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

Exposé synoptique sur la biologie de
Peneaus monodon Fabricius, 1798

Sinopsis sobre la biología del
Peneaus monodon Fabricius, 1798

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# CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Pages</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 IDENTIFY</td>
<td></td>
</tr>
<tr>
<td>1.1 Taxonomy</td>
<td></td>
</tr>
<tr>
<td>1.1.1 Definition</td>
<td>1</td>
</tr>
<tr>
<td>1.1.2 Description</td>
<td>1</td>
</tr>
<tr>
<td>1.2 Nomenclature</td>
<td></td>
</tr>
<tr>
<td>1.2.1 Valid scientific names</td>
<td>3</td>
</tr>
<tr>
<td>1.2.2 Synonyms</td>
<td>3</td>
</tr>
<tr>
<td>1.2.3 Standard common names, vernacular names</td>
<td>3</td>
</tr>
<tr>
<td>1.3 General variability</td>
<td></td>
</tr>
<tr>
<td>1.3.1 Subspecific fragmentation (races, varieties, hybrids)</td>
<td>3</td>
</tr>
<tr>
<td>1.3.2 Genetic data (chromosome number, protein specificity)</td>
<td>3</td>
</tr>
<tr>
<td>2 DISTRIBUTION</td>
<td></td>
</tr>
<tr>
<td>2.1 Delimitation of the total area of distribution and ecological characterization of this area</td>
<td></td>
</tr>
<tr>
<td>2.2 Differential distribution</td>
<td></td>
</tr>
<tr>
<td>2.2.1 Areas occupied by eggs, larvae and other junior stages; annual variations in these patterns, and seasonal variations for stages persisting over two or more seasons</td>
<td>1</td>
</tr>
<tr>
<td>2.2.2 Areas occupied by adult stages; seasonal and annual variations of these</td>
<td>1</td>
</tr>
<tr>
<td>2.3 Behaviouristic and ecological determinants of the general limits of distribution and of the variations of these limits and of differential distribution</td>
<td>1</td>
</tr>
<tr>
<td>3 BIONOMICS AND LIFE HISTORY</td>
<td></td>
</tr>
<tr>
<td>3.1 Reproduction</td>
<td></td>
</tr>
<tr>
<td>3.1.1 Sexuality (hermaphroditism, heterosexuality, intersexuality)</td>
<td>1</td>
</tr>
<tr>
<td>3.1.2 Maturity (age and size)</td>
<td>1</td>
</tr>
<tr>
<td>3.1.3 Mating (monogamous, polygamous, promiscuous)</td>
<td>1</td>
</tr>
<tr>
<td>3.1.4 Fertilization (internal, external)</td>
<td>1</td>
</tr>
<tr>
<td>3.1.5 Fecundity</td>
<td>1</td>
</tr>
<tr>
<td>3.1.6 Spawning</td>
<td>1</td>
</tr>
<tr>
<td>3.1.7 Spawning grounds</td>
<td>1</td>
</tr>
<tr>
<td>3.1.8 Egg: structure, size, hatching type, parasites, and predators</td>
<td>1</td>
</tr>
<tr>
<td>3.2 Larval history</td>
<td></td>
</tr>
<tr>
<td>3.2.1 Account of embryonic and juvenile life (prelarva, larva, postlarva, juvenile)</td>
<td>1</td>
</tr>
</tbody>
</table>

---

1/This synopsis has been prepared according to Outline Version No. 1 (H. Rosa Jr., FAO Fish. Sys. (1) Rev. 1, 1965).
3.3 Adult history
   3.3.1 Longevity
   3.3.2 Hardiness
   3.3.3 Competitors
   3.3.4 Predators
   3.3.5 Parasites and diseases
   3.3.6 Greatest size

3.4 Nutrition and growth
   3.4.1 Feeding (time, place, manner, season)
   3.4.2 Food (type, volume)
   3.4.3 Relative and absolute growth patterns and rates
   3.4.4 Relation of growth to feeding, to other activities,
   and to environmental factors

3.5 Behaviour
   3.5.1 Migration and local movements
   3.5.2 Schooling
   3.5.3 Reproductive habits

4 POPULATION (STOCK).

4.1 Structure
   4.1.1 Sex ratio
   4.1.2 Age composition
   4.1.3 Size composition

4.2 Size and density
   4.2.1 Average size
   4.2.2 Changes in size
   4.2.3 Average density
   4.2.4 Changes in density

4.3 Natality and recruitment
   4.3.1 Natality
   4.3.2 Natality rates

4.4 Mortality, morbidity
   4.4.1 Rates of mortality
   4.4.2 Factors or conditions affecting mortality
   4.4.3 Factors or conditions affecting morbidity
   4.4.4 Relation of morbidity to mortality rates

4.5 Dynamics of population

4.6 Relation of population to community and ecosystem,
   biological production, etc.

5 EXPLOITATION

5.1 Fishing equipment
   5.1.1 Fishing gear
   5.1.2 Fishing boats
5.2 Fishing areas

5.2.1 General geographic distribution
5.2.2 Geographical ranges (latitudes, distances from coast, etc.) *
5.2.3 Depth ranges

5.3 Fishing seasons

5.3.1 General pattern of fishing season *
5.3.2 Duration of fishing season *
5.3.3 Dates of beginning, peak and end of season *
5.3.4 Variation in time or duration of fishing season *
5.3.5 Factors affecting fishing season *

5.4 Fishing operations and results

5.4.1 Effort and intensity *
5.4.2 Selectivity *
5.4.3 Catches

5.5 Fisheries management and regulations *

5.6 Fish farming, transplanting and other intervention

6 REFERENCES

* As no information was available to the author, these items have been omitted from the text
1. Identity

1.1. Taxonomy

1.1.1. Definition

Phylum Arthropoda
Class Crustacea
Subclass Malacostraca
Series Homalacostraca
Superorder Eucarida
Order Decapoda
Suborder Natantia
Section Peneidae
Family Peneidae
Subfamily Peneinae
Genus Penaeus, 1798
Species Penaeus monodon Fabricius, 1798

1.1.2. Description

Generic

Genus Penaeus Fabricius, 1798 (Suppl. Entomol. Syst. : 408). Type species, by
Penaeus monodon Fabricius, 1798. Gender: masculine. Placed on Official List of
Generic Names in Zoology as name no. 498.

Rostrum toothed dorsally and ventrally.
Carapace without longitudinal or transverse sutures; cervical and orbito-antennal
sulci and antennal carinae always present. Hepatic and antennal spines pronounced, ptery-
gastomal angle rounded. Telson with deep median sulcus, without fixed subtelsonal
spines, with or without lateral movable spines. First antennular segment without
a spine on ventral distomedian border. Antennular flagella shorter than carapace.
Maxillulary palp with 2 or 3 segments, usually 3. Basal spines on 1st and 2nd
peraeopods; exopods on 1st 4 peraeopods, usually present on 5th. Petasma sym-
metrical, pod-like with thin median lobes with or without distal tubercules;
lateral lobes often with thickened ventral margin. Appendix masculina with distal
segment subtriangular or ovoid, bearing numerous spines. Thelycum usually with
an anterior process, variable in shape, lying between the coxae of 4th peraeopods
with or without lateral plates on sternite XIV. Pleurobranchiae on somites
IX to XII; a rudimentary arthrobranch on somite VII; and a posterior arthrobranch
on somite XIII; mandibulbranchiae on somites VII to XII. Tergo-cercal ossicle
consisting of a principal tooth followed by a longitudinal row of smaller teeth which
often end in a cluster of minute teeth. Body glabrous. (After Dall, 1957, slightly
modified by Pérez-Farfante).

The genus at present includes about 28 known species. Beles (1957, Brown's Klass.
Ord. Tierr. 31 (7) (12):1518) mentioned a sub-
genus Salambria Burkenroad, but this is a nomen
nudum. Although the genus falls into two very
natural groups, no other attempts have been made
to recognise these as subgenera.

Specific

Species Penaeus monodon Fabricius, 1798 (Fig. 1).

The original type material no longer exists.
A neotype was selected by Holthuis (1949, Proc.
Kon. Ned. Akad. Wetensch., 52(9):1056); it is
a male of total length 200 mm from the Bay of
Djakarta (Batavia), Java, Indonesia (June 1924,
leg. F. Kuitemijck) in the collection of the
Rijksmuseum van Natuurlijke Historie, Leiden

Type locality: "Habitat in Ocean Indico"
(Fabricius, 1798), restricted by the neotype
selection to Bay of Djakarta, Java, Indonesia.

The name monodon has been used by some
older authors for the species at present gener-
ally indicated with the name Penaeus semisul-
catus De Haan, while the name Penaeus carinatus
has been often used for the present species.
In recent years the nomenclature of the two
species has become stabilized and the name
monodon generally accepted for the present spe-
cies.

Rostrum with 7–3/2–3 teeth, usually 7/3,
exceeding tip of antennular peduncle and sig-
moid in shape in juveniles and adults. Meta-
stral carina reaching almost to epigastric tooth.
Postrostral carina often more or less flat with
feebly indications of a sulcus, carina reaching
almost to posterior edge of carapace. Cephal-
orbital carina occupying posterior 1/3 to 1/2
distance between postorbital margin of carapace
and hepatic spine. Hepatic carina prominent,
posterolateral margin, the posterior often
diverging very slightly below horizontal axis;
distinctly separated from base of antennal ca-
rina which ends above middle of hepatic carina.

Hepatic sulcus ill-defined. Cervical sulcus
often with upper 1/3 indistinct, 1/5 to 1/7
length of carapace.

Antennular flagella subequal or slightly
longer than peduncle. Proseta reaching to or barely exceeding tip, stylocerite
attaining 1/2 basal segment. Basipod 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.
Fig. 1  a. *Penaeus monodon*; b. *Petasma*; c. *Thelycum*
(b. and c. from Hall, 1962)
Penaeus monodon

bearing a tuft of setae as long as dactyl. Dactyl 1/2 to 2/3 length of propodus in female and inserted apically. First peraeopod reaching distal end of or slightly exceeding carapace, 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 peraeopod; 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, symmetrical ossicle principal + 9 to 12 conical teeth, usually 9 to 10, followed by several smaller teeth and a cluster of minute teeth, propyloric acute with 6 to 8 large teeth, sometimes with 2 to 3 smaller teeth on lateral margin.

Penaeus 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 as long as width, at least basal half naked. Length of anterior plate of telsonum twice the width, anterior rounded portion concave, posterior bluntly pointed, portion inserted between flaps of seminal receptacles 2/5 to 3/4 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, 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.

A key to the Indo-Pacific species of Penaeinae is given by Beeck and Dall (1955). A key to African species is given by Barnard (1950).

1.2 Nomenclature

1.2.1 Valid scientific names

Penaeus monodon Fabricius, 1798 (Suppl. Entomol. Syst.: 408)

1.2.2 Synonyms

Objective synonymy

Astacus (Penaeus) monodon (Fabricius) Voigt, 1836, Cuvier's Thierreich, 4176.

Subjective synonymy


1.2.3 Standard common names, vernacular names

<table>
<thead>
<tr>
<th>Country</th>
<th>Standard common names</th>
<th>Vernacular names</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australia</td>
<td>Jumbo tiger prawn</td>
<td>Tiger prawn, Giant (Black)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Jumbo prawn, Giant tiger prawn</td>
</tr>
<tr>
<td>Philippines</td>
<td>Jumbo tiger shrimp</td>
<td>Sugpo</td>
</tr>
<tr>
<td>India:</td>
<td>Calcutta</td>
<td>Bagda chingdi</td>
</tr>
<tr>
<td></td>
<td>Madras</td>
<td>Yera</td>
</tr>
<tr>
<td></td>
<td>Kerala</td>
<td>Kara chemmoon</td>
</tr>
<tr>
<td></td>
<td>Bombay</td>
<td>Jinge</td>
</tr>
<tr>
<td>South Africa</td>
<td>Tiger prawn</td>
<td></td>
</tr>
</tbody>
</table>

1.3 General variability

1.3.1 Subspecific fragmentation (races, varieties, hybrids)

No subspecies are currently recognised of the present species. Penaeus monodon manillensis Villaluz and Arriola, 1938, proved to be based on an abnormal specimen of Penaeus semisulcatus De Haan.
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, i.e. throughout the coastal districts of sea areas ISW and ISEW, and extending into areas INW and PSE, as defined in Holthuis and Rosa (1965). It occurs on the coasts of land areas 133, 154, 155, 156, 421(W), 423, 432, 433, 434, 437, 441, 451, 453, 611, 612 and 616. 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 junior stages: annual variations in these patterns, and seasonal variations for stages persisting over two or more seasons

No information is available on the eggs of the species.

Panikkar and Aiyar (1939) reported that the larvae enter Adyar 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 Ganges delta, situated many miles 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 the incoming tide. They also enter fish ponds through the coarse screen of the water control gates. In the Philippines the fry are collected from these areas during May to October, peak occurrence being noted in August and September. Juveniles also occur in prawn ponds in Singapore (Hall, 1962). Small numbers of juveniles occur in sheltered shallow waters on the coasts of Zanzibar Island during the northerly monsoon (Hall, 1967).

2.2.2 Areas occupied by adult stages: seasonal and annual variations of these

Kemp (1915) stated that the species is migratory in habit, the adults migrating out to sea during the breeding season. On 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 (1967) stated that adults are fished in water of less than 9 m off Aden and in very shallow water in the Mafia Archipelago, Tanzania.
3 ECONOMICS AND LIFE HISTORY

3.1 Reproduction

3.1.1 Sexuality (hermaphroditism, heterosexuality, intersexuality)

P. monodon is heterosexual. The sexes can be distinguished by external characters such as the presence of sex organs, petasma for males and thelycum for females. The presence of an appendix masculina on the endopod of the second pair of ploepods is another secondary sexual character of the male. While the gonital 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 a relatively larger size than males.

3.1.2 Mating (monogamous, polygamous, promiscuous)

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

3.1.3 Spawning grounds

Hall (1962) indicated the possibility of the species breeding on 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 (prelarva, larva, postlarva, juvenile)

Information on the early larval history of the species is wanting. Kemp (1915) observed 10 mm long postlarvae in Chilka Lake and Emur. They are pelagic and transparent with a crimson streak running along the ventral surface, involving the whole of the antennules and the telson, but not the other appendages, except to a slight extent on the uropode. They possess two pairs of lateral spines on the telson. The rostrum 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 'mango' 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 stated that they grow there for about a year, after which they go back to the sea to breed. The number of age groups in the fishery is not determined. Srivastaa (1953) stated 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 a 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.

3.3.3 Greatest size

The greatest length recorded by Racek (1955) was 305 mm, but Crosnier (1965) recorded a female of 307 mm from Madagascar and quoted 337 mm as the largest recorded from any area.

3.4 Nutrition and growth

3.4.1 Feeding (time, place, manner, season)

Panikkar (1952) observed that the food of young penaeids consisted of organic detritus, 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 only was found 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 suggested 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 a 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
TABLE I
Average rate of growth of *P. monodon* under cultivation
(Delmendo and Rabanal, 1956)

<table>
<thead>
<tr>
<th>Duration of culture</th>
<th>Total length in mm</th>
<th>Body depth in mm</th>
<th>Weight in grams</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fry</td>
<td>15.3</td>
<td>1.6</td>
<td>0.025</td>
</tr>
<tr>
<td>1 wk</td>
<td>21.5</td>
<td>2.5</td>
<td>0.06</td>
</tr>
<tr>
<td>2 wk</td>
<td>28.2</td>
<td>3.6</td>
<td>0.08</td>
</tr>
<tr>
<td>3 wk</td>
<td>38.8</td>
<td>4.5</td>
<td>0.02</td>
</tr>
<tr>
<td>4 wk</td>
<td>45.3</td>
<td>5.7</td>
<td>0.78</td>
</tr>
<tr>
<td>5 wk</td>
<td>57.1</td>
<td>7.8</td>
<td>1.63</td>
</tr>
<tr>
<td>6 wk</td>
<td>60.3</td>
<td>9.7</td>
<td>3.30</td>
</tr>
<tr>
<td>7 wk</td>
<td>69.5</td>
<td>10.9</td>
<td>4.36</td>
</tr>
<tr>
<td>2 mo</td>
<td>79.0</td>
<td>9.8</td>
<td>4.34</td>
</tr>
<tr>
<td>3 mo</td>
<td>94.7</td>
<td>11.1</td>
<td>6.88</td>
</tr>
<tr>
<td>4 mo</td>
<td>120.0</td>
<td>15.3</td>
<td>14.5</td>
</tr>
<tr>
<td>5 mo</td>
<td><strong>Incomplete</strong></td>
<td></td>
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</tr>
<tr>
<td>6 mo</td>
<td>141.9</td>
<td>18.3</td>
<td>22.3</td>
</tr>
<tr>
<td>7 mo</td>
<td>152.6</td>
<td>16.4</td>
<td>25.1</td>
</tr>
<tr>
<td>8 mo</td>
<td><strong>Incomplete</strong></td>
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<tr>
<td>9 mo</td>
<td>176.0</td>
<td>27.8</td>
<td>57.3</td>
</tr>
<tr>
<td>10 mo</td>
<td>211.6</td>
<td>30.2</td>
<td>62.8</td>
</tr>
<tr>
<td>11 mo</td>
<td>223.0</td>
<td>32.0</td>
<td>70.7</td>
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<tr>
<td>1 yr</td>
<td>229.8</td>
<td>32.0</td>
<td>95.1</td>
</tr>
</tbody>
</table>

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.
The average growth observed by Delmendo and Rabanal in the Philippine nursery ponds is given in Table 1.

Delmendo and Rabanal (1956) recorded that the growth rate may be still faster. The largest one-year olds may be 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 observed that a kilogram of one year old 'eugpo' may contain 8 to 20 individuals.

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 was reported by Kemp (1915), Domantay (1956) and Delmendo and Rabanal (1956). Kemp noticed that the young of the species ascend estuaries and make their way to waters of low salinity only in those seasons in which the species is not breeding. The pelagic stages of larvae and postlarvae are apparently carried by the tide well up into the Gangetic delta. According to him the adults annually resort to the sea in the breeding season. Delmendo and Rabanal (1956) stated that it is probable that the 'eugpo' 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 tides. 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. Shaikhmehr 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.
4.1.2 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 Shaikhmahmud and Tembe (1960) may be considered as 0-year class. The backwater fishery and the prawn pond fishery are fully supported by the 0-class. In a general study, Srivatsa (1953) observed that the Gulf of Kutch prawns (including this species) have only one year span of life and perhaps die soon after spawning.

4.1.3 Size composition

Panikkar and Menon (1956) recorded 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 prawns of 10 to 15 cm in the Bombay catches.
5 EXPLOITATION

5.1 Fishing equipment

5.1.1 Fishing gear

On 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) described 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. Intertidal traps called 'valakira' are used to catch young prawns in Madagascar (Creamier, 1965), and similar traps are used in some other east African countries (Hall, 1967).

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

*P. monodon* is fished to some extent throughout its geographical range (see Section 2.1), but its commercial importance is greatest in India and the Philippines.

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 Guntai estuary the species is caught in all the months but the intense fishery is from November to early January (Subrahmanyan, 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) estimated that 10 percent of the Gulf of Kutch prawn fishery is constituted by *P. monodon*. Delmendo and Rabanal (1956) stated 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*. Subrahmanyan (1966) estimated the catches of the species from the Guntai estuary as 500 tons in 1960 to 1961 and the average rate of catch as 2.1 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 postlarvae) 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:

1. Harvesting of the crop is rendered difficult due to the nongregarious habits of the prawn.

2. Rate of survival of the fry is poor, estimated at 10 to 50 percent.

3. Season for 'sugpo fry' collection varies from year to year and the supply fluctuates considerably.
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