Journal of
Fisheries and Aquatic Science

ISSN 1816-4927

Academic
Journals Inc.

www.academicjournals.com

Journal of Fisheries and Aquatic Science 9 (4): 170-175, 2014
ISSN 1816-4927 / DOI: 10.3923/jfas.2014.170.175

Maturation and Spawning of Commercially Important Penaeid Shrimp *Penaeus monodon* Fabricus at Pazhayar Tamil Nadu (South East Coast of India)

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ABSTRACT

The Penaeid shrimp commonly known as tiger shrimp is commercially important candidate species for brackish water aquaculture in India. The spawning seasons of penaeid shrimp, *P. monodon* from Pazhayar coast were studied on the basis of ovarian colour. During maturation shrimp ovaries pass through a series of colour changes. Females with olive green i.e., black green with butterfly band shaped ovaries considered as fully ripening one which is ready to spawn. The presence of fully ripened ovaries of *P. monodon* throughout the year suggests that these shrimp have the potential for spawning all the twelve months in a year. However, *P. monodon* noticed with two spawning peaks viz., March and August. Among these two seasons, the highest number of stages with maturity was noticed in the month of March.

Key words: Maturation, spawning, pazhayar, *Penaeus monodon,* colour

INTRODUCTION

The maturation and spawning have often been found confusing in literature and its seems desirable to define their usage more precisely. aptly defined maturation and spawning as follows: The term maturation refers to cyclic changes which male and female gonads undergo to attain full growth and ripeness. Similarly, spawning means the emission of male and female gametes from the body to the exterior. This definition does not include the complicated physiological changes involving endocrine control. The maturation is a well-know biological observation that the ovaries of shrimps pass throught a series of colour changes during their maturation process. Based on these colour changes 3-5 maturation stages have been recognized (Cummings, 1961; Rao, 1964; Brown and Patan, 1974).

Shrimp farmers depend on wild stocks of *Penaeus monodon* for the production of larvae. Hatcheries specially source females that have a nearly fully developed ovary, i.e., a gravid female which are in an immediate pre-spawning state to meet required production schedules. However, fluctuations in the availability of wild brood stock, on a day to day basis as well as seasonal one, coupled with variable spawning performance, make hatchery operations the weakest link in the production cycle.

The reproductive performance of penaeid prawn (shrimp) hatchery brood stock has been shown to be affected by arrange of variables including eyestalk ablation, nutrition, light intensity and

quality, photoperiod, salinity and substrate type (Emmerson, 1980). The knowledge of the natural reproductive pattern in the wild prawn stock, from which hatchery brood stock are drawn, may provide a further basis for selection of brood stock to achieve best spawner performance. So, wild brood stock very essential and important for hatchery propose.

The present study in Pazhayar coast has made an Endeavour to study the maturation and spawning with particular reference to the shrimp *Penaeus monodon*. The sequences of changes in the stage maturity are of much utility in understanding the general biology of the commercially important shrimp *Penaeus monodon* with the help of ovarian colour.

MATERIALS AND METHODS

The tiger shrimp *P. monodon* hundred females were collected every week from the trawl catches during the year of April 2012 to March 2013 from Palayar coast, (Lat. 11°21 N; long. 79°5'E) in Nagapaattinam District, Tamil Nadu, South east of coast of India with help of local fisherman and transported to the hatchery with live condition in polyethylene bags containing sea water. In the laboratory, the procured shrimp samples were sorted, sexed and identified to species level according to Tirmizi and Bashir (1973) and Bianchi (1985). Animals of 13-15 cm size were taken and the stages of the ovary and the numbers were recorded. The data were collected for a period of one year. To govern the spawning period, the percentage of females with ripe and mature stages were combined and are grouped as either just ready to spawn. The months in which the highest percentage of spawning females was observed was considered to be the spawning period (Fig. 1).

RESULTS

The *P. monodon* were classified as non spawning or spawning on the basis of the their ovaries. Females with green ovaries were consider as the spawning females or mature females while those with other than green ovaries(translucent, white, cream and yellow) were considered as non-spawning ones. Totally 4800 animals were collected to that study period. Among that 1111 animals were matured one (Table 1 and Fig. 2).

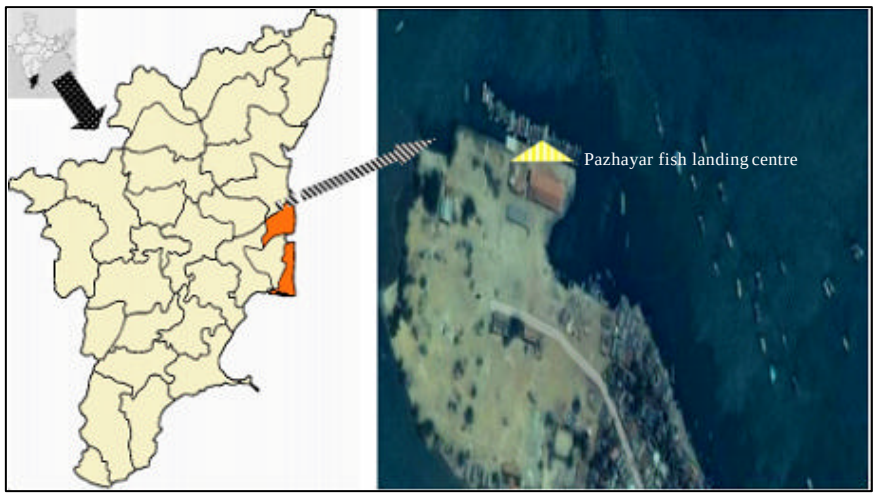

Fig. 1: Study area at Pazhayar

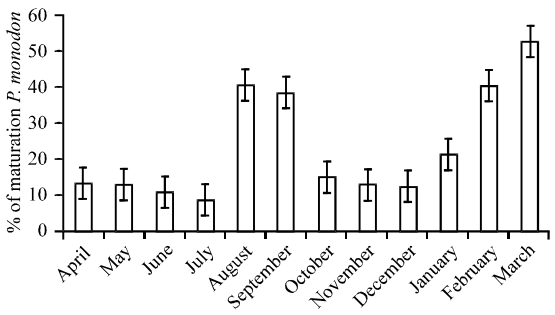

Fig. 2: Monthly percentage of *P. monodon* maturation in 2012 to 2013 at Pazhayar coast

Table 1: Monthly occurance at different stages of maturity in *Penaeus monodon* year of 2012-2013 at Pazhayar coast

Month	Immature	Early mature	Late mature	Mature
April	80	148	119	55
May	94	139	107	50
June	74	113	171	42
July	52	130	185	34
August	31	91	117	161
September	46	85	115	154
October	86	153	101	60
November	96	175	78	51
December	61	220	70	49
January	47	155	113	85
February	86	54	98	162
March	107	51	32	210

Table 2: Percentage of occurance different maturity stages *Penaeus monodon* in 2012 to 2013 at Pazhayar coast.

Month	Immature (%)	Early mature (%)	Late mature (%)	Mature (%)
April	20.00	37.00	29.75	13.25
May	24.10	35.64	27.43	12.80
June	18.50	28.25	42.75	10.50
July	12.96	32.41	46.13	8.47
August	7.75	22.75	29.25	40.25
September	11.50	21.25	28.75	38.50
October	21.50	38.25	25.25	15.00
November	24.00	43.75	19.50	12.75
December	15.25	55.00	17.50	12.25
January	11.75	38.75	28.25	21.25
February	21.50	13.50	24.50	14.50
March	26.75	12.75	8.00	52.50

During the one year of study mature females were encountered all months, the highest number of occurrence being in the months of August to September and February to March i.e., during the pre monsoon and post monsoon seasons. The peak was in March and August. Among these two seasons, the highest number of mature stage was noticed in the post monsoon, i.e., March (Table 1 and Fig. 3). The percentage occurrences of all the maturity stages in different months were given in the Table 2. The percentage of maturity was highly observed in post monsoon season (Fig. 3).

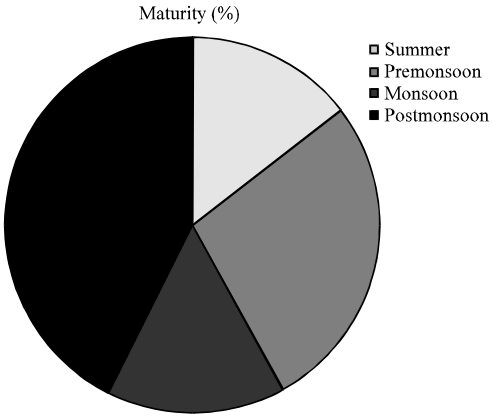

Fig. 3: Seasonal maturity stage of *P. monodon* at Pazhayar coast in 2012 to 2013

Ovarian maturation: In *P. monodon* five ovarian maturation stages were recognized by the external changes in colour and five maturity stages have been recognized in the maturation of the ovary. These stages were designated as immature, early mature, late mature, mature and spent recovering as described here (Fig. 4a-e).

- **Stage 1 Immature:** The ovaries of immature shrimps are thin, translucent, unpigmented and confined to the abdomen. It is thin, strand –lime and whitish. They contain oocytes and small spherical ova with clear cytoplasm and conspicuous nuclei
- **Stage 2 Early mature:** Ovary increases in size and the anterior and middle lobes are developing. The dorsal surface is light yellow to yellowish green. Opaque yolk granules are formed in the cytoplasm and partly obscure the nuclei. The developing ova are clearly larger than the immature stock
- **Stage 3 Late mature:** The ovary is light green and is visible through exoskeleton. The anterior and middle lobes are fully developed. The maturing ova are opaque due to the accumulation of yolk
- **Stage 4 Mature:** The ovary is dark green and clearly visible through exoskeleton. The ova are larger than in the preceding stage and the peripheral region becomes transparent
- **Stage 5 Spent recovering:** It is probable that after the extrusion of eggs, the gonad reverts almost immediately to the immature condition. This stage is therefore, distinguishable from that found in the immature virgin females only from the size of the shrimp

DISCUSSION

In the present study, to determine the degree of ovarian development of females in *P. monodon* the macroscopic characteristics of the gonad developmental stages. Results show five developmental stages on the basis of ovarian coloration (undevelop, developing, nearly ripe, ripe and spent). Five or six distinct stages have been recognized in the development of the ovary of most of the penaeid shrimps (King, 1948; Rao, 1964). The maturation of the ovary from immature to mature stage is accompanied by distinct changes in colour, size and the appearance and the process is almost similar to that described by Rao (1964) for the allied species occurring in the cochin region. The fact that all maturity stages are encountered in most of the months indicates that the species breeds thought the year as in the case of the other commercially important shrimp of the area.

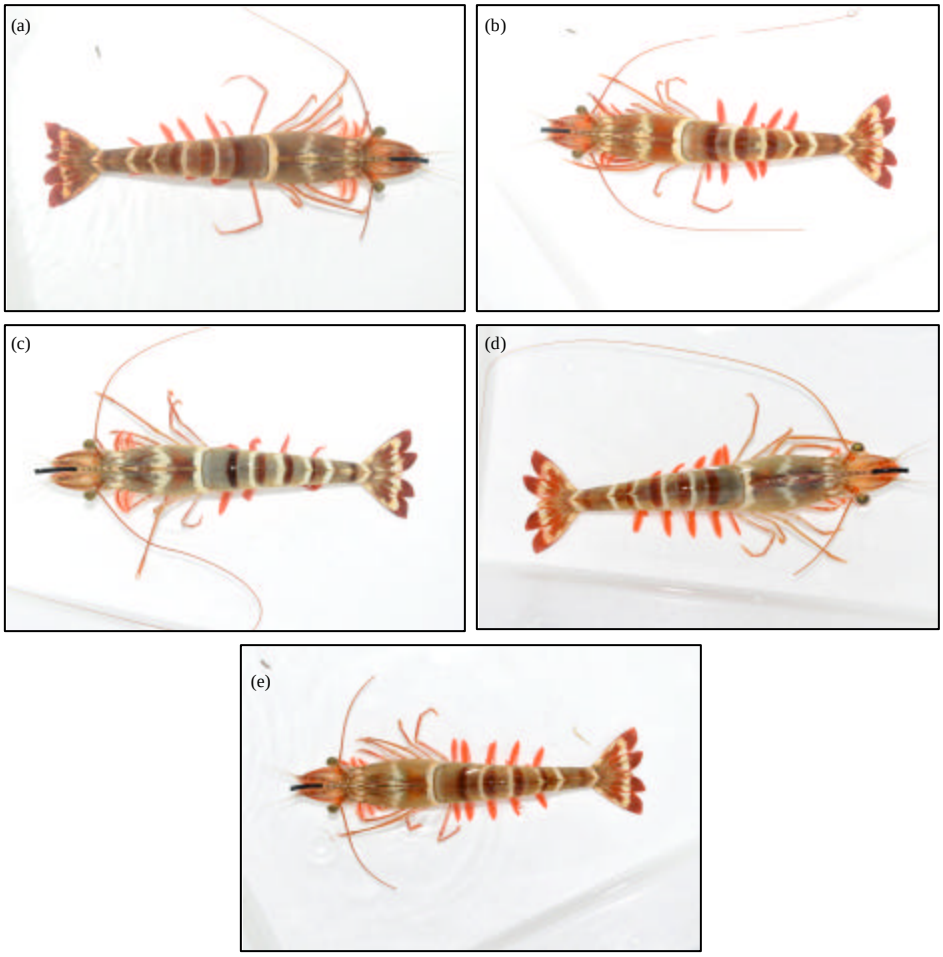

Fig. 4(a-e): Different maturity stages of *P. monodon* at Pazhayar Coast in 2012-2013, (a-b) Immature stage early mature stage, (c-d) Late mature stage mature stage and (e) Spent stage

In the present study spawning season march month very high compare to other month and also post monsoon season very high compare to other season. Some previous report also mention same results. Joshi (1980) reported that *P. stylifera* breeds throughout the year with a peak breeding during February to March and August to September in Bombay waters. Subramanyam (1963) reported that the highest breeding activity in Madras waters was during March and May to September. The present study on *Penaeus monodon* from pazhayar waters also revealed similar results. The resemblance between these peak seasons at these two centers on the east coast of India is probably due to the profound influence if the North east monsoon in these places while the west coast is more influenced by the south west monsoon. According to Rao (1964) in the species of *P.indicus* opined that this prawn breeds five times in its life time and the interval between two successive spawning is about two months. At Kozhikode matured dominated during December-March with a peak in March (44%).

The present study indicated that the spawning seasons based on the coloration of the ovaries. Therefore, the assessment of spawning season on the basis of ovarian color would be either easier

or reliable method. According to Ayub and Ahmed (2002) two peaks of spawning were observed in *P. penicillatus, P. merguinensis* and *M. affinis*. The first peak occurred from February to May, while second peak occurred either in September or October. The post monsoon and premonsoon seasons are marked by higher salinity regions where the plankton's production is comparatively high. As the plankto trophic larval stages of the prawns will have a better chance of survival during the above seasons, the peak periods of breeding coincide with these seasons.

Generally penoid spp have two distinct spawning peak throught out year. In the present observation reported many previous report. Studies on the maturity and spawning of six commercially important species were conducted during 1996-1999 at Veraval Fisheries Harbour (Dineshbabu, 2003). He found that in *P. stylifera* spawners present throughout the year with two peaks, one during May and another during January. In the case of *P. hardwickii*, also spawners available through the year with a distinct peak in February-March and another starting from May. In *M. monoceros* also there were two distinct peaks of spawners availability, a major one during January-February and a minor one during September-October. In *M. Kutchensis*, the percentage of spawners was maximum during November-December and again a minor peak was observed during February-March indicating intense spawning activities of the species during these periods. In *P. semisulcatus* the percentage of spawners was maximum during November-December and April-May, clearly indicating the peak spawning activities of the species during these periods. In *C. crassicornis*, the maximum number of spawners was observed during April-May and November-December. As the spawners of P.monodon are available through the year in palayar coastal waters, a hatchery can be utilized very well here. Spawners availability round the year avoids the need for maintaining brood stock in the shrimp hatchery a saving on both capital investment and running expenditure.

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