buccinum undatum*
Bay scallop	*Pecten irradians*
Sea star	*Asterias* sp.

Table 2. Stomach contents of 81 squid (*Loligo pealei*) taken in Vineyard Sound

Item	Empty	Crab Larvae	Fish	Squid	Green algae	Crab pieces	Unidentified
Incidence of occurrence	39	17	2	3	13	1	6
Percent of total	48	21	3	4	16	1	7

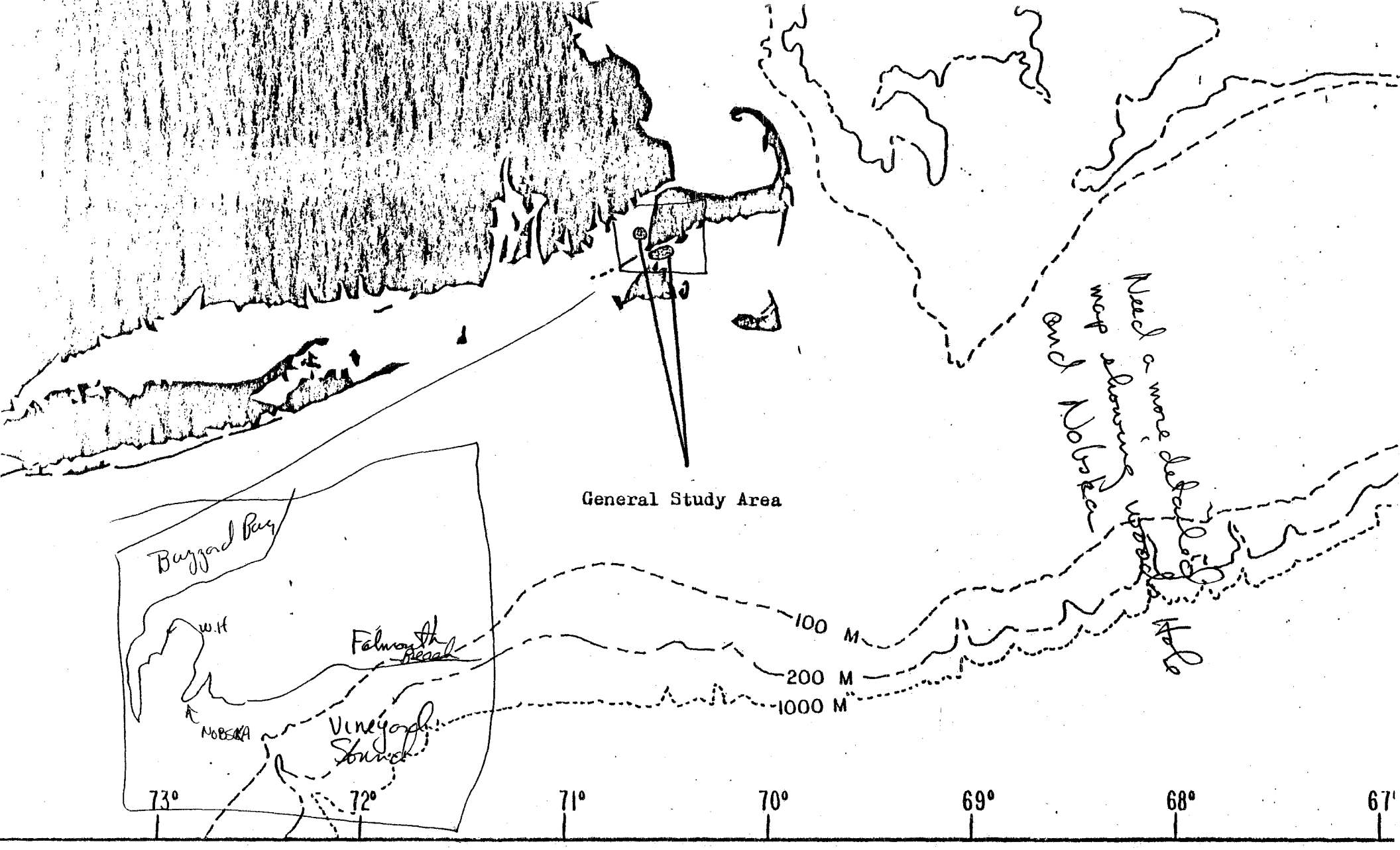

FIGURE 1. General area for Loligo pealei spawning study