Table 1—Monthwise Variation in Glycogen, Lipids, Cholesterol, Proteins, Nitrogen and Phosphorus in *P. fucata*
[Values, expressed in mg/100 g, are mean of 8 samples]

Month	Gonad	Glycogen Hepato-pancreas	Lipids	Cholesterol	Nitrogen	Proteins	Phosphorus
				1975			
Feb.	6.3	1.23	5930	5.96	66.2	413.75	470
March	4.5	0.9	6000	6.02	84.23	524.25	1200
April	3.38	2.51	4200	6.26	126	787.5	980
May	0.18	0.43	6400	8.21	86.2	426.25	580
June	0.72	1.41	3600	13.8	120.4	640	1200
July	1.09	1.55	4400	11.8	234	1462.5	1300
Aug.	1.4	1.75	3944	22.2	36	235.3	600
Sept.	1	1.5	1300	40	77	482.3	1000
Oct.	0.72	0.58	2860	39.2	64	400	800
Nov.	3.99	0.52	3980	14	77	482.3	680
Dec.	1.17	0.43	1460	11.2	58.2	363.75	560
				1976			
Jan.	1.88	0.42	1520	33.3	88.4	552.5	260

molluscan sterols[12] is essential in reproduction. It is possible that it is used up during spawning. Fluctuations in cholesterol content of gonads of 4 species of edible oysters of the Gulf of Kutch during spawning and gametogenic activity have been reported[4].

Total proteins increase initially during gametogenesis (June, July) and fall as the gametogenic activity advances (August to November).

Total phosphorous declines during 2 spawning seasons; however, it increases in peak of active gametogenesis, June-July. In the postspawning, it decreases again. The decrease during spawning may be due to the estrusion of gametes. Decrease in phosphorus has also been reported in other species of oysters[4].

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Distribution, Characters & Habits of *Clypeomorus clypeomorus* Jousseaume (Gastropoda: Cerithiidae) of the Visakhapatnam Coast

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Distribution and density of *C. clypeomorus* at different stations on the Visakhapatnam coast and at different tide levels are reported. The characters of the shell, operculum, jaws, radula and foot are given. The moving habits of the snail and the organisms associated with *C. clypeomorus* are described.

Information on the hornsnail, *Clypeomorus clypeomorus* of the family Cerithiidae is scanty. The 4

species of *Clypeomorus* reported are from the Great Barrier Reef[1]. *C. clypeomorus* occurs in great abundance among the shingles of Visakhapatnam coast. It closely resembles in its characters the genus *Cerithium* which is also a member of the family cerithiidae. During the earlier stages of the work the present snail has been identified as *Cerithium morus* following the description provided by earlier workers[2,3]. Subsequently some other snails have also been encountered in the same area and are tentatively identified as *Cerithium clypeomorus*, *Cerithium splendens* and *Cerithium obeliscus*.

While working on the larval development of this snail conspicuous differences were noted with regard to size of the egg capsule, spawning period, number of eggs per spawn, size of the veliger and life span of the veliger stage. These differences raised doubts as to the correct identity of the snail under study. Re-examination of the material revealed the existence of changes in the shape of the shell, aperture and sculpture of the shell. The shells were examined by Dr Houbrick of the Smithsonian Institution. He identified what was identified earlier as *Cerithium obeliscus* as *Rhinoclavis sinensis* and the snails *Cerithium morus*, *C. clypeomorus*, *C. splendens* (identified so by us) as *Clypeomorus* sp. Houbrick cautioned "Cerithiids exhibit much polymorphism in shell colour, sculpture and size. Because of the high variation within each species they have been split up by previous workers and considerable synonymy exists"[4].

While studying the larval development of *C. clypeomorus* many conspicuous differences were observed between the developmental stages of the present snail and those of *Cerithium morus*[5-7]. These differences should be considered in identifying this snail. Therefore, the present snail, *C. clypeomorus* differs significantly in the developmental features from the other cerithiids occurring in the country.

Observations were made at 3 stations, viz. stations I and II at Waltair point and station III at Rishikonda lying between the lat. 17°40′30″ and 17°45′ N and the long. 83°16′15″ and 83°21′30″E on the east coast of India, at weekly intervals. Detailed observations were, however, made at Waltair point shingles. Tidal levels and their vertical ranges on the Visakhapatnam coast were earlier described[8].

Collections were made at 3 tidal levels, i.e. Mean Sea Level (MSL), Mean Low Water Neaps (MLWN) and Mean Low Water Springs (MLWS). Detailed observations were made on the snails collected at the mid water zone (around MLWN). Population density was estimated in each station at 9 different places, selected at random, and the average number of animals from these different places is given as population density per m^2 area at each station. The density of the population at different tide levels was also estimated by the same method.

The moving habits of the snail were observed in the field by marking the animal with enamel paint during low tides. The point of release was also marked with the same paint. During successive low tides the distance travelled by the animal was measured along straight lines from the point of release.

The animals associated with *C. clypeomorus* were collected and identified. The animals that settled on the shell were collected by rinsing the freshly collected snails in sea water. The serpulids living on the shells were collected by carefully cutting open their tubes. They were later fixed in 5% formaldehyde and identified. The structure of the radula was studied by removing it from the buccal mass and spreading it on a white background.

Distribution—The snails prefer protected locations such as the under surfaces of small stones, pebbles and boulders and adhere in clusters to the substratum with the foot. The animals are generally absent on areas directly exposed to wave action. In some instances the animals are found burried in the sand in between the rocks. This is perhaps due to the dislodging of the animals by wave action. The animals occur only in shingles. They are not observed in places where the rocks are big in size. The snails are mostly confined to the region around MLWN and seldom present below MLWS and above MHWN. Young snails are most abundant in between MSL and MLWN (Fig. 1).

Density—Comparatively more animals are present at stations I and II, the bulk of which being mature individuals. The average number (range in parenthesis) of animals per m^2 are 1160 (340-2248), 955 (280-2208) and 763 (230-1650) respectively in stations I, II and III. At all the 3 stations the population density is more around the MLWN level (Table 1). The percentage frequency of different size group animals at the same tide level and the percentage frequency of same size group animals at different tide levels are given in Fig.2.

Characters—Shell: The shell is conical in shape (Fig. 3). The surface is rough with strongly raised spiral ridges of small tubercles which are spread transversely. The spire is pointed and the protoconch is generally worn out. A deeply excavated short anterior canal and an ill developed posterior canal are present. Callus formation is considerable both on the outer and inner lips. The shape of the aperture varies from oval to that of the letter 'D'. The body whorl of the shell contains 6 spiral rows of tubercles. Other whorls of the shell contain 3 rows, the tubercles of the distal 2 rows are more prominent than the proximal row. The colour of the shell is dark grey to black. Some of the shells are worn out due to the wave action and turned whitish

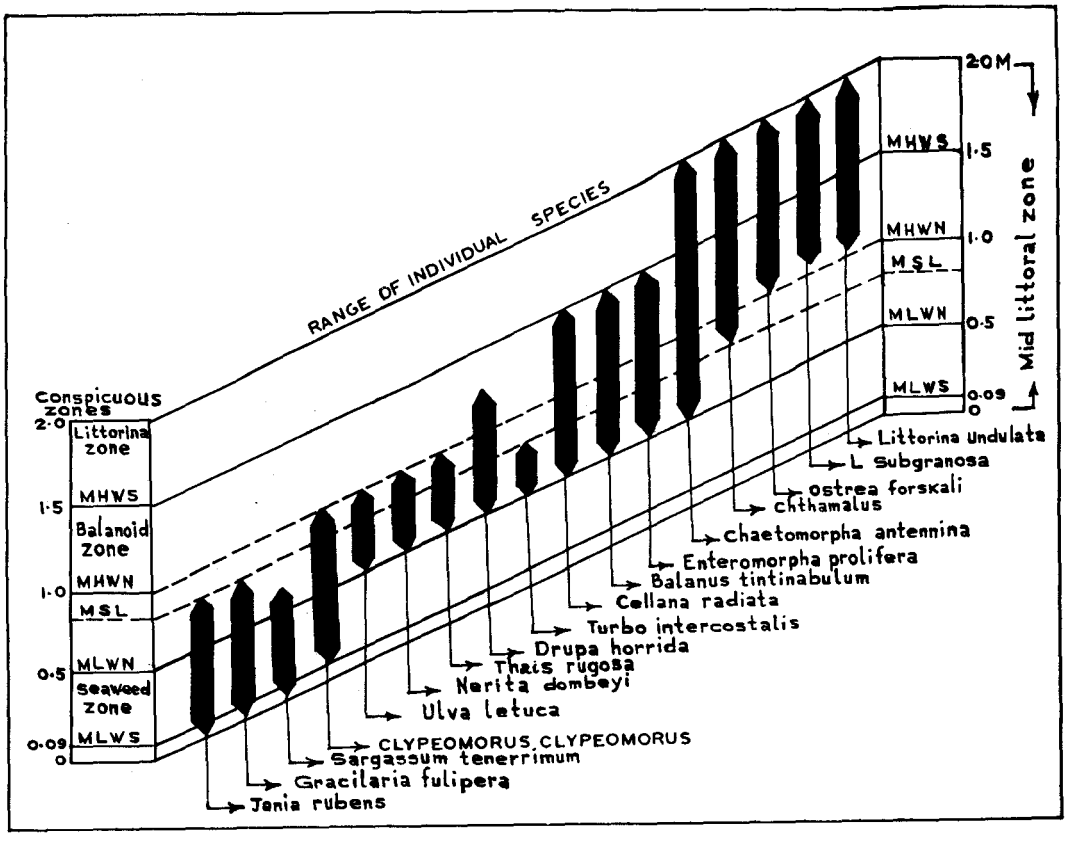

Fig. 1—Zonation at Waltair point

Table 1—Density of the Population at Different Tide Levels

Tide level	Density/m²		
	Station I	Station II	Station III
MSL	595	370	332
MLWN	2037	1954	1451
MLWS	852	540	506

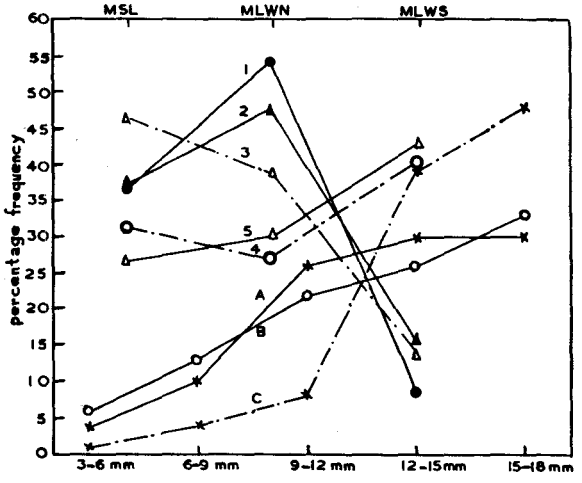

Fig. 2—Percentage frequency of different size groups at same tide level and same size group at different tide levels [Size groups (mm): 1, 3 to 6; 2, 6 to 9; 3, 9 to 12; 4, 12 to 15; and 5, 15 to 18. Tide levels: A, MSL; B, MLWN; and C, MLWS]

Fig. 3—Shell of *C. clypeomorus*

brown. The maximum size of the shell is 18 mm. The operculum is oval and horny with an eccentric nucleus. It measures about 6 mm in width.

Jaws and radula: A pair of tan coloured jaws are present on the roof of the buccal mass. The 2 jaws are united dorsally by cuticle. Each jaw is roughly triangular in shape and to some extent elongated. The radula is narrow (5 to 6 mm length and 0.5 to 0.6 mm width). It is a typical taenioglossate type of radula and closely resembles that of the allied genus *Cerithium*. There are about 85 to 100 rows of teeth.

Foot: The foot is relatively small and the maximum size is 6 mm in the adults. The shape of the foot at rest is roughly triangular but during locomotion it is observed that the anterior half of the foot first

elongates and gets fixed to the substratum and then the posterior portion is released and drawn towards the anterior portion. The colour of the foot is dark grey on the dorsal surface and pale grey on the ventral surface. The sole is provided with subepithelial gland cells secreting mucus. No grooves are discernible in the foot.

Moving habits—During the high tide the shingle beds are totally submerged and the wave action is considerably strong and hence their movements and feeding could not be observed. However, observations are made sometimes with difficulty at the MHWN level during the hightide. Small stones submerged in water during high tide are lifted and observed. The animals are present in clusters underneath the stones and pebbles. Sometimes animals are also found accidentally burried in the sand among the shingles.

When the tide recedes they slowly move about grazing on the algae or detritus present on the surface of the stones and pebbles. They seem to exhibit positive phototaxis because at times of low tide these animals get spread over the upper surfaces of the stones and boulders of the midlittoral zone in the intertidal region basking in the sun.

Although the animal is slow moving it covers fairly extensive areas in search of food and shelter. Twenty animals each from MHWN level and MLWN level were painted and released at the commencement of high tide. The animals were observed for their movements on the next day at the fag end of the low tide. The animals (6) at MHWN level move 46 cm in one day compared to those (9) at MLWN (34cm).

Associated organisms—Shells of *C. clypeomorus* provide substratum to some organisms and the most common among them being serpulids, *Pomatoleios crosslandi* and *Hydroides brachyacantha.* In the order of abundance comes the egg capsules of different species of *Nerita.* The barnacle *Chthamalus* also grows on the shells of these snails. Besides these, the bivalve mollusc *Gastrochaena impressa*, the barnacle *Balanus amphitrite* and some calcareous algae also settle on the shells of these snails.

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Seasonal Variations in Glycogen of Some Marine Fishes of Saurashtra Coast

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Glycogen content was estimated in different muscles of 4 commercially important marine fishes *Johnius vogleri* (Bkr), *Megalaspis cordyla* (L.), *Arius maculatus* (Thunberg) and *Ilisha megaloptera* (Swainson), of Saurashtra coast for 12 months. Well marked seasonal variations were observed in the level of glycogen; high level was noticed mostly during August to October. Seasonal glycogen changes appear to be influenced by maturation cycle and depletion (spent stage) of gonad.

Biochemical analyses of muscles (edible parts) of fish for fat, glycogen, proteins, lopolytic and glyocolytic enzymes, vitamins, etc. have been done in several marine and fresh water fish to realise their food and nutritional value[1,2].

In spite of the fact that more than 75 species of edible fishes are captured from the vast coastline of Gujarat (1063 km), practically no detailed biochemical analysis of the fish has been carried out. Recently, Bhavsar[3] and Verghese[4] have done biochemical analysis of body muscle, liver and gonad in pomfrets (*Pampus argenteus* and *Parastromateus niger*) and mudskippers (*Periophthalmus dipus* and *Boleophthalmus dentatus*) respectively of Saurashtra coast. Therefore, in the present study, glycogen content of some commercially important marine fishes of Saurashtra coast has been estimated.

The fishes (scientific names and family name in parenthesis) studied are: Dhoma [*Johnius vogleri* (Bkr); Sciaenidae], Bangara [*Megalaspis cordyla* (L); Carangidae], Khangi [*Arius maculatus* (Thunberg); Ariidae] and Kanti [*Ilisha megaloptera* (Swainson); Clupeidae].

Monthly collections of fishes for 1 yr (1977) were made from the trawlers and gill nets fishing off Saurashtra coast with bases at Porbander/Veraval. The freshly collected fishes were dissected, different muscles removed carefully, and small pieces (500 mg) of respective muscle transferred to test-tubes containing 30% KOH. The test-tubes were brought to the laboratory and glycogen estimated by the method of Seifter *et al.*[5]. All the estimations were made in triplicate and values pooled.