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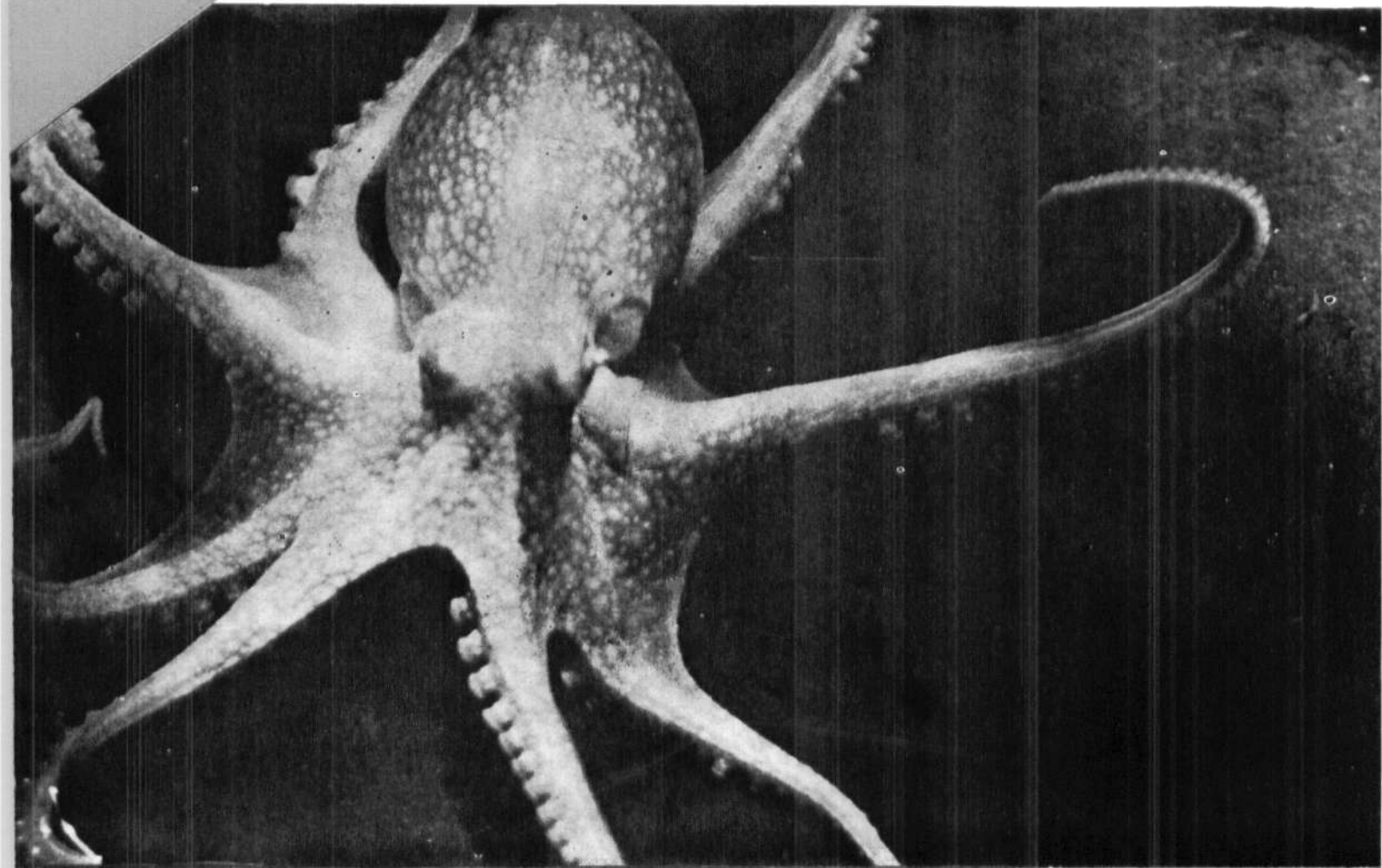
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CEPHALOPOD BIONOMICS, FISHERIES AND RESOURCES OF THE EXCLUSIVE ECONOMIC ZONE OF INDIA

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ON THE CEPHALOPODS OBTAINED IN EXPERIMENTAL TRAWLING AND LIGHT FISHING CONDUCTED AT VIZHINJAM

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ABSTRACT

Trawling and light fishing with different types of lamps for light attraction were carried out at Vizhinjam. One species of cuttlefish and two species of squids formed part of the trawl catches while three species of squids were obtained in light fishing. The biological characteristics of these cephalopods are briefly dealt with.

INTRODUCTION

The Research Vessel CADALMIN II of the Central Marine Fisheries Research Institute was available at Vizhinjam during March-April, 1978, primarily for conducting light fishing experiments in connection with the anchovy live-bait culture. During day time the vessel was employed for carrying out trawling experiments, in which cephalopods were one of the major components of the catch. In light fishing also squids formed an important item, besides anchovies. The results of the experimental trawling and light fishing were reported by Kuthalingam *et al.* (1982) and Luther *et al.* (1982). The present report is on the squids and cuttlefishes obtained during the course of these experiments. Though the catch of cephalopods (as also other shellfish and finfish) was not high by quantity or number, their occurrence may be indicative of a potential resource in the area.

The CADALMIN II is 13.25 m long and fitted with 88 b.h.p. Ashok Leyland marine engine, mechanical winch and Simrad echosounder. It can accommodate seven personnel including scientists, and has a laboratory for conducting experiments on-board.

TRAWLING

Experimental trawling was conducted in the area 8-76/3F (8°20'8"30"N and 76°50'-77"E) off Vizhinjam. A total of 17 hauls of one hour duration each were made in the depth ranges 10-20 m, 20-30 m and 30-40 m,

with a 30-metre otter trawl having a cod-end mesh of 25 mm.

During the course of trawling operations the surface temperature ranged between 30°C and 31.5°C and the salinity between 30.01‰ and 35.64‰. The bottom values of these parameters also did not show much variations: temperature ranged from 28.4°C to 29°C and salinity from 30.52‰ to 36.37‰. The bottom of the trawling areas was predominantly sandy, at some places mixed with mud.

The total catch of fish and shellfish was 920 kg, of which cephalopods were 36.5 kg forming about 4%. Most of them were taken from the depth 30-40 m at a catch rate of 4 kg/hour of trawling; the catch rate from the other two depth zones (10-20 m and 20-30 m) was 0.7 kg/h each.

The cephalopod catch was composed of the cuttlefish *Sepia pharaonis* and the squids *Loligo duvaucelii* and *Doryteuthis sibogae*. Apart from these, a very few specimens of *Sepia aculeata* were also obtained. The length-frequency, stages of maturity, and condition of stomachs of *Loligo duvaucelii* and *Sepia pharaonis* and the body weight—shell (cuttlebone) weight and body weight—mantle weight relationships in *Sepia pharaonis* are shown in Fig. 1 and that of *Doryteuthis sibogae* in Fig. 2.

Sepia pharaonis

Of the 19 cuttlefishes obtained in trawling, 14 in the range of 80-229 m were males; the females were only

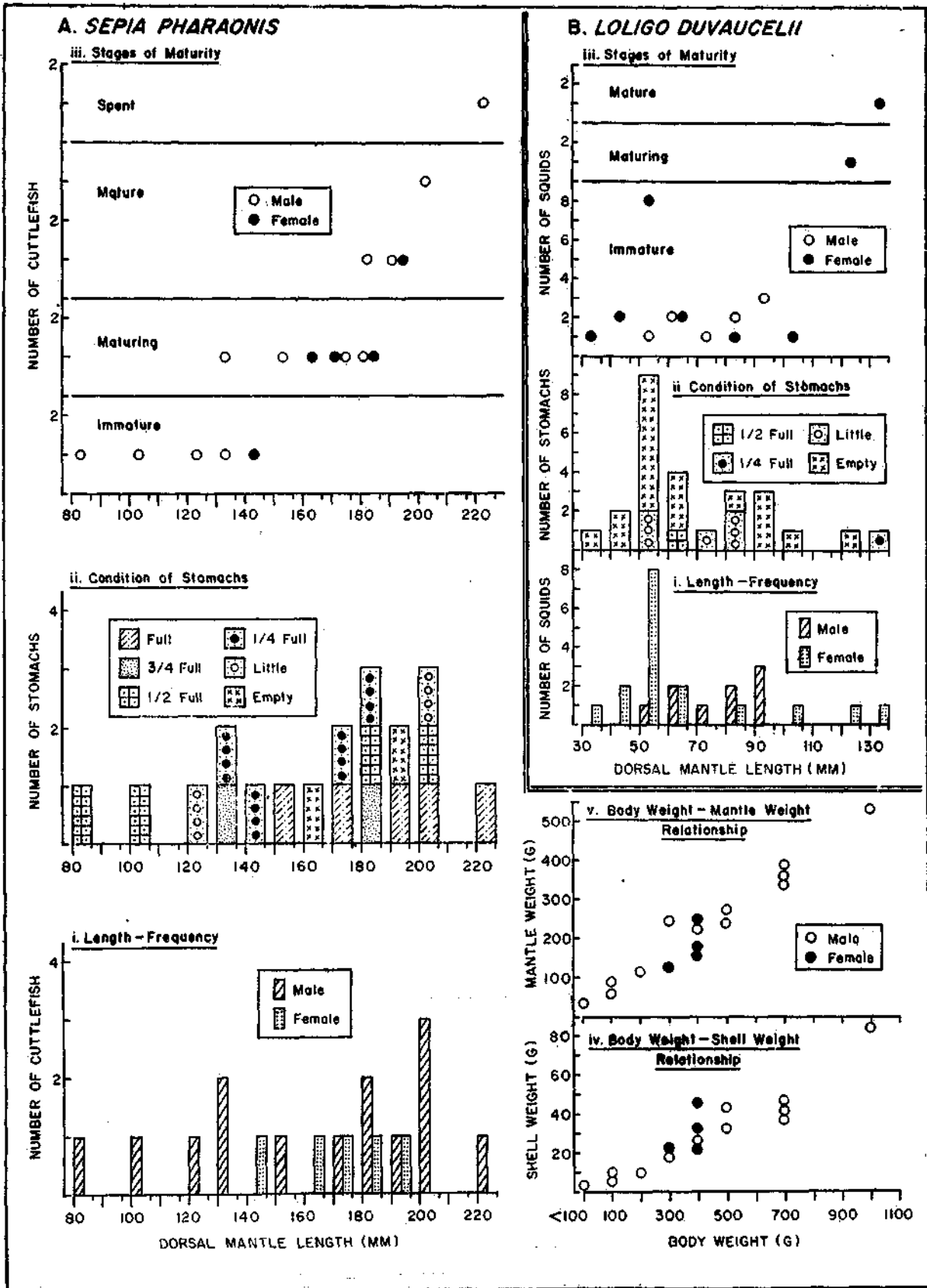


FIG. 1. Cephalopods obtained in trawling: A. *Sepia pharaonis*: (i) Length frequency; (ii) Condition of stomachs; (iii) Stages of maturity; (iv) Body weight—shell (cuttlebone) weight relationship; B. *Loligo duvaucelii*, (i) Length frequency; (ii) Condition of stomachs; (iii) Maturity stages.

five in number and had a smaller size range, 140-199 mm (Fig. 1 A i-iv). Majority of the cuttlefishes had stomachs with food in varying degrees of fullness ; only two had empty stomachs. Fish and crustaceans in almost equal proportions were the food. Above the length of 180 mm the males were mature and one male cuttlefish of the size 220 mm was found to be in spent condition. The maturing and immature males had a size range of 130-139 mm and 80-139 mm respectively. Among females there was only one mature individual 190 mm in size ; others were maturing and immature. In males the shell (cuttlebone) weight ranged from 3 g to a maximum of 84 g, with a mean value of 29 g.

corresponding figures being 51.6%, 41.4% and 81.4% in the range of 125 g and 246 g.

Loligo duvaucelii

Twenty six specimens of this squid were obtained, of which 9 were males in the size range 50-99 mm and 17 were females in the size range 30-139 mm (Fig. 1B, i-iii). Both the sexes combined, the maximum number was in the length group 50-59 mm. Over 75% of the specimens had empty stomachs. The rest of the squids had stomachs with food comprising fish (68%) and crustaceans (32%). All the males were immature. Among females one specimen measuring 120 mm was

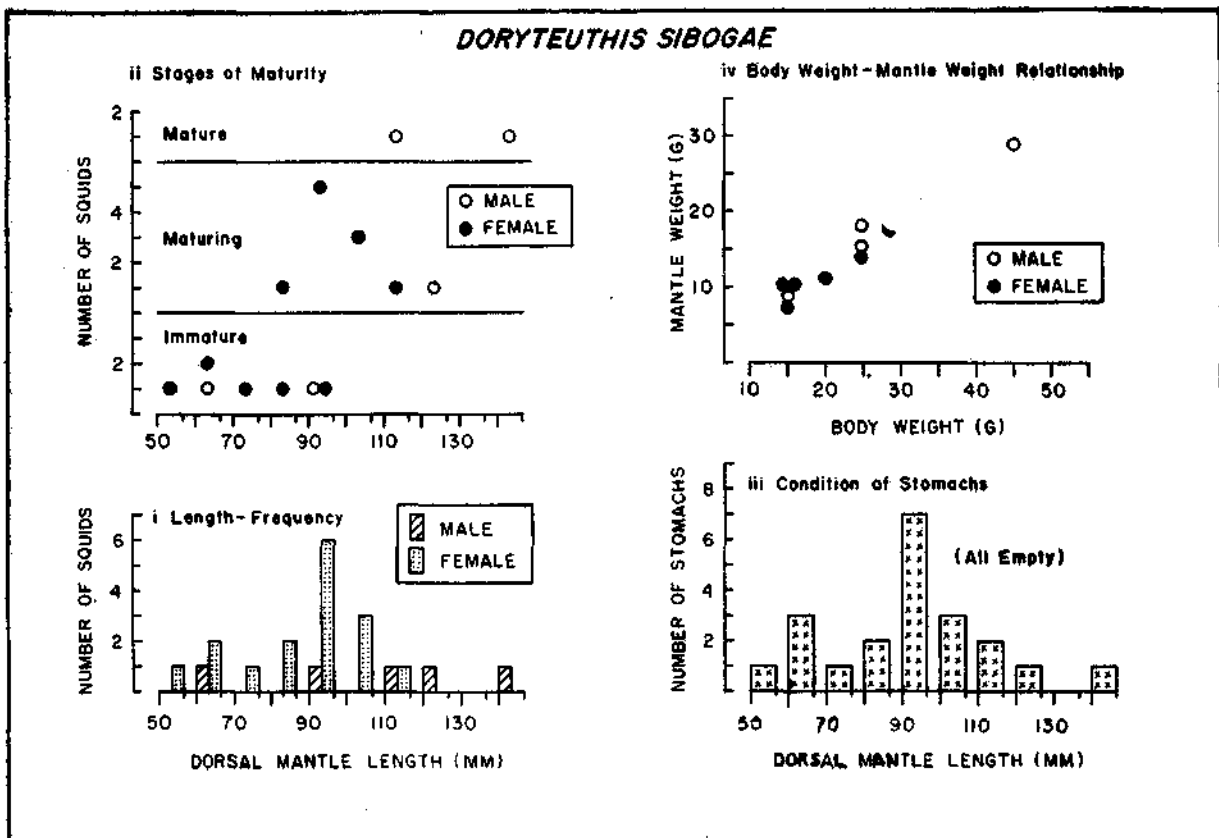


FIG. 2. Cephalopods obtained in trawling : *Doryteuthis sibogae*. (i) Length frequency ; (ii) Stage of maturity ; (iii) Condition of stomachs ; (iv) Body weight-mantle weight relationship.

forming 6.6% of the total body weight. In females the cuttlebone weight was generally higher than in males. Within a range of 22 g and 47 g the average weight was 31 g forming 8.2% of the body weight. The average mantle weight in male cuttlefish was 56.7% of the total body weight with a minimum of 48.6% and a maximum of 82.3% within the range of 27.5 g and 535 g. In females all the values were lower, the

maturing and another one of the size 130 mm was mature ; all the others were immature.

Doryteuthis sibogae

Of a total of 21 squids in the size range 50-149 mm, five were males (60-149 mm) and 16 females (55-119 mm). The maximum number was in the length group 90-99 mm (Fig. 2 i-iv). Among males two were

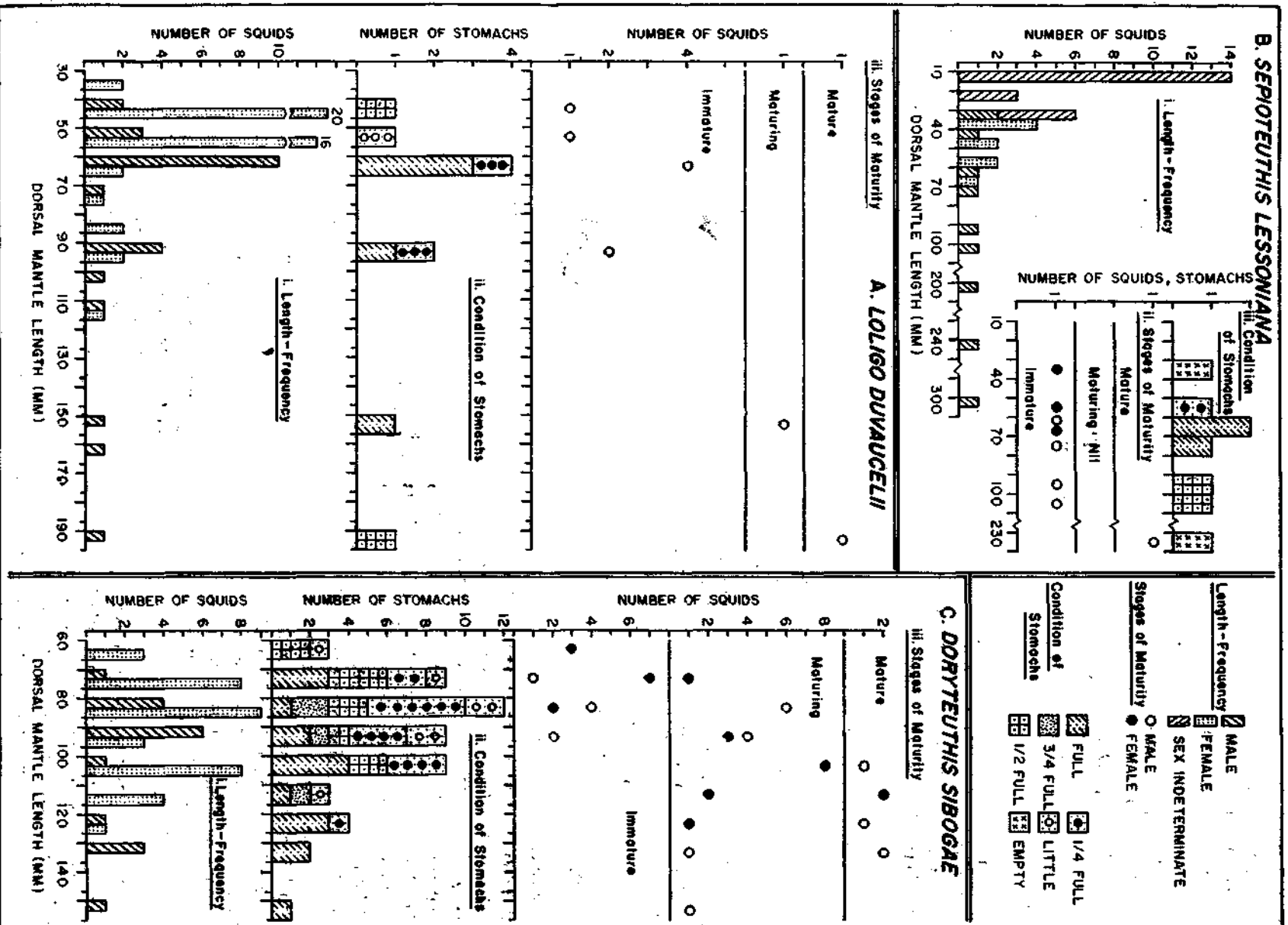


Fig. 3. Cephalopods obtained in light fishing. (I) Length frequency; (II) Condition of stomachs; (III) Maturity stages of *A. Loligo duvaucelli*, *B. Sepioteuthis lessoniana* and *C. Doryteuthis sibogae*.

immature, one maturing and two mature. Six females in the range 50-99 mm were immature and 10 females in the range 80-119 mm were maturing. There were no fully mature females. All the 21 squids had empty stomachs. In male squids the mantle weight formed an average of 64% of the total bodyweight, with a minimum of 60% (9 g) in squids weighing 15 g, and a maximum of 64.4% (29 g) in squids weighing 45 g. In females the average mantle weight was 60% of the total body weight within a range of 55-66% (8.5-16 g).

Apart from the above mentioned cephalopods, five small specimens of the cuttlefish *Sepia aculeata* were taken in the trawl. They ranged from 21 mm to 93 mm; four of them were males.

LIGHT FISHING

The source of artificial light was a 500-Watt lamp, a 1000-Watt lamp and a 160-Watt fluorescent lamp, lighted by a generator kept on-board. Besides these electric lights, a kerosene petromax lamp with the mantle directed downwards and giving a light intensity of approximately 200 candles power was also used. These were tried separately, and the petromax light was found to be the most effective, since the attraction of squids to this light was much greater than to the electric light.

The principal catching device was a bag-like monofilament nylon net 1.5 m deep having a 3.5 m × 3.5 m square rim made of cane. The net could be lowered into the water and lifted up by means of four corner ropes that ran over four pulleys fastened to two bamboo poles rigged horizontally to the vessel. By tying weights at its bottom the net could be kept in position when lowered into the water. The light, whose height could be adjusted, was suspended over the middle of the net from another bamboo pole. Normally the light was kept 1 to 1.5 m above the surface of the water. When the net was in the lowered position with the rim well below the surface, the squids attracted towards the light were trapped by suddenly lifting the net by pulling the corner ropes. The squids were collected from the net by using a hand-net.

Most of the light fishing was attempted in the Vizhinjam Bay where the water was comparatively more calm than outside and devoid of strong under-currents. The depth of the area where the fishing was done ranged from 8 m to 20 m. The sky was clear or partly cloudy and very rarely it was completely cloudy. The sea condition was calm to slightly rough and the water

temperature throughout the period was within the range of 29-30°C.

Outside the Bay, fishing was attempted but many difficulties were met with. The sea was always rough or moderately rough causing rolling of the vessel. Because of this the light could not be suspended steady with the result that the attraction of squids was poor. The net was drifted away from the normal position by undercurrents and therefore quick pulling up of the net was difficult. The resultant delay has often caused the squids that have collected below the light to escape from the net.

The squids that were caught in light fishing were *Loligo duvaucelii*, *Sepioteuthis lessoniana* and *Doryteuthis sibogae*. No cuttlefish was attracted by light, except for a small *Sepiella inermis* measuring 35 mm. The squids came in small groups comprising individuals of about the same size, and with slight disturbance like the moving of the light or net and rolling of the vessel, the entire group moved away at high speed. Often the small fishes attracted towards light seemed to be scared away by the approaching squids.

While the electric light attracted squids, though to a lesser extent compared to the petromax, the sound of the generator seemed to be a deterrent to squids coming towards the light. With the engine of the vessel kept off, the petromax light attracted more number of squids. Light fishing was also attempted in the night next to fullmoon, and since there was bright moon light throughout, the response of squids (as also fish) to petromax light was poor.

The length-frequency, condition of stomachs and stages of maturity of *Loligo duvaucelii*, *Sepioteuthis lessoniana* and *Doryteuthis sibogae* are shown in Fig. 3.

Loligo duvaucelii; The male squids ranged in size from 40 mm to 199 mm with the main mode at 65 mm, followed by a smaller mode at 95 mm. The females had a smaller size range of 30-119 mm with the main mode at 45 mm, followed by a smaller mode at 95 mm. Among the squids examined for maturity stages and condition of stomachs, there were no females. The male squids upto a length of 99 mm were immature; one squid measuring 159 mm was in maturing stage and another one of 199 mm was mature. All the stomachs had food, most of them full. Fish was the sole item of food found in the stomachs of these squids.

Sepioteuthis lessoniana; Fortyone squids were obtained during the light fishing experiments. Except for three males of the size between 200 mm and 300 mm,

all the others were juveniles. Of these, 7 (30-109 mm in size) were males and 9 (30-69 mm) females; the remaining 21 were small and their sex could not be determined externally. Among 8 squids examined for condition of stomachs, 6 had stomachs with food in different degrees of fulness. In this case also fish was the most important food.

Doryteuthis sibogae; The male and female squids did not show much variation in size range. The males were of the size 70-159 mm with the main mode at 95 mm and another one at 135 mm. The females ranged from 60 mm to 129 mm with modes at 85 mm and 105 mm. Both the sexes combined, the mode was at 85 mm. About 59% of the males and 66% of the females were maturing and mature; the maximum sizes of immature squids were 99 mm for males and 89

mm for females. As in the case of *Loligo duvaucelii*, this squid did not have empty stomachs. The incidence of full stomachs was over 32%. The food was composed entirely of fish.

The present trawling and light fishing experiments were short and preliminary, and the cephalopods obtained were only incidental. From the results of these experiments it is not possible to make any estimates of the available cephalopod resources of this area. However, with more effort to conduct regular trawling and light fishing with light-attraction system and catching devices such as jigging for squids and improved hooks for cuttlefish it may be possible to exploit cephalopods to a much greater extent than being done at present by the traditional fisheries.

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