

## HERMAPHRODITISM IN SOME MARINE ANIMALS

P.V. KAGWADE

Bombay Research Centre of Central Marine Fisheries Research Institute, Bombay.

### ABSTRACT

Hermaphroditism, a phenomenon in which one and the same individual produces sperms, the male gamete the ovum, the female gamete, is generally common in plants and lower animals and hence is considered as a primitive character. However, it is rare in higher invertebrates such as insects, spiders, prawns and also in the lower vertebrates to which fishes belong. Prawns and fishes have highly evolved reproductive systems and occur as separate individuals of males and females. Yet, both these groups do have some species which are regularly hermaphrodites and others which are teratologically hermaphrodites. There are different types of hermaphroditism. In an ovotestis, when only one sex functions at a time, it is called gonochoristic and depending on which activates first, hermaphroditism is termed as protandrous when the testis becomes active and protogynous when the ovary becomes active. In synchronous hermaphroditism both the sperms and ova in an ovotestis become active simultaneously. Sex reversal is another type of functional hermaphroditism in which upto a certain size or age, the animal functions as one sex and then transforms itself into the opposite sex. Here depending upon which of the sexes functions first, it would be termed aprotandrous or protogynous accordingly, it has a period of inter-sex in between.

Protandric hermaphroditism involving sex reversal is very common in nearly a dozen species of deepsea prawns of the family Pandalidae belonging to the genera *Pandalus* and *Pandalopsis* in the northern boreal and temperate waters (Carlisle, 1959 a & b; Butler, 1964; Rasmusen, 1965 and Hoffman, 1972). Among the hippolytids, the Mediterranean species of *Lysmata seticaudata* and *L. nilita*, the antiboreal South American and circum Antarctic species of *Chorismus* and among palaemonids of the family Cam-

pylonotidae, the South American magellanic species *Compylonotus semistriatus* and another deep water Australasian species of the same genus are reported to reverse the sex from male to female, while the burrowing axiid prawn, *Calocaris macandreae* is found not to be protandrous but a functional hermaphrodite throughout its life (Yaldwyn, 1966). Likewise, the Indian hippolytid, *Hippolysmata ensirostris* is a regular hermaphrodite throughout its life (Kagwade, 1981) exhibiting the synchronous type. The ovarian parts of this species are big and occupy the greater part of the cephalothorax in front while the testicular parts are small, narrow and extend behind from the posterior part of the ovaries.

Normal and functional hermaphroditism is known to occur in a number of teleosts. Members of the order Perciformes display diverse types of sexuality, specially those belonging to the families Serranidae, Labridae, Meanidae and Sparidae. Most of their species are protogynous. Among the remaining, some are protandrous and others synchronous, there are also some which are gonochoristic.

The protogynous species are *Maena smaris*, *M. chryselis* and *Pagellus erythrinus*, the Adriatic species from the Mediterranean sea (Zei, 1949); *Epinephelus guttatus*, *E. striatus*, *Mycteroperca bonaci*, *M. tigris*, *M. falcata*, *M. venenosa*, *Cephalopholis fulvus*, *Petrometopan cruentatus*, *Alphestes afer* and *Promicrops itaiara* from the Bermuda waters (Smith, 1959); *Centropristes striatus*, the Atlantic sea bass (Lavenda, 1949) and *Halichoeres poecilopterus* from the Japanese waters (Okada, 1962).

The protandrous species are *Sparus auratus*, *S. longispinis*, *Sargus sargus*, *Pagellus cedntrodontus*, *P. mormyrus*, *P. acarne* and *Rhabdosargus sarba* (Yamamoto, 1969; Chan and Yeung, 1983).

The synchronous hermaphrodites among the perciforms are *Hypoplectrus unicolor*, *Prionodes phoeba*, *P. tabacarius* and *P. tigrinus* from Bermuda and nearby places of Miami, Florida and British West Indies (Smith, 1959).

Mead (1960) recorded ovotestes in 10 species of uncommon deep sea fishes belonging to the families Chlorophthalmidae, Bathypteroidae, Alapisauridae and Paralepididae of the order Inioimi. These specimens were caught by the U.S. Fish and Wildlife exploratory vessel *Oregon* from Gulf of Mexico, off equatorial Brazil, off Surinam and Western Caribbean Waters from depth between 200 and 600 fathoms, by the vessel *Atlantis* off Azores in Atlantic ocean at 3200 fathoms and by the vessel *Delaware* off New England. All the specimens were adults except for two

that measured between 120 mm and 180 mm in length. The two exceptions were the pelagic *Alepisaurus ferox* which were caught by long lines. They measured 605 mm and 735 mm in length and possessed immature ovotestes.

The flatheads belonging to the family Platycephalidae, *Inegocia (Cociella) crocodila* and *I. meerdervoort*, caught by trawl nets in the East China Sea and Yellow Sea and the deepsea luminescent fish, *Gonostoma gracile* are reported to be protandrous hermaphrodites (Yamamoto, 1969). The symbranchoid eel, *Monopterus javanensis* from the ponds and rice fields of China is found to be a protogynous hermaphrodite (Liu and Ku, 1951). Normal hermaphrodites also exist among fishes belonging to the families Ostariophysi, Polynemidae, Aulopiformes and Antheriniformes.

Among the Indian fishes, teratological hermaphroditism has been met within a number of fishes. To list some: *Hilsa ilisha*, *Cirrhina reba*, *Barbus stigma*, *Rastrelliger kanagurta*, *Katsuwonus pelamis*, *Sardinella longiceps* and *Eleutheronema tetradactylum* (Kagwade, 1967). But regular hermaphroditism without sex reversal has been recorded among the members of the family Polynemidae (Hida, 1967; Kagwade, 1970). The hermaphroditism in this group may be synchronous as in *Polynemus heptadactylus* (Kagwade, 1967) or gonochoristic as in *Polydactylus indicus* (Kagwade, 1974).

Hermaphroditism is neither confined to any taxonomically related group within an order nor does it exhibit a zoogeographic relation. Though not common among the many species of decapod crustaceans other than the prawns which have highly evolved reproductive systems, teleosts present a big list of regular and functional hermaphrodites from among a number of families. It appears that more and more species will be added to the list from time to time. Their distribution pattern suggests that they are not bound by any ecological features. They are found in tropical, temperate and cold waters at various depths from shallow to mid water to very deep benthic waters anywhere in the world. So it is doubted whether environment has any major role in hermaphroditic sexuality in prawns or fishes.

Abnormal hermaphroditism like the normal ones has become very common among fishes. The abnormal hermaphroditism need not be treated as sterile cases because some of them are found to be functional. Normal hermaphroditism occurs as a natural phenomenon and forms a normal mode of reproduction.

Is there any advantage for an individual to exist as a hermaphrodite? It is a very difficult question to answer. Some have

attempted to give explanations and others models. Yet there is no satisfactory answer to it considering the anatomical and physiological aspects. As far as sex reversal is concerned, it can be said that it is as advantageous as gonochorism because an individual functions at a particular time as a gonochorist and prevents self fertilization.

From the fishery management point of view, the protandrous species should not be exploited in the early male phase but should be allowed to grow to large sizes giving them a chance to change into a female and then to spawn. Such a situation may not be warranted for protogynous species because the female phase being the earlier one, gets ample opportunities to spawn prior to capture and the ones left behind to change into males, though small in number due to exploitation, are potential enough to fertilize the eggs. The fishery management for the synchronous hermaphrodites should be on the same lines as for any of the gonochorist species.

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