

**SYNOPSIS OF BIOLOGICAL  
DATA ON THE TIGER PRAWN**  
*Penaeus esculentus* Haswell, 1879

Prepared by  
I. Kirkegaard and R. H. Walker



**DIVISION OF FISHERIES AND OCEANOGRAPHY**  
**COMMONWEALTH SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANIZATION**  
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## SYNOPSIS OF FISHERIES BIOLOGICAL DATA

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Fishery Resources and Exploitation Division  
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00100 Rome, Italy

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L.W. Scattergood, Chief, Branch of Reports  
U.S. Department of the Interior  
Fish and Wildlife Service  
Bureau of Commercial Fisheries  
Washington, D.C. 20240, U.S.A.

**CSIRO:**

The Chief  
CSIRO Division of Fisheries and Oceanography  
Box 21  
Cronulla, N.S.W.  
Australia 2230

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SYNOPSIS OF BIOLOGICAL DATA ON THE TIGER PRAWN

Penaeus esculentus Haswell, 1879

Prepared by

I. KIRKEGAARD

Department of Harbours and Marine  
Queensland Fisheries Research Institute  
P.O. Box 3, Scarborough, Queensland, Australia

and

R.H. WALKER

CSIRO Division of Fisheries and Oceanography  
Queensland Fisheries Research Institute  
P.O. Box 3, Scarborough, Queensland, Australia

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\* As no information was available to the authors, these items have been omitted from the text

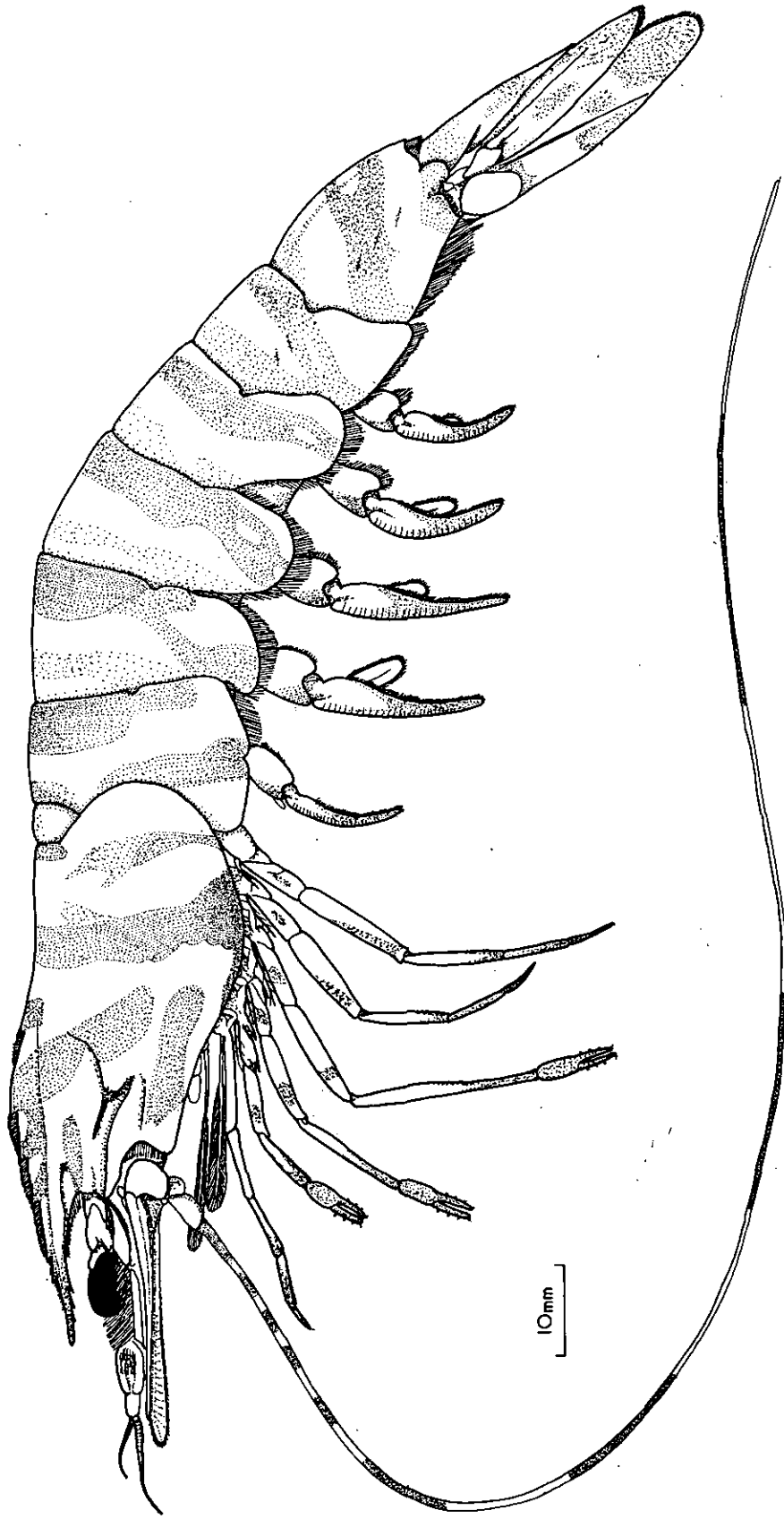


Fig. 1.- Penaeus esculentus Haswell, 1879 (from Dall, 1957)



## 1 IDENTITY

### 1.1 Nomenclature

#### 1.11 Valid name

Penaeus esculentus Haswell, 1879, Proc. Linn. Soc. N.S.W. 4, 38-44.

#### 1.12 Objective synonymy

None.

### 1.2 Taxonomy

#### 1.21 Affinities

- Suprageneric

Phylum Arthropoda  
Class Crustacea  
Order Decapoda  
Family Penaeidae  
Subfamily Penaeinae

- Generic

Genus: Penaeus Fabricius, 1798, Supplementum Entomologiae Systematicae, p. 408.

Genotype: Penaeus monodon Fabricius, 1798 (neotype Holthuis, 1949).

Generic concept is that of Dall (1957, pp. 141-2):

"Rostrum toothed ventrally. Carapace without longitudinal or transverse sutures; cervical and orbito-antennal sulci and antennal carinae always present. Hepatic and antennal spines pronounced, pterygostomial angle rounded. Telson with deep sulcus, without fixed subapical 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. Maxilliped 3 sexually dimorphic. Basial spines on 1st and 2nd pereopods, exopods on 1st 4 pereopods, usually present on 5th. Petasma pod-like with thin median lobes, usually with small thickened distal protuberances and forming a posterior tube-like projection; lateral lobes usually with thickened distal rounded margins. Appendix masculina with an ovoid distal segment, bearing numerous spinules. Thelycum usually

with an anterior process, variable in shape, lying between the coxae of the 4th pereopods and seminal receptacle occupying ventral surface of last thoracic sternite, receptacle often closed by 2 flaps which meet or overlap on the mid line; seminal receptacle sometimes open. Zygocardiac ossicle consisting of a principal tooth followed by a longitudinal row of smaller teeth which often end in a cluster of minute teeth. Pleurobranchiae on 3rd to 8th thoracic somites; a rudimentary arthrobranch on 1st, and a posterior arthrobranch on 7th thoracic somites; mastigobranchiae on 1st to 6th thoracic somites. Body glabrous."

- Specific

Type specimen: No holotype; syntype, Macleay Museum, University of Sydney (Racek, personal communication).

Type locality: Port Jackson and Port Darwin (Haswell, 1876).

Diagnosis (Dall, 1957, pp. 157-9; Fig. 1):

Rostrum.—5-7/3-4 teeth, usually 6/3; exceeding tip of antennular peduncle in specimens below 5 cm, becoming shorter with age, reaching middle of 2nd segment of antennular peduncle in 23 cm females; sigmoidal with low blade in juveniles, becoming almost straight with high blade in large specimens. Adrostral carina reaching epigastric tooth, postrostral carina non-sulcate ending 1/9 length carapace from posterior edge.

Carapace.—Length 1.5 times depth; gastro-orbital carina occupying posterior 2/3 distance between postorbital margin of carapace and hepatic spine. Hepatic carina distinct but not prominent, very slightly inclined downwards from horizontal axis, barely reaching posterior end of antennal carina. Hepatic and cervical sulci shallow, latter curving upwards posteriorly, ending below epigastric spine and ranging from 1/6 to 1/4 length carapace. Cervical carina well defined and extending almost as far as sulcus.

Antennules.—Flagella subequal, 2/3 length peduncle. Prosartema reaching basal 1/3 to 1/2 2nd segment; stylocerite attaining 1/2 basal segment.

Thoracic appendages.—Third maxilliped exceeding basal segment of antennular peduncle by dactyl, male with apical tuft of setae on propodus, extending as far as slightly hollowed dactyl which is inserted subapically, with a large subapical tuft of setae on carpus. Dactyl 2/3 length propodus in male and female. First pereopod exceeding carpoperite by dactyl, 2nd reaching end of basal segment of antennular peduncle, 3rd reaching tip of peduncle, 4th and 5th exceeding carpoperite by 1/2 dactyl. An ischial spine on 1st pereopod; 5th with a small exopod.

Abdomen.—Dorsally carinated from 1/2 4th somite, carina curving downwards strongly towards end of 6th somite; 5th with a small,

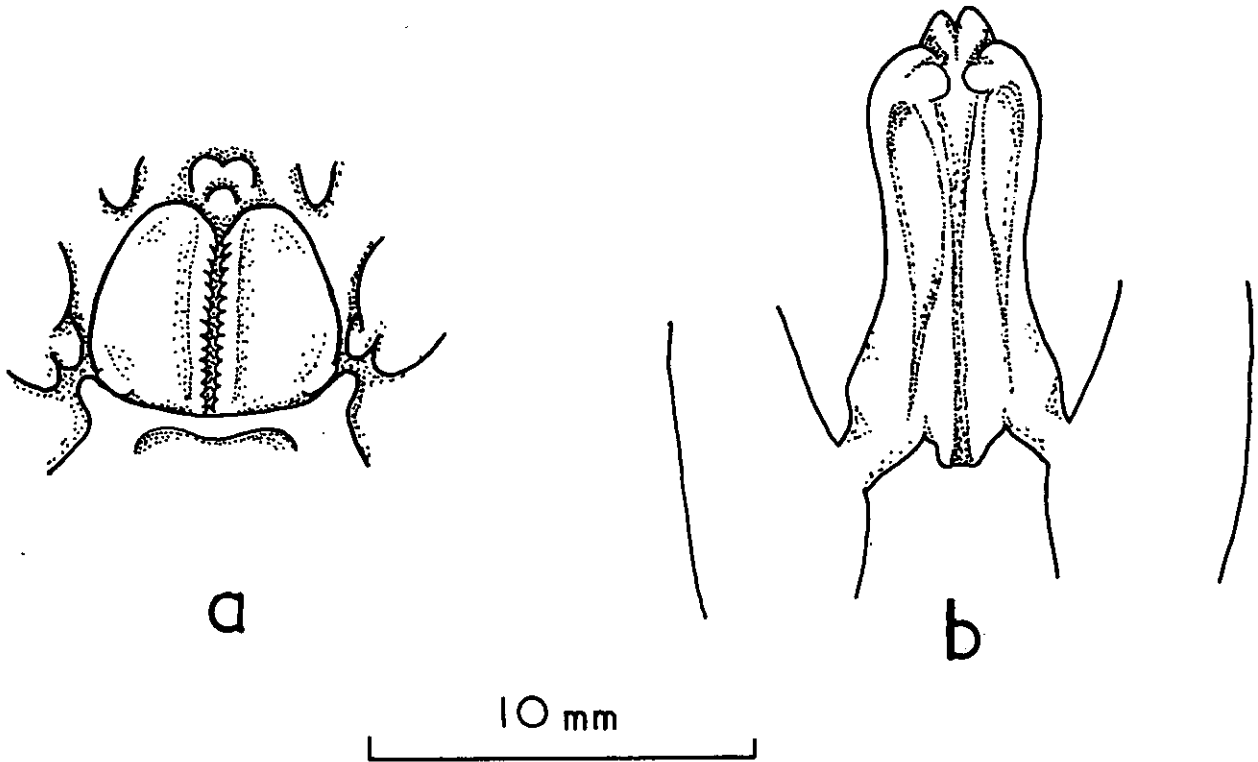


Fig. 2.- Penaeus esculentus a. Thelycum. b. Petasma.

barely perceptible cicatrice, 6th with 3 ill-defined cicatrices. Telson unarmed.

Gastric mill.—Cardiac plate with 16-18 spinules; zygo-cardiac ossicle with principal + 9-12 conical teeth and a cluster of minute teeth; prepyloric with 8-9 lateral teeth.

Petasma [Fig. 2b].—Lateral lobes with a number of minute distal setae and an irregular lateral external row of about 20 spinules.

Thelycum [Fig. 2a].—Length of anterior plate  $1\frac{1}{2}$  width, concave and pear-shaped, apex barely inserted between flaps of seminal receptacle. Seminal receptacle more or less circular, flaps forming tumid lips on mid line, inner edges tending to be serrated in large impregnated females.

Appendix masculina.—Length distal piece  $1\frac{1}{5}$  width.

Colour in life (mature prawns living in open waters).—Carapace and abdomen transversely banded, those of abdomen mid brown, 2 to each somite, the anterior much lighter; spaces between bands buff to yellow. Rostrum with red and brown alternating bands. Antennae with alternating mid-brown and white bands. Bases of pleopods yellow with tinge of blue. Uropods brown changing distally to yellow. Fringing setae of uropods and tips of other appendages dark red.

Juvenile prawns in estuaries (usually in *Zostera* beds) tend to be irregularly mottled with dark and light brown with intervening light-coloured patches."

Table 1 gives features which separate *P. esculentus* from species with which it can be confused: *P. semisulcatus* and *P. monodon*. Figure 1 shows a female *P. esculentus*, 37 mm carapace length.

Subjective synonymy:

*Penaeus monodon* Whitelegge, 1889, placed in synonymy by Racek (1955), reasons not given.

*Peneus esculentus* Schmitt 1926, placed in synonymy by Kubo (1949), with reasons.

TABLE 1

FEATURES SEPARATING P. ESCULENTUS FROM P. SEMISULCATUS AND P. MONODON  
(from Dall, 1957)

Feature	<u>P. semisulcatus</u>	<u>P. monodon</u>	<u>P. esculentus</u>
Adrostral carina	Extending well beyond epigastric tooth		Reaching epigastric tooth
Postrostral carina	Sulcate	Usually sulcate or indications thereof	Non-sulcate
Gastro-orbital carina	Occupying posterior 2/3 distance between cervical sulcus and anterior margin of carapace	Occupying the posterior 1/3 distance between post-orbital margin of carapace and hepatic spine	Occupying the posterior 2/3 distance between post-orbital margin of carapace and hepatic spine
Hepatic carina	Extending posteriorly for 1/3 of its length beyond junction with antennal carina	Extending posteriorly past end antennal carina by 1/3 its length	Barely reaching posterior end of antennal carina
4th and 5th abdominal somites	Each somite with 2 pairs of lateral cicatrices	Each somite with 1 small cicatrice	4th with none, 5th with 1 pair of lateral cicatrices
5th pereopod	Exopod present	Exopod absent	Exopod present
Petasma	No external spinules on the lateral lobe		An external row of about 20 prominent spinules on lateral lobe
Colour	Green colouration	Blue colouration usually present	No trace of blue

Key to the Indo-Pacific species of *Penaeus* (modified from Dall, 1957):

- 1    Adrostral carina reaching almost to posterior border of carapace;  
gastrofrontal carina present ..... 2  
Adrostral carina not reaching behind middle of carapace; gastrofrontal  
carina absent ..... 10
- 2(1) Telson armed, usually with 3 pairs of spinules ..... 3  
Telson unarmed ..... 8
- 3(2) Postrostral carina sulcate; not more than 1 ventral rostral tooth ... 4  
Postrostral carina non-sulcate; usually 2 ventral rostral teeth ..... 7
- 4(3) Sulcus on postrostral carina less than  $\frac{1}{2}$  length of carapace; ischial  
spine on 1st pereopod ..... *P. longistylus* Kubo  
Sulcus on postrostral carina more than  $\frac{1}{2}$  length of carapace; no ischial  
spine on 1st pereopod ..... 5
- 5(4) Rostrum with accessory pair of carinae on blade of rostrum; gastro-  
frontal sulcus with trifurcate posterior end ..... *P. plebejus* Hess  
(=*P. maccullochi* Schmitt)  
Rostrum without accessory pair of carinae; gastrofrontal sulcus with  
bifurcate posterior end ..... 6
- 6(5) Thelycum with apex of anterior plate rounded; seminal receptacle cylin-  
drical, not closed by 2 flaps; adrostral sulcus narrower than postrost-  
ral carina ..... *P. japonicus* Bate  
Thelycum with apex of anterior plate bifid; seminal receptacle flat,  
closed by 2 flaps; adrostral sulcus as wide as postrostral carina .....  
..... *P. latisulcatus* Kishinouye
- 7(3) Adrostral carinae continuing almost to posterior edge of carapace; ant-  
erior plate of thelycum with lanceolate apical process.. *P. teraoi* Kubo  
Adrostral carinae becoming indistinct posteriorly; anterior plate of  
thelycum without lanceolate apical process ..... *P. marginatus* Randall
- 8(2) Rostrum with 1 ventral tooth ..... *P. canaliculatus* Olivier  
Rostrum with more than 1 ventral tooth ..... 9
- 9(8) Thelycum with a median longitudinal carina on sternite of 7th thoracic  
somite; ventral surface of flaps of seminal receptacle not pubescent ..  
..... *P. californensis* Holmes  
Thelycum without a median carina on sternite of 7th thoracic somite;  
ventral surface of flaps of seminal receptacle pubescent .....  
..... *P. brevirostris* Kingsley
- 10(1) Hepatic carina present ..... 11  
Hepatic carina absent ..... 17

- 11(10) Third maxilliped in male with apical tuft of setae on propodus; lateral lobe of petasma thickened distally; thelycum with seminal receptacle closed by 2 flaps .....12  
 Third maxilliped in male without apical tuft of setae on propodus; lateral lobe of petasma not thickened distally; thelycum with open seminal receptacle (spp. limited to Pacific America) .....15
- 12(11) Fifth pereopods with small but distinct exopods .....13  
 Fifth pereopods without exopods ..... P. monodon Fabricius  
 (= P. carinatus Dana)
- 13(12) Postrostral carina sulcate ..... P. semisulcatus de Haan  
 Postrostral carina non-sulcate .....14
- 14(13) Hepatic carina arcuate, extending behind posterior end of antennal carina; rostral teeth  $9/2$  ..... P. gracilirostris Thallwitz  
 Hepatic carina straight, not extending beyond posterior end of antennal carina; rostral teeth  $5-7/3-4$  ..... P. esculentus Haswell
- 15(11) Adrostral carina reaching as far as epigastric tooth; rostral teeth usually  $9/2$  ..... P. vannamei Boone  
 Adrostral carina extending posteriorly to epigastric tooth; ventral rostral teeth more than 2 .....16
- 16(15) Antennular flagella longer than peduncle; thelycum with prominent pyramidal upheaval on 8th thoracic somite; an expanded coxal projection on 5th pereopod of female ..... P. stylirostris Stimpson  
 Antennular flagella as long as or shorter than peduncle; thelycum without pyramidal upheaval; no coxal projections on 5th pereopods of female ..... P. occidentalis Streets
- 17(10) Third pereopod exceeding scaphocerite by at least dactyl; maxillulary palp 2-segmented .....18  
 Third pereopod not quite reaching tip of scaphocerite; maxillulary palp 3-segmented ..... P. orientalis Kishinouye
- 18(17) Gastro-orbital carina occupying the posterior  $2/3$  distance between hepatic spine and orbital angle ..... P. indicus Milne Edwards  
 Gastro-orbital carina absent or not reaching hepatic spine and occupying the middle  $1/2$  distance between hepatic spine and orbital angle...19
- 19(18) Dactyl of 3rd maxilliped adult male  $1/2$  propodus; adrostral carina not reaching as far as epigastric tooth ..... P. merguensis de Man  
 Dactyl of 3rd maxilliped adult male much longer than propodus; adrostral carina reaching just beyond epigastric tooth .....  
 ..... P. penicillatus Alcock

1.22 Taxonomic status

Morphospecies.

1.23 Subspecies

Monotypic.

1.24 Standard common names, vernacular names

Tiger prawn - Australia.

1.3 Morphology

1.31 External morphology (including changes with growth)

Two compound eyes on eyestalks arising directly under outer edge of carapace on each side of the rostrum. Appendages attached to the sternites of the cephalothoracic segments:- antennules, antennae, mandibles, maxillae I and II, maxillipeds I, II, and III, and pereiopods I to V, pereiopods I and II with small chelae. Females: sternite of segment bearing pereiopod V modified into a thelycum; abdomen, 6 distinct segments and a telson, sternites of first 5 abdominal segments bear paired pleopods, 6th bears uropods on its posterior margin. Males: endopods of first pair of pleopods are modified into a petasma, second pair each bear an appendix masculina.

In juveniles rostrum is relatively long and sigmoidal in shape with a low blade; in adults is relatively short and straight with a high blade (Dall, 1957).



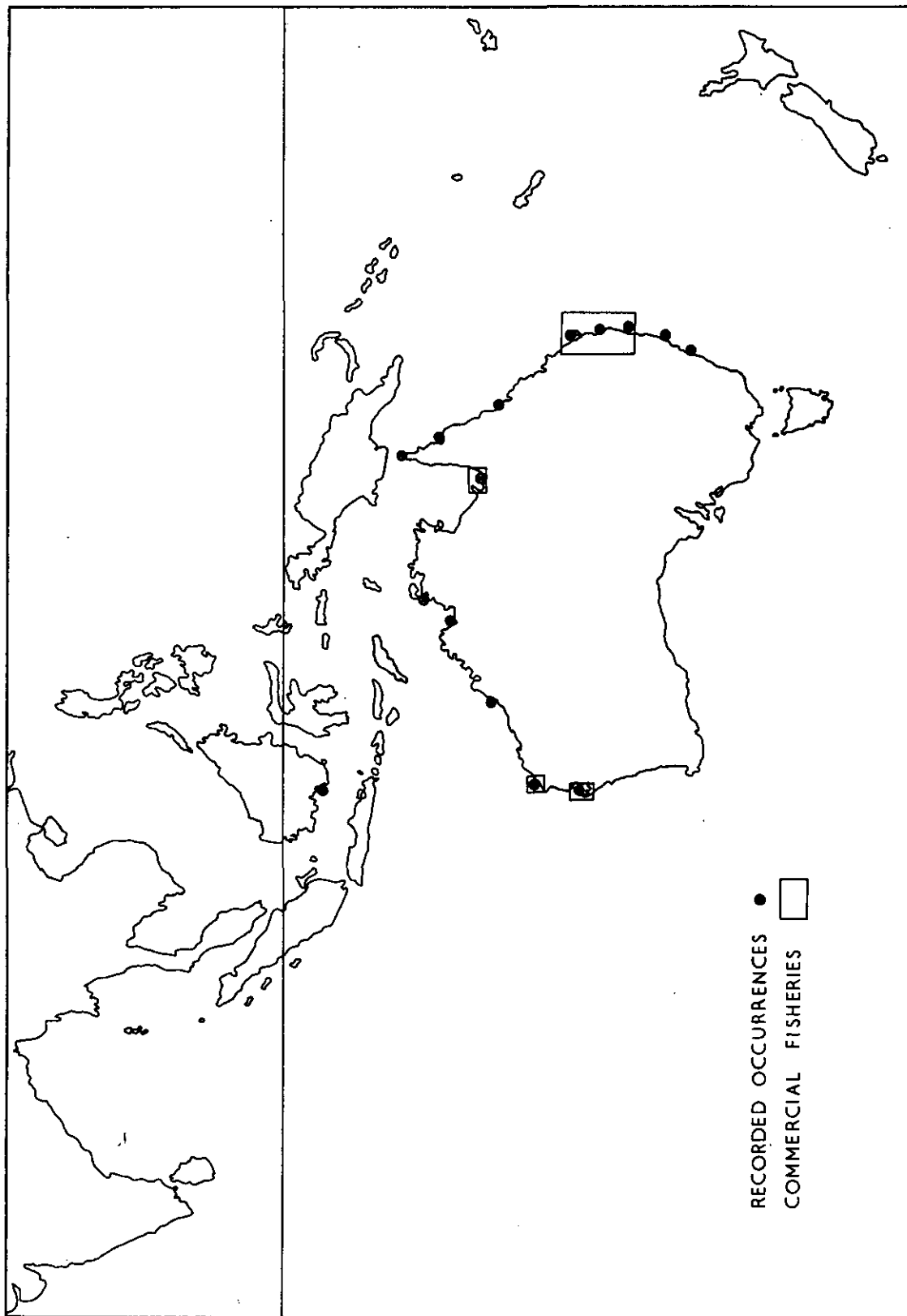


Fig. 3.- Distribution of Penaeus esculentus.

## 2 DISTRIBUTION

### 2.1 Total area

Endemic to the warmer waters of Australia. Recorded from South Borneo (Kubo, 1949) (Fig. 3, Table 2).

TABLE 2  
AREAS WHERE P. ESCULENTUS OCCURS

Land Area	Code (Rosa, 1965)
Northern Territory	611
Western Australia	612
New South Wales	615
Queensland	616
South Borneo	434

### 2.2 Differential distribution

#### 2.21 Spawn, larvae, and juveniles

Racek (1959) collected larvae which might be those of P. esculentus in 100-150 m, off New South Wales. Dall (1958) found juvenile P. esculentus in warm sheltered regions in the Brisbane River, Queensland. Racek (1959) reports that P. esculentus is rarely found in estuarine areas in New South Wales, but is more common in estuarine areas along the southern, central, and northern coastline of Queensland.

#### 2.22 Adults

Mature P. esculentus are found in Queensland in the 2-50 m area where, because of river discharge, water is of lower density than oceanic water. In northern New South Wales and also off Cape Moreton in southern Queensland, adult P. esculentus occupy the 100-200 m area.

### 2.3 Determinants of distribution changes

Little is known of the factors which determine the distribution of P. esculentus. They leave the 2-50 m area when salinity is lowered by floods (Racek, 1959). These prawns rarely school and are generally fairly evenly distributed over the fishing grounds.

### 3 BIONOMICS AND LIFE HISTORY

#### 3.1 Reproduction

##### 3.11 Sexuality

Heterosexual and sexually dimorphic. Adult males have a petasma and an appendix masculina, and are smaller than adult females which have a thelycum.

##### 3.12 Maturity

In New South Wales tiger prawns reach sexual maturity 10-12 months after hatching. Prawns in warmer waters mature sooner than those in colder waters.

Racek (1959) lists the following features of sexual maturity. Maturity occurs in the outer littoral zone, April-June. Colour of ripe ovaries is brownish-green. Mean length at maturity: males, 149 mm; females 182 mm.

#### 3.2 Pre-adult phase

##### 3.23 Adolescent phase

Adolescents found in estuarine areas and to 50 m in northern New South Wales (Racek, 1959).

#### 3.3 Adult phase

##### 3.32 Hardiness

Adults tend to avoid areas of low salinity.

##### 3.33 Competitors

P. esculentus is caught together with other species of prawns. These are: in New South Wales, P. plebejus; in the Gulf of Carpentaria, Queensland, P. latisulcatus, Metapenaeus endeavouri, and P. merguensis (less commonly); in Western Australia, similar to the Gulf of Carpentaria. All these species might compete with P. esculentus.

##### 3.34 Predators

Racek (1959) lists fishes which prey on prawns in New South Wales: in the 2-50 m area, common stingray (Urolophus testaceus), shovelnose ray (Aptychotrema rostrata), estuary catfish (Cnidoglanis macrocephalus) and angel shark (Squatina tergocellata); in the 50-200 m area, the giant boarfish (Paristiopterus labiosus) is a common prawn predator.

### 3.4 Nutrition and growth

#### 3.42 Food

Racek (1959), discussing the food of penaeids generally, gives the following list of stomach contents: fragments from unidentified Crustacea, setae of annelid worms, jaws of annelid worms, plant fragments, sand, foraminiferans, minute shells, squid suckers, complete small fishes, fish scales, muscle fibres, eye lens of fish, and unidentified eggs. Aquarium observations (Racek, 1959) indicate that tiger prawns can attack small fish.

### 3.5 Behaviour

#### 3.51 Migrations and local movements

As juveniles grow they leave the estuaries for the open sea where they mature. Juvenile and young adult prawns leave estuaries and perfluvial regions when floods lower salinity. They return after salinity has returned to pre-flood level. Strong winds also result in a migratory movement; the prawns move constantly against the direction of such winds (Racek, 1959).

#### 3.52 Schooling

Tiger prawns rarely school.

## 4 POPULATION

4.1 Structure

## 4.11 Sex ratio

Sex ratio of catches varies from day to day, and from season to season (Table 3). Males appear to be completely absent beyond 120 m (Racek, 1959).

TABLE 3  
SEX RATIOS OF *P. ESCULENTUS* IN 2-50 m  
IN NEW SOUTH WALES  
(Racek, 1959)

Season	% Males	% Females
Spring	52%	48%
Summer	61%	39%
Autumn	33%	67%
Winter	22%	78%

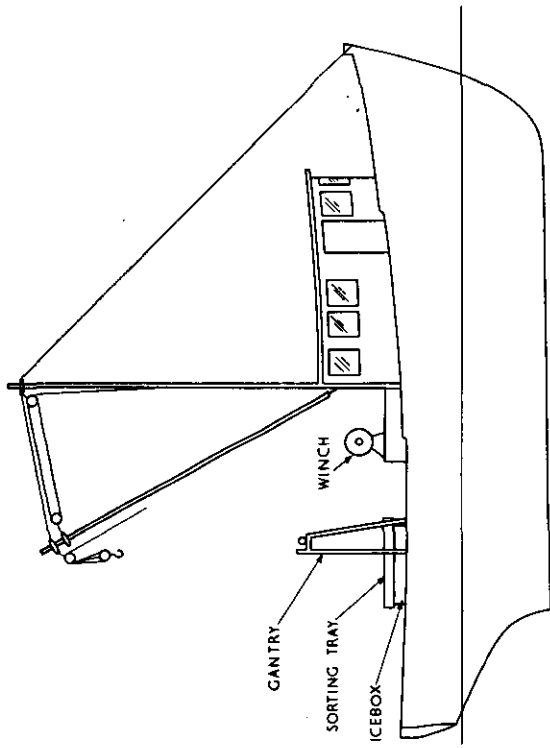
4.6 The population in the community and the ecosystem

## - Species composition of the community

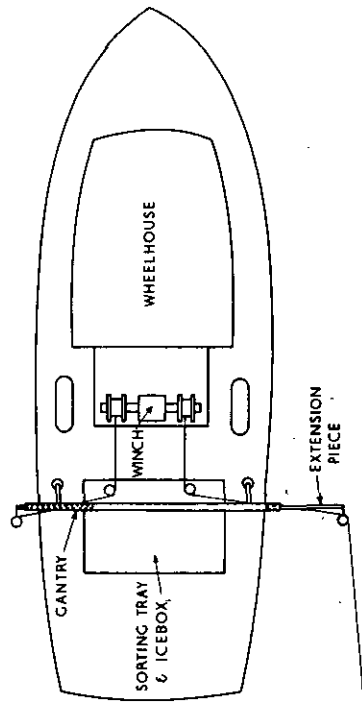
Animals found associated with *P. esculentus* are discussed in Sections 3.33 and 3.34. The bellows fish *Macrorhamphosus elevatus* and the spider crab *Latreilla* sp. are also associated with *P. esculentus* in the 50-200 m area of New South Wales.

## - Changes in environmental factors and their effect on the population

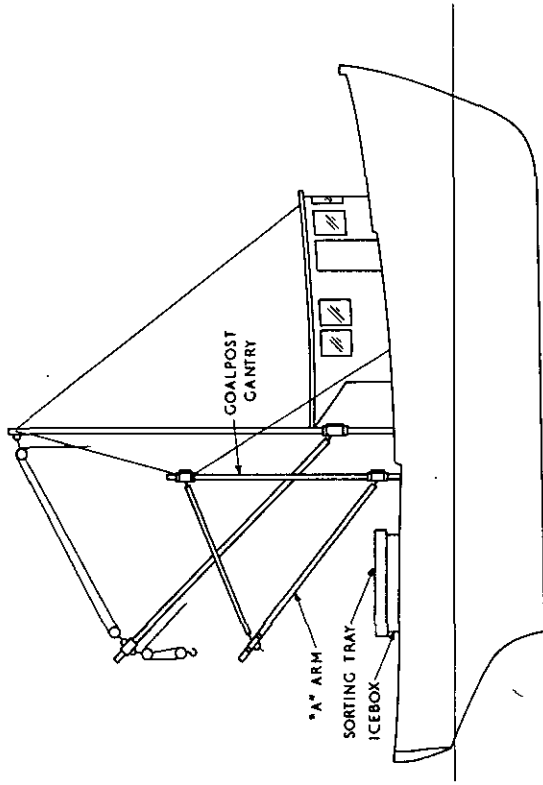
Effects of floods and winds are discussed in Section 3.51.



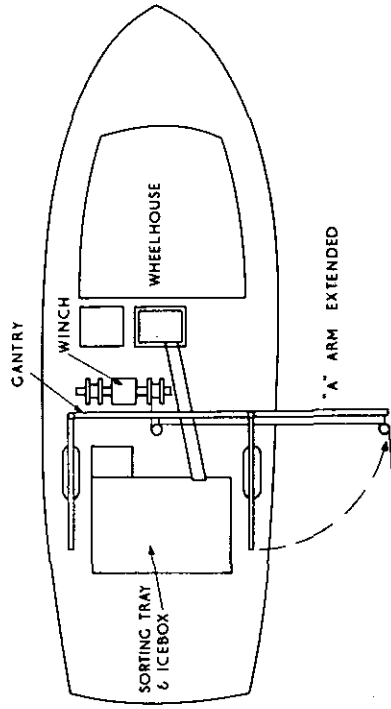
Small stern trawler rigged for single gear



Deck layout of above showing method of extending gantry.



Larger stern trawler rigged for double gear



Deck layout of above showing method of extending 'A' arm.

Fig. 4.- Deck layout of typical Australian prawn trawlers.

## 5 EXPLOITATION

### 5.1 Fishing equipment

#### 5.11 Gears

In eastern Australia tiger prawns are caught incidentally while more abundant species are being fished. In Western Australia there is a fishery for P. esculentus.

Gear used for the capture of prawns differs for various stages in their life cycles. In estuaries, beam trawls, small otter trawls, set nets, and scoop and cast nets are all used. In the open sea, prawns are caught using an otter trawl. On the eastern Australian coast P. esculentus and P. plebejus are usually fished with nets having a wide, low, and flat mouth. The nets have a heavily weighted lead line, or a tickler chain which stirs up the bottom. Western Australian fishermen also use flat trawls for tiger prawns.

#### 5.12 Boats

Three general classes of boats are distinguishable in the Australian prawn fishery.

1. In estuaries, boats generally under 30 ft (9.1 m) in length, with a shallow draught, powered by a small inboard motor, are used for short trips. Very few have any provision for storing prawns, and prawns are cooked soon after capture. These boats are equipped with small beam or otter trawls, or they tend set nets of various kinds.

2. Boats from 30-70 ft (9.1-21.3 m) are used for trips of 1-5 days. Prawns are stored on ice or in a freezing brine in insulated boxes on deck. Prawns are sold uncooked for processing or cooked for the local market. Some boats have refrigerated fish holds. These boats are used in the large enclosed bays and in the open sea out to the edge of the continental shelf.

3. Boats, 50-70 ft (15.25-21.3 m), fitted with refrigerated fish holds, can process and freeze prawns on board. These boats can make extended cruises and usually fish for large prawns suitable for export.

Boats of the second and third categories are equipped for otter trawling. The method by which Australian trawlers are rigged is rather unusual (Fig. 4) (Wright, 1966). In the standard Australian type of stern trawler the winch, mounted athwartship, is usually a modified truck back axle and differential, driven via a clutch by an auxiliary power take-off from the main engine. The winch of some larger boats is a modified tractor complete with motor. Each winch drum also has its own clutch and brake to allow adjustments to the trawl wire. An overhead gallows with extensible arms which project outboard during trawling is mounted amidships. Wire from the winch drums is led up to the gallows and out along the gantry to the otter boards on each side of the boat. When the trawl is brought up the

otter boards are winched up to the gallows head and the cod-end brought aboard by means of a lazyline and derrick and emptied into the sorting tray; the rest of the trawl floats in the water.

Some newer boats use double gear similar to that used in the Gulf of Mexico (Fig. 4). The large central goalpost gantry has hinged 'A' arms, which are secured outboard when trawling. These arms are swung back to the sides of the boat when not in use. The winch drum axis is athwartship, as opposed to the American practice of having the axis fore-and-aft. A lazyline is used to bring the cod-end aboard.

Some boats use try nets. These are usually operated with an auxiliary electric or hydraulic winch from a small derrick set aft.

Boats in categories 2 and 3 are usually fitted with echo sounders and radios. There are 2 to 4 crew depending on the size of the boat.

## 5.2 Fishing areas

### 5.21 General geographic distribution

*P. esculentus* is fished commercially throughout its Australian range (Section 2.1, Fig. 3).

### 5.23 Depth ranges

Caught commercially between the shore and about 200 m.

### 5.24 Conditions of the grounds

In eastern Australia exploitation of oceanic prawning grounds seems to have resulted, in some areas, in regional overfishing. There are no data available for the effect of this type of fishing on *P. esculentus*.

## 5.3 Fishing seasons

### 5.31 General pattern of seasons

In eastern Australia most prawns are caught between November and April. In Western Australia the season is between March and August.

### 5.32 Dates of beginning, peak, and end of seasons

(See Section 5.31.)

### 5.33 Variation in date or duration of season

The season becomes longer in the northern prawning grounds.



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#### 5.4 Fishing operations and results

##### 5.43 Catches

In 1964-65, 319,000 lb (144,826 kg) of tiger prawns were caught in Queensland, and 899,000 lb (408,146 kg) in Western Australia (Commonwealth of Australia, 1966).

## 6 PROTECTION AND MANAGEMENT

### 6.1 Regulatory (legislative) measures

#### 6.11 Limitation or reduction of total catch

Western Australia limits the number of boat licences available: 15 licences are available for Exmouth Gulf and 30 for Shark Bay.

#### 6.12 Protection of portions of population

##### - Closed areas

In Queensland and New South Wales portions of various estuaries and inlets, where juvenile prawns occur, are closed to prawn fishing. In Western Australia, nursery grounds in Shark Bay and at the head of Exmouth Gulf are closed to trawling.

##### - Closed seasons

In Queensland and New South Wales portions of inlets and estuaries are closed for periods which usually coincide with the presence of prawns in these areas.

##### - Limitations on size or efficiency of gear

Regulations provide for minimum mesh and maximum net sizes in all States.

##### - Restrictions based on sex or condition

No restrictions, but consumers are prejudiced against soft-shelled prawns (prawns which have recently ecdysed).

##### - Restrictions on use of fish

No restrictions, but the Australian market is mainly for boiled prawns.

### 6.2 Control or alteration of physical features of the environment

#### 6.21 Regulation of flow

Dams on some rivers regulate flow.

#### 6.22 Control of water levels

Also affected by dams and weirs.

### 6.23 Control of erosion and silting

There has been no critical study of the effects of dredging, or flood control by dams.

### 6.27 Habitat improvement

Habitats suitable for larval and juvenile prawns are steadily being reduced by pollution problems, clearing of foreshore, and filling of swamps. No critical study has been made of the effects of these factors.

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FRm/S33 (Rev. 1)	Synopsis of biological data on the Norway pout <i>Trisopterus esmarkii</i> (Nilsson) 1855	January 1968
FRi/S36	Synopsis of biological data on the bream <i>Abramis brama</i> (L.)	February 1968
FRm/S34 (Rev. 1)	Synopsis of biological data on the blue whiting <i>Micromesistius poutassou</i> (Risso) 1810	July 1968
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FR/S32 (Rev. 1)	Synopsis of biological data on catla <i>Catla catla</i> (Hamilton, 1822)	October 1968
DFO/S3	Synopsis of biological data on the tiger prawn <i>Penaeus esculentus</i> Haswell 1879	July 1969