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FISHERY AND BIOLOGY OF CEPHALOPODS

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The cephalopods are distributed in all the oceans of the world from shallow inshore areas to deep oceanic waters. They are purely marine in habitat. Among the cephalopods several species of squids, cuttlefishes and octopi are commercially important. Until recent times there was hardly any market for cephalopods in our country. Also the cuttlefishes are the first to be thrown out into the sea from the trawlers, immediately on hauling the net since the ink ejected by them contaminates the catch, particularly prawns (Silas et al., 1974). At present with the increasing demand, the export market for cephalopods has developed fast and they fetch a high price.

A large number of cephalopod species were recorded from our country (Silas, 1968; Oommen, 1977). The important commercial species like Sepia aculeata Ferussac and d'Orbigny, S. pharaonis Ehrenberg, Sepiella inermis (Ferussac and d'Orbigny) and Loligo duvauceli d'Orbigny which contribute to the fishery at several centres along the east and west coasts are widely distributed in the Indo-Pacific region.

EXPLOITATION AND FISHERY

The contribution of cephalopods to the marine fish catch in India varied from 1184 tonnes in 1970 to 15931 tonnes in 1978 (Table 1). They accounted for 0.1 to 1.14% of the total fish production. It may be seen from the table that since 1974 there has been a marked increase in the catches, due to the increased number of trawlers and also due to the insatiable demand for cephalopods in the foreign markets.

Except for the Palk Bay squid Sepioteuthis arctipinnis Gould there is no regular fishery for other cephalopods which are caught incidentally in small quantities along with fishes in gears like trawl net, shore seine, boat seine, gill net and cast net. In the Vizhinjam

area hook and lines and scoop nets are also used. The shoaling behaviour and the migration to shallow waters for spawning by cephalopods is taken advantage in conducting regular fishing, as in the Palk Bay. Here the squid, S. arctipinnis migrate into inshore waters by about February and spawn till about June. During this period a shore seine called ola valai is used for squid fishing (Rao, 1954). The net consists of a rectangular bag of about 8m x 2m with close and wide meshed webbing. The wing ropes measure about 274 m, bear 3-4 close set rows of palm leaf near the wings and 1 or 2 rows for the rest of the wing rope length. In the Palk Bay region special squid jiggs were used previously (Hornell, 1917) but now obsolete. In this method a fisherman keeps watch by sitting on a Y-shaped pole called machan. A long jig of 5-6 hooks is arranged like a grapnel which is hidden under a heap of leaves near the machan to lure the squids. When they approach the leaves for spawning they are lifted with a jerk. Now a modified jigging method is followed in this area (Sarvesan, 1974). The jig consists of 35-40 cm long slender wire equipped with 3-4 strong hooks on one end and the other is tied to a pole which serves as the handle. The fishermen in canoes or catamarans hook the squids with the jig with a quick jerk. Also in the Palk Bay area the octopi, used as baits, are caught in shell traps (Sarvesan, 1974). About 100 to 120 gastropod shells like Lambis lambis, Tonna dolium, Raphna bulbosa, Murex birgineus and Hemifuses are strung along a thin coir rope. These lines are laid in 4-6 m depth with wooden floats attached. The traps are raised daily and the small octopi like Octopus dollfusi and O. globosus which take refuge in the shell cavities are dislodged with a needle to be used as bait.

Jigging is the most widely practised method, particularly by the Japanese in catching cephalopods. Multiple mechanical jiggs are now used by the Japanese. In California, lampara nets are used in squid fishing. The squid shoals, attracted by light during night time are encircled and hauled into the boat by power lifted dip nets.

While published information is lacking on the species wise cephalopod landings, it appears that the cuttlefishes are dominant,

followed by squids and the contribution by octopi is negligible.

Future outlook: The exploratory surveys along the west coast revealed the occurrence of commercially important species of squids such as Symplectoteuthis auilaniensis and Loligo spp., (Silas, 1969). There is need to try special fishing methods such as light fishing with jiggs to exploit the squid resources (Silas et al., 1974).

Present status of utility: Apart from their utility as food for man cephalopods are important forage organisms for fish, birds and mammals in the sea. At present as food they are not a popular item in our country. However in recent years significant progress was made in the export of cephalopods to foreign countries. In 1978 frozen squids weighing 2428 tonnes (value Rs. 3.28 crores) and frozen cuttle fish weighing 979 tonnes (value Rs. 1.66 crores) were sent to a number of countries, France being the main importer. In 1977 cuttle bones weighing 49 tonnes (value Rs. 2.99 lakhs) were exported. The cuttlebones are a source of calcium. They are used in the preparation of abrasives and dentrifices. Also wooden or metal surfaces are polished with cuttlebones.

Food and feeding habits: BIOLOGY

Food and feeding habits: The cephalopods are carnivorous and they hunt their prey by sight, Their well developed eyes help them to pursue the prey. The flexible muscular arms and tentacles with their suckers give them a strong grip over the prey. The powerful jaws present in the buccal mass help to cut the prey into pieces. Fishes, crustaceans and cephalopods are the important food items consumed by them.

Rao (1954) stated that spawners of Palk Bay squid in general do not feed during the spawning period. High feeding intensity in L. duvauceli was observed (Oommen, 1977) during February-May and the squids obtained during night time had few empty stomachs (Oommen, 1976). The studies by Kore and Joshi (1975) also indicated that the

squid is carnivorous, cannibalistic and shows seasonal variation in the intensity of feeding. In S. inermis high feeding intensity was observed in April-May and no such periodicity was found in S. aculeata (Commen, 1977).

The squids are known to change their food with growth. Vovk (cited by Arnold and Arnold, 1977) reported that in Loligo pealei planktonic feeding was dominant in the smallest size squid (75 mm mantle length). Euphausiid feeding became important to larger squid (125 mm length). Cannibalism and fish feeding dominated in sizes larger than 160 mm. Kore and Joshi (1975) also reported in L. duvaucei an increase in cannibalism and decrease in crustacean feeding for larger squid.

Growth: Rao (1954) concluded that S. arctipinnis attains an average mantle length of 95, 166 and 219.5 mm at the end of 1, 2 and 3rd year of life respectively. Males grow to a larger size than females. For other species published data are lacking.

Maturity: In S. arctipinnis males attain sexual maturity between 67.5 to 112.5 mm length when they are 6-14 months old; females mature at 102.5 to 112.5 mm when they are 12-14 months old. No published information is available on other species.

Fecundity: Summers (1971) estimated that mature females of Loligo pealei lay between 3500 to 6000 eggs depending on their size.

Octopus vulgaris is perhaps most prolific, laying 1,50,000 eggs over a period of few days. At the other end O. bimaculoides lays a few hundred eggs (Akimushkin as cited by Wells and Wells, 1977). For Indian species there seem to be no published data available.

Spawning: In S. arctipinnis spawning commences in January and is continued till the end of June (Rao, 1954). Squids migrate into shallow inshore waters and adjacent lagoons from the offshore waters by about February and deposit their eggs capsules till about June. Squids and cuttle fishes are known to exhibit elaborate courtship before mating.

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The eggs are deposited singly or in clusters on sticks, rods or floating objects. Females show a tendency to lay on existing clusters. A common site may be used by many females for egg laying for extended periods and large masses are built up. In majority of cephalopods about which information is available, mating behaviour and/or egg laying is followed by death (Arnold and Arnold, 1977). Octopods do not swarm to breed (Wells and Wells, 1977).

Fertilisation and development: In cephalopods the spermatophores are transferred along a groove in the hectocotylus from males to the mantle cavity of females and fertilisation is internal. The pattern of development is generally uniform in cephalopods if allowance is made for the variable amount of yolk (Arnold and Arnold, 1977). Alagarwami (1966) studied the embryonic development of the squid referred to S. arctipinnis on corroborative evidence. The early cleavage is of meroblastic type resulting in 64 celled stage. By further marginal divisions of the blastomeres the blastoderm separating the embryonic and non embryonic regions. On the 5th day the organ forming areas are noticed and differentiation of various organs is in progress. On the 7th day the embryo is far advanced in development and more organs like the formation of lense in the eyes are developed. By the 14th day the developing embryo appears as a miniature adult but still with yolk sac attached. The mantle, fins, arms, eyes and the visceral organs are all well developed and the embryos move inside the chorion. On the 15th day the young hatch out and they resemble very much the adult. They begin an independent life.

Octopods brood their eggs (Wells and Wells, 1977). Parental care in O. dollfusi was described by Sarvesan (1974).

Larval history: Properly speaking there are no larval forms in Decapoda. Development is direct to a miniature adult which may or may not enter into a planktonic type of existence before forming typical schools or sedentary life styles (Arnold and Arnold, 1977). In the

Octopoda also, Wells and Wells (1977) advocate that the term 'larva' be better avoided.

Table 1: Cephalopod and total fish catches (Source: C.M.F.R.I. Annual reports)

Year	Total Fish Catch tonnes	Cephalopods tonnes	% of Cephalopods
1970	10,85,607	1,184	0.12
1971	11,61,389	1,505	0.13
1972	9,80,049	1,026	0.10
1973	12,20,240	1,394	0.11
1974	12,17,797	3,677	0.30
1975	14,22,693	7,889	0.55
1976	13,52,855	10,826	0.80
1977	12,59,782	10,005	0.79
1978	14,03,607	15,931	1.14