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SYNOPSIS OF BIOLOGICAL DATA ON THE JUMBO TIGER PRAWN  
Penaeus monodon Fabricius 1798

Exposé synoptique sur la biologie de Penaeus monodon Fabricius 1798

Sinopsis sobre la biología del Penaeus monodon Fabricius 1798

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<sup>2/</sup> This synopsis has been prepared according to Outline Version No. 1 (H. Rosa Jr., FAO Fish. Synops., (1) Rev.1, 1965)

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## 1 IDENTITY

## 1.1 Taxonomy

## 1.1.1 Definition

Phylum Arthropoda  
 Class Crustacea  
 Subclass Malacostraca  
 Series Eumalacostraca  
 Superorder Eucarida  
 Order Decapoda  
 Suborder Natantia  
 Section Penaeidea  
 Family Penaeidae  
 Subfamily Penaeinae  
 Genus Penaeus Fabricius 1798  
 Species Penaeus monodon  
 Fabricius 1798

## 1.1.2 Description

Genus Penaeus Fabricius 1798  
 (Supplementum Entomologiae Systematicae  
 (Hafniae))  
 Type species by original description Penaeus monodon Fabricius 1798.

Shell glabrous, rostrum moderate, toothed above and below, carapace without longitudinal or transverse sutures, cervical and orbito-antennal sulci and antennal carina always present. Antennal and hepatic spines pronounced, pterygostomial angle rounded. Telson with deep sulcus, with or without lateral movable spines, fixed subapical spines absent. Antennular flagella shorter than carapace. Mandibular palp foliaceous, two segmented. Maxillary palp with two or three segments, usually three. Maxilliped III sexually dimorphic. Basal spines on first and second pereopods, exopods present on first four pereopods but sometimes wanting on fifth. Petasma symmetrical, pod-like with thin median lobes, usually with small thickened distal protuberances and forming a posterior tube-like projection; lateral lobes usually with thickened rounded distal margins. Appendix masculina with an ovoid distal segment bearing numerous spinules. Thelycum with an anterior process, variable in shape, receptacle often closed by two flaps which meet or overlap on the mid line; seminal receptacle sometimes open. Pterocardiac ossicle bar-shaped. Zygocardiac ossicle consisting of a principal tooth followed by a longitudinal row of smaller teeth which often end in a cluster of minute teeth. A pleurobranchia each on third to eighth thoracic somite, two each on subsequent somites till sixth and a single posterior one on seventh. A podobranchia on second somite only. A mastigobranchia on each of the anterior six somites (adapted from Kubo, 1949, and Dall, 1957).

Penaeus monodon Fabricius 1798 (Fig.1)

Rostrum with 7-8/2-3 teeth, usually 7/3, exceeding tip of antennular peduncle and

sigmoid in shape in juveniles and adults. Antennular flagella subequal or slightly longer than peduncle. Prosartema reaching to or barely exceeding tip, stylocerite attaining 1/2 basal segment. Endopod of maxilliped III reaching tip of antennular peduncle in adult male, reaching distal end of basal segment of antennular peduncle in females and juvenile males. Dactyl almost length of propodus in male, inserted at 1/5 length of propodus, the distal end of latter bearing a tuft of setae as long as dactyl. Dactyl 1/2 to 2/3 length of propodus in female and inserted apically. First pereopod reaching distal end of or slightly exceeding caepocerite, second reaching distal end of basal segment of antennular peduncle, third reaching to or exceeding tip of peduncle by dactyl, fourth reaching as far as first, fifth exceeding fourth by dactyl. Ischial spine on first pereopod; no exopod on fifth leg.

Abdomen dorsally carinated from anterior 1/3 of fourth somite. Carina curving downwards fairly strongly towards posterior end of sixth somite. The fourth and fifth somites each with a small cicatrice, sixth with three cicatrices. Telson unarmed. Cardiac plate with 18 to 24 spinules, usually 20 to 24, zygocardiac ossicle principal + 9 to 12 conical teeth, usually 9 to 10, followed by several smaller teeth and a cluster of minute teeth; prepyloric acute with 6 to 8 large teeth, sometimes with 2 to 3 smaller teeth on lateral margin.

Petasma symmetrical median anterior lobe small, separated from lateral by a shallow notch, not projecting as far as lateral lobes. Lateral lobes without distal setae, with distolateral irregular group of ossicles greatly variable in number. Distal piece of appendix masculina 1.6 to 1.7 times longer than width, at least basal half naked. Length of anterior plate of thelycum twice the width, anterior rounded portion concave, posterior bluntly pointed portion inserted between flaps of seminal receptacles for 2/5 their length. Seminal receptacles circular, flaps forming tumid reflected lips on mid line, with smooth inner edges, in impregnated females (Dall, 1957).

Colour of fresh specimens dark blue to black, carapace and abdomen transversely banded,

pereiopods covered sp.

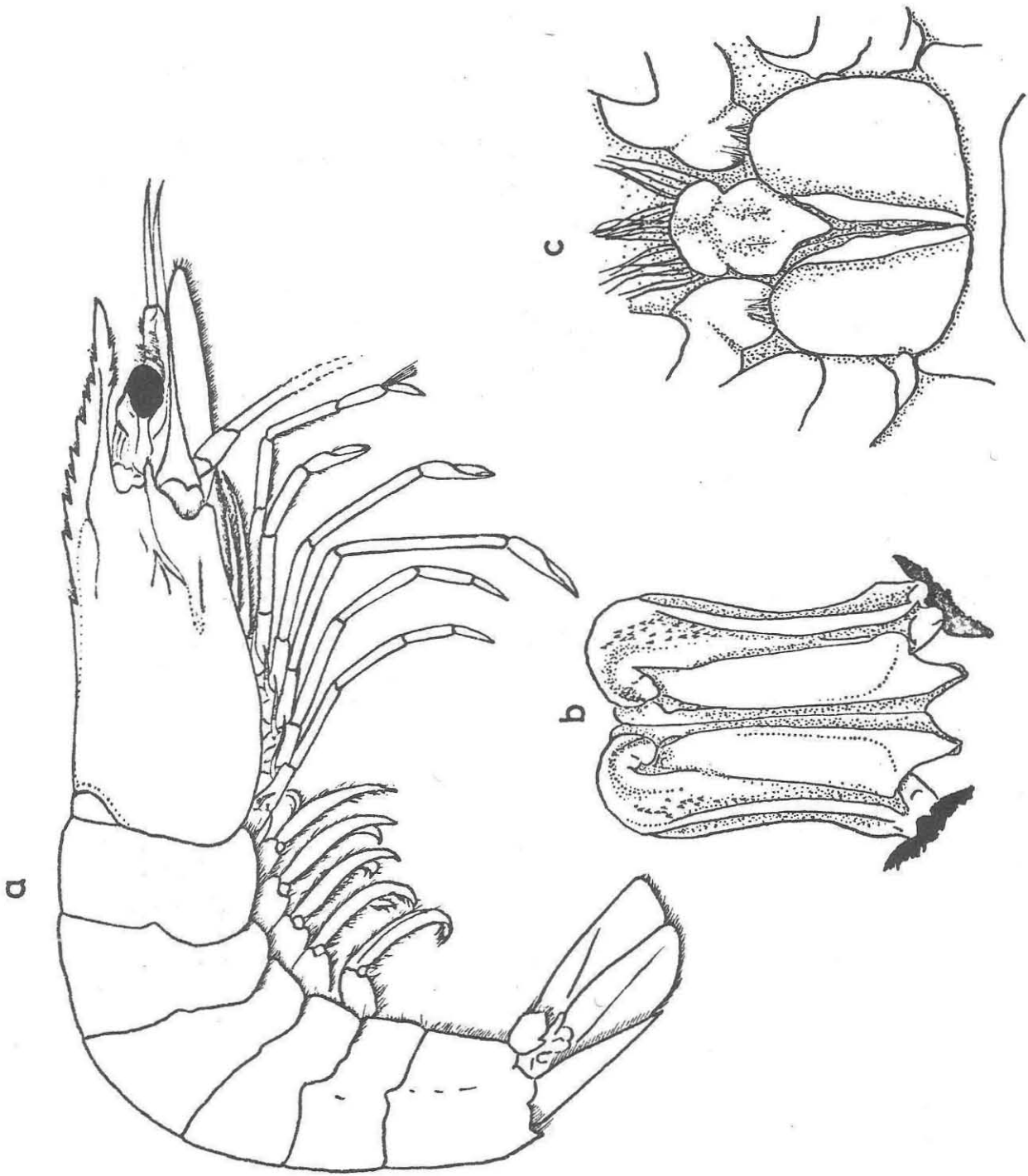


Fig. 1 a. *Penaeus monodon*; b. *Petasma*; c. *Thelycum*  
(b. and c. from Hall, 1962)

a pair of broad dark bands on each abdominal somite. Pleopods fringed with bright red setae. Pleopods and uropods tipped with light blue. Pattern of colour variable.

## 1.2 Nomenclature

### 1.2.1 Valid scientific name

Penaeus monodon Fabricius 1798

The correct identity of this very large species of prawn has been the subject matter of protracted discussions for a considerable length of time. On this subject Racek and Dall (1965) state that the designation of a neotype in the place of the lost real type of Fabricius by Holthuis (1949), has finally rectified the century-long confusion of this species with P. semisulcatus de Haan and helped to abolish some junior synonymy.

### 1.2.2 Synonyms

Penaeus monodon Fabricius, 1798, p. 408. Haswell, 1882, p.199. Kishinouye, 1900, p.7, 15. Stebbing, 1910, p. 380, Holthuis, 1949, pp. 1051-57. Kubo, 1949, p.291. Barnard, 1950, p. 584. Dall, 1957, pp. 152-54. *Racek & Dall 1965*  
*Joubert 1965*

Penaeus carinatus Dana, 1852, p. 602. de Man, 1911, p. 101. Kemp, 1915, p. 317. Burkenroad, 1934, p. 74. Anderson and Lindner, 1943, p. 305. Racek, 1955, pp. 215-17; 1959, pp. 10-11.

Penaeus semisulcatus Alcock, 1906, pp. 10-11.

Penaeus caeruleus Stebbing, 1905, p. 77. Burkenroad, 1934, p. 74. Racek, 1955, pp. 217-18; 1959, pp. 10-11.

Penaeus carinatus Schmitt, 1926, pp. 359, 363.

Penaeus bubulus Kubo, 1949, pp. 296-301. (after Racek and Dall, 1965)

### 1.2.3 Standard common names, vernacular names

Country	Standard common name	Vernacular name
Australia	Jumbo tiger prawn Giant (Black) tiger prawn	Tiger prawn, Jumbo prawn Giant tiger prawn
Philippines	Jumbo tiger shrimp	Sugpo
India:		
Calcutta	-	Bagda chingdi
Madras	-	Yera
Kerala	-	Kara chemmeen
Bombay	-	Jinga
South Africa	Tiger prawn	-

## 1.3 General variability

### 1.3.1 Subspecific fragmentation

Villaluz and Arriola (1938) report a variety P. monodon van manillensis, from Philippine waters.

*Racek & Dal, 1965, p. 10-11; Goswin 1965, p. 30; Joubert 1965, 22-24*

*Hall, 1956, p. 72-73, 1962 p. 15;*

*Hos*



## 2 DISTRIBUTION

2.1 Delimitation of the total area of distribution and ecological characterization of this area

The species is fairly widely distributed throughout the greater part of the west Indo-Pacific region ranging from South Africa to southern Japan, and from Karachi to northern New South Wales. The species apparently prefers warm water habitats. It is recorded from seas, rivers, estuaries, backwaters and even from freshwater.

2.2 Differential distribution

## 2.2.1 Areas occupied by eggs, larvae and other young stages

No information is available on the eggs of the species.

Panikkar and Aiyar (1939) report that the larvae enter Adayar backwaters (Madras) along with postlarvae during all the months that the bar remains open.

Occurrence of postlarvae has been reported from the Chilka Lake and the Ennur backwaters by Kemp (1915). They are pelagic and are reported to live among weeds. Large numbers of them settle in weed pools and backwaters of the Gangetic delta, situated many miles away from the sea. Delmendo and Rabanal (1956) observed that the fry of the species are carried to the shallow coastal areas, tidal rivers and estuaries by incoming tide. They also enter fish ponds through the coarse screen of the water control gates of the fish ponds. In the Philippines the fry are collected from these areas during May to October; peak occurrence being noted in August and September.

## 2.2.2 Areas occupied by adult stages

Kemp (1915) states that the species is migratory in habit, the adults migrating out to sea during the breeding season. In the Kerala coast the species occurs both in the sea and in the backwaters in relatively smaller quantities. In the trawler catches of the region it is seen that the larger sized prawns are obtained from the deeper waters. In Bombay the catches mostly consist of immature specimens. Hall (1962) records the species among the catches of the Singapore prawn ponds.

In Madagascar waters the species is obtained from as deep as 45 m although ~~that~~ it is more common in shallower waters (Crevin 1968). Bannard (1950) recorded the species from 72 m. in South Africa waters.

200 mm are frequently seen among the catches obtained from paddy fields.

of Calicut  
up to 65 m. In the backwaters/Ponnemon  
are caught along with other species of prawns.  
in small waters. Specimens as large as



The occurrence of mature forms in the haul catches obtained from relatively deeper waters (35-60m) off the East coast of India indicate the possibility of their spawning in these waters.

## 3 BIONOMICS AND LIFE HISTORY

3.1 Reproduction

## 3.1.1 Sexuality

P. monodon is heterosexual. Sexes can be distinguished by external characters such as the presence of sex organs, petasma for males and thelycum for females. The presence of appendix masculina in the endopod of the second pair of pleopods is another secondary sexual character of the male. While the genital openings of the male are situated on the coxa of the fifth pair of walking legs those of the female are on the coxa of the third pair of walking legs. Females also attain relatively larger size than males.

## 3.1.3 Mating

Possibly promiscuous as in other prawns. Observations on this species are wanting.

## 3.1.7 Spawning grounds

Hall (1962) indicated the possibility of the species breeding in the same grounds as P. indicus, outside Singapore waters, during the months February to April.

3.2 Larval history

## 3.2.1 Account of embryonic and juvenile life

Information on the early larval history of the species is wanting. Kemp (1915) observed 10 mm long postlarvae in Chilka Lake and Ennur. They are pelagic and transparent with a crimson streak running along the ventral surface, involving the whole of antennules and the telson, but not the other appendages, except to a slight extent on the uropods. They possess two pairs of lateral spines on the telson and the rostrum; the latter in the youngest individuals is without inferior teeth, and extends a little beyond the eyes.

Larger postlarval specimens are still slender, but are deeply mottled with dark grey and dull green. They live among weeds. The 'sugpo' fry, figured by Delmendo and Rabanal (1956), appears to be an advanced postlarval stage. The smallest size of fry recorded is 15.3 mm total length, 1.6 mm body depth and 0.025 g weight.

3.3 Adult history

## 3.3.1 Longevity

Panikkar and Aiyar (1939) found the larval and postlarval stages of the species entering the backwaters of Madras and state that they grow there for about a year, after which they go back to the sea to breed. Number of their

age groups in the fishery is not determined. Srivatsa (1953) states that the life span of the prawns (including P. monodon) in the Gulf of Kutch is 12 to 14 months.

## 3.3.2 Hardiness

P. monodon is euryhaline, capable of withstanding wide range of salinity. Panikkar and Menon (1956) observed the species even in the freshwater regions of Collair Lake. To some extent they are eurythermal as evidenced from the wide gradient of temperature of the natural habitat of the species.

## 3.3.6 Greatest size

Greatest recorded size is 305 mm or 12 in (Racek, 1955).

3.4 Nutrition and growth

## 3.4.1 Feeding

Panikkar (1952) observed that the food of young penaeids consisted of organic detritus found in the mud, algal material and other extremely small organisms contained in the mud. Hall (1962) found that the food of the species consisted of large crustaceans, vegetable matter, polychaetes, molluscs and fish. Small crustaceans and insects were taken occasionally. Small crustacean material was found only in the stomachs of prawns obtained from prawn ponds and mostly consisted of harpacticoid copepods. Large crustacean food items were mostly of brachyuran origin. He observed three specimens having their food bolus divided into three parts, each having different food items. Based on this he observed that the species had been engaged in ingesting material of secondary choice when no opportunity was presented for ingesting preferential crustacean material. According to him the presence of split bolus was not indicative of varying feeding behaviour during different periods of the day.

## 3.4.3 Relative and absolute growth patterns and rates

From the available literature it is fairly clear that the species migrates into the estuaries and backwaters early in life. No information is available on its growth in the sea. In the Philippine waters the species is cultured from the fry stage. The average growth observed by Delmendo and Rabanal in the Philippine nursery ponds is given in Table I.

Delmendo and Rabanal (1956) record that the growth rate may be still faster. The largest one-year olds may, however, measure as long as 250.0 mm and weigh 120 g while the smallest may be only 180 mm in length and 50 g in weight. They observe that a kilogram of one year old 'sugpo' may contain 8 to 20 individuals.

Naturalis → P4

TABLE I

Average rate of growth of P. monodon under cultivation  
(Delmendo and Rabanal, 1956)

Duration of culture	Total length in mm	Body depth in mm	Weight in grams
Fry	15.3	1.6	0.025
1 wk	21.5	2.5	0.06
2 wk	28.2	3.6	0.08
3 wk	38.8	4.5	0.02
4 wk	45.3	5.7	0.78
5 wk	57.1	7.8	1.63
6 wk	60.3	9.7	3.30
7 wk	69.5	10.9	4.36
2 mo	79.0	9.8	4.34
3 mo	94.7	11.1	6.88
4 mo	120.0	15.3	14.5
5 mo	I n c o m p l e t e		
6 mo	141.9	18.3	22.3
7 mo	152.6	16.4	25.1
8 mo	I n c o m p l e t e		
9 mo	178.0	27.8	57.3
10 mo	211.6	30.2	62.8
11 mo	223.0	32.0	70.7
1 yr	229.8	32.0	95.1

Note - The data for the 9th to 12th months are for the 1951 to 1952 season only and are therefore not strictly comparable with averages for the earlier periods.

Hall (1962) estimated the weight length relationship of the species as

$$W = 1.0000 C^{2.640}$$

where W is weight of prawn in g and C is carapace length in cm.

### 3.5 Behaviour

#### 3.5.1 Migration and local movements

That the young ones of the species take shelter under weeds in the estuaries is reported by Kemp (1915), Domantay (1956) and Delmendo and Rabanal (1956). Kemp noticed that the young of the species ascends estuaries and makes its way to water of low salinity only in those seasons in which it is not breeding. The pelagic stages of larvae and postlarvae are apparently carried by tide well up into the Gangetic delta. According to him the adults annually resort to sea in the breeding season. Delmendo and Rabanal (1956) stated that it is probable that the 'sugpo' spawn in the sea not far from the coast and that the young are carried to shallow coastal areas, tidal rivers and estuaries by the incoming tide. They also enter fish ponds through the coarse screens of the water control gates, where they constitute a welcome and gratuitous addition to the cultivated fish crop. Shaikhmahmud and Tembe (1960) observed that the species is caught regularly in Bombay waters. From the available information about this species, as well as others of the genus, it is quite clear that the general pattern of movement seen in most of the penaeid prawns, sea to estuary and back, is followed by this species also.

#### 4 POPULATION (STOCK)

##### 4.1 Structure

##### 4.1.2 Age composition

Attempts have not been made to assess the age composition of the species in the marine catches. Based on the growth rate given by Delmendo and Rabanal (1956) the prawns observed in Bombay stake net catches by Shaikh-mahmud and Tembe (1960) may be considered as 0-year class. The backwater fishery and the prawn pond fishery are fully supported by the 0-year class. In a general study Srivatsa (1953) observes that the Gulf of Kutch prawns (which includes this species also) have only one year span of life and perhaps die soon after spawning.

##### 4.1.3 Size composition

Panikkar and Menon (1956) record 10 to 11 in (25.4 to 27.9 cm) as its largest size in the marine catches off the coasts of India. Shaikhmahmud and Tembe (1960) observed 100 to 150 mm size in the Bombay catches.

## 5 EXPLOITATION

### 5.1 Fishing equipment

#### 5.1.1 Fishing gear

In the southwest coast of India the species is caught in small quantities by stake nets, cast nets, dip nets, etc. In the Philippines, Domantay (1956), describes several nets and contraptions made of cotton twine and bamboo poles for the capture of the species, particularly from the mangrove swamps. These contraptions include impounding nets, push nets, skimming nets, drive-in-nets, lever nets, drag nets, dip nets, cover pot, entangling nets, guiding barriers, etc. Fish lures, locally known as 'bon-bon', are extensively used in Philippine waters to catch the fry of the species.

From the sea the species is caught in stake nets, shore seines, boat seines and trawl nets.

#### 5.1.2 Fishing boats

Catamarans, dug-outs, canoes and trawlers land P. monodon along with other prawns.

### 5.2 Fishing areas

#### 5.2.1 General geographic distribution

Land areas: 154, 421(W), 423, 432, 433, 434, 437, 441, 451, 453, 612, 516. (Holthuis and Rosa, 1965).

Water areas: ISW, ISEW, ANW, and PSE. (Holthuis and Rosa, 1965).

#### 5.2.3 Depth ranges

From the estuarine and backwater fishery the juveniles and postlarvae are caught from shallow regions. From the sea the adults are caught in depths up to 60 fm (110 m).

### 5.3 Fishing seasons

In the Kerala backwater fishery the species is caught throughout the season in small numbers. In the Gautami estuary the species is caught in all the months but the intense fishery is from November to early January (Subrahmanyam, 1966). The 'sugpo' fry season in the Philippines starts from May and extends up to October. In Bombay they are found in the commercial catches from August to October. Year to year variation in the fishing season is generally not evident.

### 5.4 Fishing operations and results

#### 5.4.3 Catches

Srivatsa (1953) estimates that 10 percent of the Gulf of Kutch prawn fishery is constituted by P. monodon. Delmendo and Rabanal (1956)

state that unstocked ponds in the Philippines yield 50 to 200 kg of prawns per hectare per year and the stocked ponds yield about 500 kg, of which 70 percent may consist of P. monodon. Subrahmanyam (1966) estimated the catches of the species from the Gautami estuary as 500 tons in 1960 to 1961 and the average rate of catch as 2,107 kg/day/net.

### 5.6 Fish farming, transplanting and other intervention

The species is cultured in Philippine waters and to some extent in Formosa (Delmendo and Rabanal, 1956; Kesteven and Job, 1957). In the Philippines the 'sugpo fry' (advanced post-larva) are collected, reared, transplanted and grown in culture ponds. The 'sugpo fry' are collected from natural waters of the tidal creeks by using 'bon-bon' lures made of a bunch of water grass and are transported to the nursery ponds. After attaining some growth the small prawns are collected from the nursery ponds and are stocked in rearing ponds, either by themselves or along with Chanos chanos. Best results are obtained when prawns are stocked alone. They are harvested twice - once at the time of transplantation to the rearing ponds and a second time at the final harvesting. They attain marketable size within six months to one year. Delmendo and Rabanal (1956) record the following three factors which exercise some kind of limitations to this lucrative practice:

- i. Harvesting of the crop is rendered difficult due to the nongregarious habits of the prawn.
- ii. Rate of survival of the fry is poor, estimated at 10 to 50 percent.
- iii. Season for 'sugpo fry' collection varies from year to year and the supply fluctuates considerably.

## 6 REFERENCES

- Aloock, A., The prawns of the Peneus group. In Catalogue of the Indian Decapod Crustacea in the collection of the Indian Museum. Part 3, Macrura. Fasc. I. Indian Museum, Calcutta, 55 p.  
1906
- Anderson, W.W., and M.J. Lindner, A provisional key to the shrimps of the family Penaeidae with especial reference to American forms. Trans.Am.Fish.Soc., 73:284-319  
1943
- Barnard, K.H., Descriptive catalogue of South African crustacea (crabs and shrimps). Ann.S.Afr.Mus., 38:1-837  
1950
- Burkenroad, M.D., The Penaeidea of Louisiana, with a discussion of their world relationships. Bull.Amer.Mus.nat.Hist., 68:61-143  
1934
- Dall, W., A revision of the Australian species of Penaeinae (Crustacea Decapoda; Penaeidae). Aust.J.mar.Freshwat.Res., 8(2):136-231  
1957
- Dana, J.D., Crustacea of the United States exploring expedition, during the years 1852 1838 to 1842. 13(1):1019-262
- Delmendo, M.N., and H.R. Rabanal, Cultivation of "Sugpo" (Jumbo Tiger Shrimp), Penaeus monodon Fabricius, in the Philippines. Proc.Indo-Pacif.Fish.Counc., 6(3): 424-31  
1956
- de Man, J.G., The Decapoda of the Siboga expedition. Part I. Family Penaeidae., 1911 Siboga Exped. Monogr., 39a:1-131
- Domantay, J.S., Prawn fisheries of the Philippines. Proc.Indo-Pacif.Fish.Counc., 6(3): 1956 362-66
- Fabricius, J.C., "Supplementum Entomologiae Systematicae". (Hafniae) 1798
- Hall, D.N.F., Observations on the taxonomy and biology of some Indo-west Pacific Penaeidae (Crustacea, Decapoda). Fish.Publ., Colonial Office, London, 17:1-229  
1962
- Haswell, W.A., Catalogue of the Australian stalk- and sessile-eyed crustacea. (Australian Museum, Sydney)  
1882
- Holthuis, L.B., The identity of Penaeus monodon Fabr., Proc.Acad.Sci.,Amsterdam, 52:1-8  
1949
- Holthuis, L.B., and H. Rosa, List of species of shrimps and prawns of economic value. 1965 FAO Fish.tech.Pap., (52):21 p.
- Kemp, S., Fauna of the Chilka Lake. Crustacea Decapoda. Mem.Indian Mus., 5:201-325  
1915
- Kesteven, G.L., and T.J. Job, Shrimp culture in Asia and the Far East: A preliminary review. Proc.Gulf Caribb.Fish.Inst., 10:49-68  
1957
- Kishinouye, K., Japanese species of the genus Penaeus. J.Fish.Bur.,Tokyo, 8(1):1-29  
1900
- Kubo, I., Studies on the penaeids of Japanese and its adjacent waters. J.Tokyo Coll. Fish., 36(1):1-467  
1949



- Panikkar, N.K., Possibilities of further expansion of fish and prawn cultural practices  
1952 in India. Curr.Sci., 21:29-33
- Panikkar, N.K., and R.G. Aiyar, Observations on breeding in brackish-water animals of  
1939 Madras. Proc.Indian Acad.Sci., B. 25(9):343-64
- Panikkar, N.K., and M.K. Menon, Prawn fisheries of India. Proc.Indo-Pacif.Fish.Coun.,  
1956 6(3):328-44
- Racek, A.A., Littoral Penaeinae from New South Wales and adjacent Queensland waters.  
1955 Aust.J.mar.Freshwat.Res., 6(2):209-41
- Racek, A.A., and W. Dall, Littoral Penaeinae (Crustacea Decapoda) from northern Austra-  
1965 lia, New Guinea and adjacent waters. Verh.K.Ned.Akad.Wet.(Afd.Nat.),  
56(3):1-119
- Schmitt, W.L., Report on the crustacea Macrura (families Penaeidea, Campylonotidae and  
1926 Pandalidae) obtained from the F.I.S. Endeavour in Australian seas. Zool.  
Res.Fish.Exp.'Endeavour', 5:309-81
- Shaikhmahmud, F.S., and V.B. Tembe, Study of Bombay prawns. The seasonal fluctuation  
1960 and variation in abundance of the commercially important species of Bombay  
prawns with a brief note on their size, state of maturity and sex ratio.  
Indian J.Fish., 7(1):69-81
- Stebbing, T.R.R., South African Crustacea. Part III. Mar.Invest.S.Africa. 4:21-123  
1905
- \_\_\_\_\_, General catalogue of the South African crustacea. Ann.S.Afr.Mus., 6(4):  
1910 281-593
- Srivatsa, K.R., A survey and comparative analysis of the prawn (shrimp) fishery of the  
1953 Gulf of Kutch in Saurashtra in Western India. Saurashtra Government Publi-  
cation, India
- Subrahmanyam, M., Fluctuations in prawn landings in the Godavari estuarine system.  
1966 Proc.Indo-Pacif.Fish.Coun., 11(2):44-51
- Villaluz, D.K., and F.J. Arriola, Five other known species of the genus Penaeus in the  
1938 Philippines. Philipp.J.Sci., 66:35-41

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