

INFORMATION ON PRAWNS FROM INDIAN WATERS SYNOPSIS OF BIOLOGICAL DATA

by

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ABSTRACT

The paper gives a brief review of available biological information on the marine, brackish and freshwater prawns and shrimps of India. Estimates of commercial production are given, with a brief outline of culture practices. A bibliography of 70 titles, from 1906 to 1962 is appended.

A. Marine and Marine to Brackishwater species

PENAEIDAE

(1) *Penaens indicus*

The most important species among the Indian prawns, on account of its great abundance on the east and west coasts and the brackishwater lakes. Data collected so far is insufficient for drawing any definite conclusions with regard to its growth, duration of life etc., (Menon, 1957). Vast majority of them from the backwaters do not exceed 120 mm in length, but mature individuals measure 150 mm or over in length (Menon, 1957).

In the inshore waters of Bombay almost all males were found to be immature and very few females were recorded in November-December (Shaikhmahmud & Tembe, 1960).

(2) *Metapenaens dobsoni*

A marine species that migrates to the backwaters in the post-larval phase, but not growing beyond 60-65 mm in length in these backwaters (Menon, 1955). Growth rates in the two sexes differ, the females growing faster than the males. The average sizes attained by the two sexes at different ages are given below (Panikkar and Menon, 1955).

Sex	I year	II year	III year
Male	70 mm	90-95 mm	110 mm
Female	75-80 mm	100-105 mm	120 mm

Sexual maturity is attained in the first year. The breeding season extends from May to December, with a peak period from August through December. It spawns in the sea, the eggs being liberated at a depth of 10-12 fathoms. When 4-6 mm it migrates to the brackishwaters.

Diatoms (*Fragilaria* and *Coscinodiscus*), foraminifera, copepods, amphipods and nematodes form the food of the species.

(3) *Metapenaens monoceras*

It inhabits the inshore waters, brackishwater lakes and estuaries attaining a maximum length of 170-180 mm. Growing at an average rate of 7.98 mm per month, it measures 106-110 mm in the first year, 131-135 mm in the second year and 156-160 mm in the third year (George, 1959). The length-weight relationship is expressed by the formula.

$$W = 0.01989L^2.7603$$

It breeds in the sea with a peak period in November-December. The early larvae migrate to the backwaters where they grow to about 100 mm, leaving them once again when less than one year old. The sex ratio between males and females has been observed to be 48.62 : 51.38.

(4) *Metapenaens brevicornis*

It inhabits marine to freshwater zones throughout the year and grows to a maximum

length of 5 in. (Alcock, 1906). The two sexes have been observed to attain the following sizes in their first and second years (Rajyalaxmi, 1962).

Sex	I year	II year
Male	45.8 mm	80.5 mm
Female	47.4 mm	89.0 mm

The length-weight relationship for the two groups of individuals in the length-ranges of 21-35 mm and 38-120 mm can be expressed as

$\log W = -5.0083 + 2.9810 \log L$
and $\log W = -4.540 + 2.6976 \log L$
respectively.

There are two spawning periods, one in March-April and the other in July-August. Spawning occurs in the lower reaches of the estuary, possibly in inshore waters. The post-larvae migrate into the brackishwaters when they are about 7 mm in length. The sex-ratio between the males and females was observed to be 1:1.13 up to 41 mm, 1:1 between 44-65 mm, while over 65 mm the proportion of females increases abruptly, so much so that all specimens observed about 89 mm were found to be females. Males mature when 75 mm in size (Rajyalaxmi, 1962).

Crustacean remains constitute the chief food item, while algal filaments, polychaeta remains and gastropod shells also form the food of the species.

While 0-1 year groups constitute the fishery in less saline zones, large-sized individuals are taken from inshore waters during winter.

(5) *Parapenaeopsis stylifera*

It is purely a marine form, rarely migrating to brackishwaters and estuaries. Attaining a length of 90-100 mm in the first year, it grows to its maximum size of 126-130 mm in the second year (Menon, 1953). Sexual maturity is attained in the first year of life, the minimum size of mature males and females observed being 60 mm and 75 mm

respectively. The females growing faster after maturity outnumber the males in the second year of their life. The breeding season extends from October to May, with a peak period in October or early November.

Its fishery is constituted by 0-1 year groups. Feeding on detritus and large amounts of sand and mud, it lives for 2-3 years.

(6) *Parapenaeopsis sculptilis*

Inhabiting the tidal the marine zones of the estuaries, the species is available to the commercial fishery in the Hooghly only in the winters and monsoons. The maximum size attained has been reported to be 5.5" (Alcock, 1906) and 152 mm (Rajyalaxmi, 1962). The rate of growth for the first few months after hatching is 12-15 mm per month, but thereafter it differs as indicated below (Rajyalaxmi, 1962).

Sex	I year	II year	III year
Male	45.59 mm	74 mm	—
Female	50.65 mm	79.90 mm	104-118 mm

The length-weight relationship is expressed as $\log W = -5.1272 + 2.9580 \log L$.

Spawning takes place in inshore waters and extends from December-January to April-May. The juveniles migrate up the estuary.

The two sexes occur in an equal proportion in the length range of 23-26 mm but between 29-69 mm the males and females are in the ration of 1:3.24. All are females between the length range of 89-125 mm. The size of males at sexual maturity has been found to be 75 mm. The ratio of males to females during January to May is 1:4.2, while during June to December 1:1.9. The largest specimens are always caught from inshore waters during winter 0-1 year age groups contribute to the fishery of less saline areas.

B. Fresh and Fresh to Brackishwater species

PALAEMONIDAE

(1) *Palaemon carcinus*

It occurs in the fresh water and gradient zones throughout the year. The

maximum size to which it grows has been recorded to be over a foot, by Patwardhan (1937). (Rajyalaxmi, 1962) found the growth varying in the two sexes as follows:—

Sex	I year	II year	III year
Male	107 mm	149 mm	—
Female	82.5 mm	130.5 mm	168.5 mm

The length-weight relationship is expressed as follows:—

$$\log W = -5.5837 + 3.32276 \log L.$$

Spawning takes place in the gradient zone of the estuary (Rajyalaxmi, 1961) and the period extends from December to July, with a peak intensity during March to May. An individual appears to spawn more than once in a season.

The species is fished during its breeding season from the gradient zone, while immature ones are caught during other months from the freshwaters.

(2) *Palaemon malcolmsonii*

It is a fresh water species available during monsoon and winter months. The maximum size attained by males and females is 230 mm and 133 mm respectively (Henderson and Matthai, 1910).

The growth attained by the two sexes at different ages is given below (Rajyalaxmi, 1962):

Sex	I year	II year	III year
Male	58 mm	90.5 mm	118.5 mm
Female	56 mm	93.5 mm	—

The length-weight relationship is given by the formula

$$\log W = -5.4372 + 3.1702 \log L.$$

The minimum size of mature females has been observed to be 79 mm. The species spawn more than once in a season but spawning migrations have not been recorded (Rajyalaxmi, 1961). Gonads start maturing in May and the breeding season extends up to August.

In the length range of 33.5 to 48.5 mm the ratio between males and females is 1:2.6, between 53.5 and 78.5 mm the ratio is 1:1, between 83 and 113.5 mm the ratio is 1:5.4. From 118.5 to 123.5 mm the ratio is 1:1. Above 123.5 mm males alone are present.

The fishery exists mainly during the monsoon months.

(3) *Palaemon mirabilis*

It occurs in all zones and in all seasons. The maximum size recorded is 62 mm (Rajyalaxmi, 1962). The males and females both attain a length of 22.25 mm in the first 12 months, while in 17 months the males grow to 35-38 mm and the females in 15 months grow to 35 mm and in 22 months to 48 mm. Females live longer than males (Rajyalaxmi, 1962).

A perennial breeder, it has four peak periods during November, January, April and August. Though maturation, spawning and early development of eggs occur all along the river, the later development and hatching occur only in the lower reaches of the gradient and tidal zones of the Hooghly estuary (Rajyalaxmi, 1961). Males attaining maturity at 25-27 mm seem to die after attaining a size of 38 mm, while the females mature at 38 mm size. Between a length range of 17 and 20 mm the males and females are in a ratio of 1:1.1. From 23 mm to 32 mm males show a rise, the ratio being 1.4:1. Beyond 35 mm size, males decrease gradually as females increase in members. Beyond 41 mm all are females (Rajyalaxmi, 1962).

The length-weight relationship is expressed by the formula

$$\log W = -4.9725 + 3.0210 \log L.$$

Next to detritus, algal filaments and crustacean remains are seen in the guts. Polychaete and insect remains also form significant amounts of the food of the species.

(4) *Leander styliferus*

The species occurs in the tidal and gradient zones. The maximum size attained

by the species has been recorded to be a little over 100 mm (Kemp, 1917). Growth is uniform in the two sexes, although females appear to grow to a slightly bigger size than males. The fastest growth is recorded during the second year. Monthly length increment is to the tune of 3-4 mm (Kunju, 1955 and Rajyalaxmi, 1962). Individuals grow to 55 mm at the end of the first year and to 85 mm at the end of the second (Rajyalaxmi, 1962).

The length-weight relationship is expressed by the formula

$$\log W = -5.02108 + 2.8754 \log L \text{ (Kunju, 1955)}$$

The breeding period is quite prolonged, extending from October to July. Spawning on to the pleopods and fertilization occur in the tidal as well as gradient zones. Actual hatching occurs in more saline areas, probably inshore waters. Juveniles migrate to the estuary. Proportion of females increase in mature individuals (Rajyalaxmi, 1962).

The food consists of crustacean remains (*Acetes*, *Macropsis orientalis*, *Acartiella* and *Diaptomus*), remains of fish larvae, insects and plant matter. Miscellaneous matter, including gastropod shells and larvae, foraminiferan shells and monaxon spicules of sponges, is also seen (Kunju, 1955).

(5) *Leander tennipes*

Inhabiting the tidal and marine environment, it is available only in the winter. It grows up to 74 mm. There is no difference in the growth rate of the two sexes. Growing at a rate of 2-3 mm per month, length of 40-49.5 mm is attained in the first year and 64.5 mm in the second (Rajyalaxmi, 1962).

The length-weight relationships expressed by the formula

$$\log W = -3.6741 + 2.1433 \log L.$$

Both the sexes mature when about 43 mm. in size. Spawning is prolonged from October to March and occurs in inshore areas.

Main items of food are crustacean remains, while miscellaneous items, including mainly debris, sand, insect appendages, gas-

tropod shells, vertebrae, algal filaments and foraminifera have also been recorded from the guts (Rajyalaxmi, 1962).

STATISTICS OF PRODUCTION

The Indian Prawn Fishery plays a very important and a valuable part in the economy of the national fishing industry. The average annual production being 100,000 m. tons, it occupies third place among the national fish-landings, but ranks second in the world prawn landings, the U.S.A. being the first. The commercially important species inhabit the seas, estuaries, brackishwater lakes and rivers. Of the total marine prawn production, about 90% are landed on the west coast of India in the maritime states of Gujarat, Maharashtra and Kerala, while on the east coast the marine landings are restricted to the State of Madras alone. The brackish-water lakes Chilka, Pulicat, Collair and Vembanad backwaters, are some of the important areas producing large crops of the prawns. The Cauvery, Krishna, Godavari, Narmada, Tapti and Hooghly estuaries constitute yet another important source of prawns. The rivers harbour the freshwater species, some of which grow to a considerably large size, but do not constitute a major fishery.

The total marine landings of prawns for 1961 are estimated at 62,768 m. tons, while consolidated and reliable statistics are not available for the inland areas excepting where investigations are being conducted by the Central Inland Fisheries Research Institute (Vide Table I). Of the various marine species *Metapenaeus monoceros* is landed in the largest numbers in Gujarat, *Leander tennipes* (inshore) and *Metapenaeus affinis* (offshore) in Maharashtra, *Metapenaeus dobsoni* in Mysore and Northern and Central Kerala, while *Penaeus indicus* is caught in Southern Kerala and is the most important species on the east coast in Madras waters. However, *Metapenaeus brevicornis* is the predominant species of Bengal.

The brackishwater lakes—Chilka, Pulicat and Collair—have a dominant fishery of

Penaeus indicus, but it is relegated to a second position in the Kerala backwaters by *Metapenaeus dobsoni*. *P. indicus*, though smaller in size than *Penaeus carinatus*, is probably the most important commercial species as it is abundant along practically the entire coast-line and brackish-water areas of India.

The freshwater prawn fishery of the rivers is constituted by *Palaemon carcinus*, *Palaemon mirabilis*, *Palaemon rudis*, *P. villosomanus* and *Palaemon malcolmsoni*.

TABLE I

Average Annual Production of prawns from Marine and Inland Sources

MARINE:	Metric tons (Approx.)
Panaeid prawns	39,083
Non-penaeid prawns	23,685
INLAND:	
Godavari River	200
Hooghly Estuary	576
Mahanadi River	194
Chilka Lake	873
Pulicat Lake	1,500

REVIEW OF THE CULTURAL METHODS

Prawns are not exclusively cultured in fresh or brackishwater ponds anywhere in India, as is done in Singapore. However, some sort of 'Cultural' practices do exist in the paddy fields bordering the Uembaned Lake in Kerala covering about 11,000 acres and in the 'Bheris' and paddy fields situated along side the tidal rivers in the Sunderban area of Bengal. The prawn fry in these fields is impounded along with some other species of fish under the tidal influence.

Species cultivated

The following species are 'cultivated'

Kerala	Bengal
1. <i>Metapenaeus dobsoni</i>	1. <i>Palaemon carcinus</i>
2. <i>Penaeus indicus</i>	2. <i>Palaemon rudis</i>
3. <i>Metapenaeus monoceros</i>	3. <i>Penaeus semisulcatus</i>

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|-----------------------------------|-----------------------------------|
| 4. <i>Penaeus carinatus</i> | 4. <i>Metapenaeus monoceros</i> |
| 5. <i>Palaemon rudis</i> | 5. <i>Metapenaeus brevicornis</i> |
| 6. <i>Leander styliferus</i> | |
| 7. <i>Caridina gracilirostris</i> | |
| 8. <i>Acetes</i> sp. | |

Collection of stocking material

In none of the two areas referred to above is the stocking material scientifically collected or segregated for stocking. Mere construction of certain devices for impounding them is all that is done. In Kerala, large, rectangular sluice boxes, open at the two ends are fitted in the embankments to connect, at will, the paddy field with the backwater or the canal outside. The sluice-boxes are provided with two vertical grooves on the side walls, into which slide a number of $\frac{3}{4}$ in. - 1 in. planks, one on top of the other, to regulate the flow of water. These shutters are removed when the flood tide gains the highest level in the canal or backwater to ensure that the water flows into the fields with the maximum possible force as on it depends the number of prawn fry entering the fields. At the turn of the tide the shutters are lowered to retain the impounded prawns inside these so-called 'ponds'. When the ebb tide is at its lowest in the canal or backwater, the shutters are once again lifted up to allow the water to flow back but a screen is fitted to prevent the prawns from escaping into the backwater. During the subsequent turn of the tide, the screen is removed and a fresh stock of prawn fry from the backwater is once again allowed to enter into these fields.

The single rice crop in the Sunderban area of Bengal is harvested by the end of January by which time the fields are completely dry. From February or March onwards tidal water is allowed to enter the system of channels, provided in almost all paddy fields, through elaborately constructed sluice-gates. Prawn-fry along with the fry of various species of fish viz., *Mugil tade*, *Mugil parsia*, *Mugil corsula*, *Lates calcarifer* & *Mystus gulio* are thus impounded in these channels where they are retained till the onset of the

monsoon, when the accumulated freshwater of the paddy field mixes with and dilutes the strongly saline water of these channels and allows the fry a free access to the whole of the field for 'grazing' in between the roots of the paddy. During low tides, basket-traps, known as 'atols', are fixed in between the gap of a V-shaped bamboo fencing erected on the side of the paddy-field to prevent the egress of fish and prawn fry into the canal or the river outside.

Pond Construction

At the end of the N.E. Monsoon in October-November, a good number of fields lying together are converted into a single block and taken on lease from the owner for culture operations. The main embankments are massive structures, 5 to 6 feet in height, with a base of 15 ft. and top width of 12 ft. They are made of ordinary mud. In some places, especially along the edge of the backwaters where strong winds and waters may destroy ordinary mud banks, mud and laterite stones are used to make the embankments a quasi-permanent structure. Where these dykes have become a permanent feature, the sides are simply lined with rubble or the rubble, pointed and strengthened with cement.

As the 'bheris' and paddy-fields are situated along the tidal rivers and their tributaries in the Sunderban area, they are of necessity protected by strong embankments. The fields have a system of branching channels varying in design and from 0.6 to 1.5 metres in depth and covering about 8% of the total area of the field meant originally for draining of excess rainwater. The mouths of the main channels leading to the river are guarded by sluice-gates with concrete framework to effect proper regulation of drainage.

Little addition or modification is needed to utilize these fields for fish culture except that the embankments are maintained sufficiently high and strong to protect the fields from tidal flooding and the channels kept in good repair.

Management of the fields

The preliminaries of 'prawn-culture' in Kerala, as stated earlier, being at the end of the N.E. monsoon in October-November. Embankments are constructed or repaired and sluice-boxes installed. The prawns fry from the backwaters is impounded by operating the sluice-gates during every high tide as described above.

However, in the Sunderban area the operations start from February or March and the fry of euryhaline species of fish together with that of prawns are taken in with tidal water and retained in the channels till the onset of the monsoons. The depth of water in the channels varies from a few centimetres to about 1 metre, and is always kept some 30 cms. below the level of the paddy field till the onset of monsoons, whence the feeding of tidal water in the channels is stopped. The fields are prepared for transplanting the paddy and as soon as the paddy seedlings have been established well and the plots inundated, the secondary dykes constructed on the banks of the channels to keep the fry confined only to them are broken and the fry allowed a free entry into the paddy plots to graze between the rice seedlings on the abundant plankton present there.

Fertilization

The fields are not fertilized in Kerala, but the decaying stumps of straw and other plant residues constitute sufficient organic matter to give rise to planktonic organisms, large quantities of algae and diatoms. The bottom, being loamy, supports a good crop of Polychaete worms and various types of lamellibranchs.

The fields in the Sunderbans (West Bengal) are prepared for transplanting rice seedlings by about July, when they are manured by cow dung, bone meal, ammonium sulphate, superphosphate, etc., but the fields are never fertilized for fish culture alone.

Artificial feeding

Artificial feeding is not resorted to in India.

Harvesting and Marketing

In the fields bordering the Vembanad backwaters the normal type of prawn fishing ends by mid-April and is carried on by bag net 20-25 ft. in length with a 6 ft. x 6 ft. or 6 ft. x 5 ft. mouth and 1 ft. x 1 ft. tail. It is made up of 10 sections, the section at the end having a mesh size of $\frac{1}{8}$ in., the next seven sections a $\frac{1}{4}$ in. mesh, while $\frac{1}{2}$ in. mesh is used for sections 9 & 10. In smaller fields with smaller sluices, a net of about 18 ft. or 20 ft. long with 8 sections is used. Fishing starts with neap tides, 4 to 5 days before every new and full moon, and is continued for 7-8 days at a time. In fact it is only a method for a large scale fishing of prawns, rather than prawn culture, as no time is allowed for them to grow in these fields. About 30-40 years back such a culture was in vogue when the fry used to be retained for some months to grow.

In the Sunderbans areas the end of the rainy season marks the beginning of the fishing season. The water level in the fields goes low by about October and the fish move back to the channels. Appreciable quantities of fish are obtained every day by letting water at high tide against which the fish would swim and get caught in the traps (*atols*), which are fixed for this purpose alone, set in the gaps between the bamboo-fencing. Just before or after harvesting of paddy, the channels are bunded off into small portions and thoroughly netted with seine nets to remove all fish. The growth of the prawns during the period of impoundment is satisfactory.

Yield

The yield of prawns from Kerala paddy fields varies from place to place but is the highest in the district of Ernakulam. On the basis of the yield, the various fields of the area have been divided into A, B & C classes. The yield per acre from A class fields amounts to 1080 lb., B class to 630 lb., and C class to 160 lb. This high yield from A class fields is

attributed to the nature of the local sub-soil and favourable tide-tidal range being about 3 ft. and is comparable with that of the yield in Java and the prawn ponds of Singapore. The total annual production of fish from these fields has been computed to be 5000 tons, of which 80% is constituted by prawns while the rest of the catch comprises of mullets (*Mugil* spp.) and pearl-spot (*Eetroplus* spp.).

The yield from the Sunderban fields varies from 200 lb. to 600 lb. per acre. The bulk of the catch is composed of mullets (*Mugil* spp.), cock-up (*Lates calcarifer*) and tengra (*Mystus gulio*.) while the prawns constitute only about 20%.

Marketing

The prawns are generally sold fresh in the markets in Bengal but in Kerala they are sundried or smoked or boiled and sundried and also processed.

Apart from the inland trade, 4,536 m. tons of prawns valued at Rs. 14,552,971/- were exported during 1960-61 to over twenty countries of which Burma, the U.S.A. Ceylon, Hong Kong, Singapore and Mauritius were the main.

AN UP-TO-DATE LIST OF PUBLICATIONS ON INDIAN PRAWNS¹

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