

# Saga of marine prawn fishery of Karnataka

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## Abstract

Trends in prawn fishery of Karnataka, especially during 1950-2020 are broadly divided into four phases, namely primary phase (1950-1970) in which fishery was confined with traditional gears and also as phase of introduction of exploratory surveys, ii) growth phase in which trawl fishery dominated and ventured into deeper waters for prawn fishing (1971-1990), iii) enhanced growth phase (1991-2000) with intensification on trawl fishery in terms of fishing capacity as well as introduction of innovative methods and iv) the present stagnation phase (2006-2020). Till 1970 the fishery was dominated by indigenous fishing units, but later the trawlers contributed the majority of prawn catch. 28 species of marine prawns were recorded along the Karnataka coast, among which, *Metapenaeus dobsoni*, *Parapenaeopsis stylifera*, *Penaeus indicus*, *M. monoceros*, *Solenocera choprai*, *M. affinis*, *P. monodon*, *P. semisulcatus* and *P. merguensis* were the major contributors. Deep-sea prawn fishery from the coast started from the year 2000 and the major species landed were *Aristeus alcocki* and *Heterocarpus* spp. After a promising start, "red ring" landing showed a diminishing trend in catch as well as in mean size. These reductions influenced the feasibility of the deepsea prawn fishery operations and the fishery came to an end by 2009. Prawns were invariably contributing more than 25% of the total revenue in Karnataka fisheries till 1990, but over the period of time, the contribution of prawn in the fishery revenue of Karnataka reduced substantially. An analysis of the trawl economics carried out based on major trawl fishing harbors of Karnataka showed that in 2000, prawns contributed 23% of the revenue of trawlers, which was reduced to 11% in 2010 and to 6% in 2020.

**Keywords:** Prawn fishery, Karnataka, growth phases, estuarine fishery, economic performance

## Introduction

Karnataka with 300 km coast line has 156 fishing villages and 88 fish landing centres in 3 coastal districts namely, Dakshina Kannada, Udupi and Uttara Kannada. There are 12 fishing harbors, 5 in Uttara Kannada and 7 in Dakshina Kannada. The fishermen of the coast are highly progressive in adopting modern fishing technologies and qualitative and quantitative changes, in terms of fleet size, methods of trawling, depth of operation, extend of fishing hours and installation of high speed engines were noted. The depth of operation has been the major change, in the early 1960s it was about to 10 to 20 m and it has been extended up

to 500 m. In accordance with the developments in fishing operation, prawn fishery of Karnataka also went through various phases. In terms of trends in fishery operation and production, prawn fisheries of Karnataka can be broadly divided into four phases namely primary phase (1950-1970) in which fishery was confined with traditional gears and also as phase of introduction of exploratory surveys, ii) growth phase in which trawl fishery dominated the prawn landing and were ventured into deeper waters (1971-1990), iii) enhanced growth phase (1991-2000) with intensification on trawl fishery in terms of fishing capacity as well as introduction of innovative methods and iv) the present status is the stagnation phase (2006-2020). The paper is

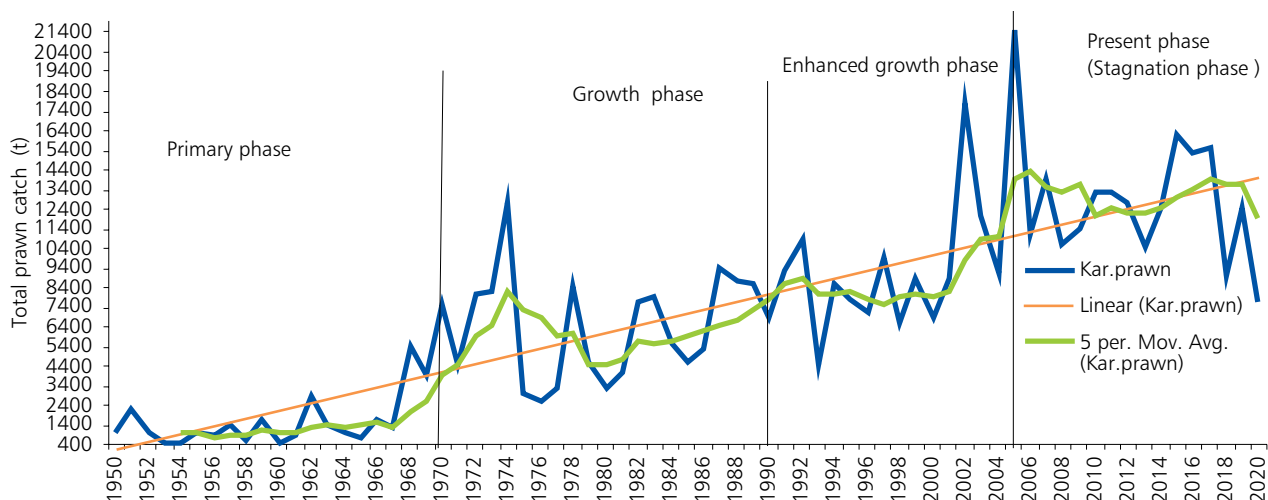


Fig. 1. Different phases Karnataka prawn fishery during 1950-2020 (Source: NMFDC of ICAR-CMFRI, Kochi).

presented based on the observations on the fishery and analysis of fishery data over the period (1950-2020) and also historical data published by earlier workers (Kuthalingam, et al., 1966, Ramamurty and Sukumaran, 1984, Ramamurty, 1972 and Sukumaran, 1982, 1985).

Exploratory fishing initiated in 1963 by Indo-Norwegian Project (INP) vessels from Karwar and the Government of India's exploratory fishing vessels (*MFV Tarpon*, *MV Samudra* and *MV Sagarvihari* (all having 42 hp capacity each) also conducted exploratory fishing cruises off

## I. Primary phase

Although fishing has been a traditional occupation of the inhabitants on this coastal belt since time immemorial it remained as a traditional activity until the early sixties. Popular gear used by artisanal fishermen include rampan or rampani, small shore seines (Yendi or kairampani), drag nets (Korubalae) cast nets (Beesubale) gillnets and drift nets (Kanthabalae). Mechanized craft include purse seiners, trawlers and gill netters. The important species contributing to the fishery were *Metapenaeus dobsoni*, *M. affinis*, *M. monoceros*, *Parapenaeopsis stylifera*, *Penaeus indicus* and *P. monodon*. Of these, *M. dobsoni* and *P. stylifera* together contributed to the bulk of the prawn catch (about 85%) and one or the other species was always found to dominate the fishery.

## Exploratory Fishing

The first exploratory trawling along the Karnataka coast was conducted by *M. V. Tarpon* during 1962-63 to 1964-65, off Mangalore and Malpe, in 14-54 m depth range. *M. dobsoni* dominated the prawn catch, forming as much as 53.8% followed by *P. stylifera* (26.5%), *M. affinis* (15.7%), *Penaeus* spp. (3.6%) and *M. monoceros* (0.4%). Prawn catches were higher in less than 40 m depths.

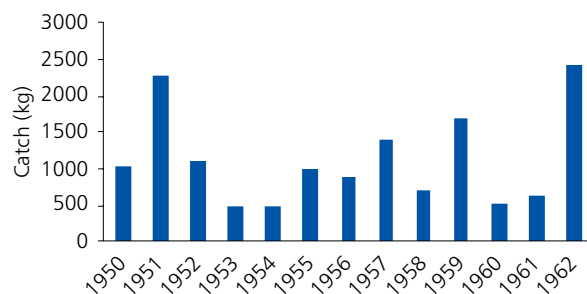


Fig. 2. Prawn catch recorded from Mysore State during early phase of prawn fishery.

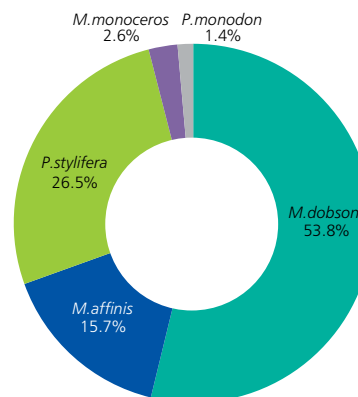


Fig. 3. Species composition of prawns caught from Karnataka during 1959-1970.

Karnataka coast. Catch trends during primary phase of prawn fishery and common species of prawns such as *M. affinis*, *M. dobsoni*, *P. styliifera*, *P. indicus* and *P. merguensis* were landed during 1959-1970 (Fig. 2 & 3).

## Commercial trawl fishery (single day trawling)

The report on the development of mechanised fishing in Mysore published in the Indo-Pacific Fisheries Council (1962) is the first record on the trawl fishery of Karnataka. During the last 50 years history of commercial trawling of Mangalore, gradual changes have occurred especially in the depth of operation, hours of operation per fishing trip and species composition of the landings. In early sixties the depth of operation was up to 10-20 m and during 1967-1970 the depth of operation extended up to 30 m. From 1960s, fishing was augmented with the introduction of mechanized boats (trawlers) and improved gears. In the initial years of trawling boats of 32 feet in length used to conduct single-day trips by leaving for fishing in the early hours of morning and returning by around 2-4 PM. Generally they fish for about 5 hours in the depth range of 10-40m. The first report on the commercial trawler prawn fishery was of Ramamurthy (1972) based on the data collected during 1967-70 from commercial vessels operated from Mangalore. The annual prawn landings varied from 658.7 t in 1969-70 to 1638.7 t in 1968-69 with *M. dobsoni* (37.3-59.0%) dominating the fishery followed by *P. styliifera* (24.3-47.6%), *M. affinis* (13.6-17.2%) and *P. indicus* (0.2-6.9%).

## II. Growth phase

Trawl was the major gear operated for capturing prawns from sea. Two categories of bottom trawler units are in operation in Karnataka. The first category consists of small boats (<9.75 m OAL) conducting daily trips. The trawl net has a cod end mesh size of 10-20 mm and catch generally consists of prawns, flatfishes and other finfishes. The second category, comprise of medium sized boats (9.75-15.0 m OAL) are making multi-day fishing cruises. Apart from these ring seines operated along the coast catch good quantity of prawns, especially during monsoon and post monsoon months.

### Single-day trawl fishing

Single day trawling (SDT) by fishermen started in 1962 and the fishing effort gradually increased from 27104

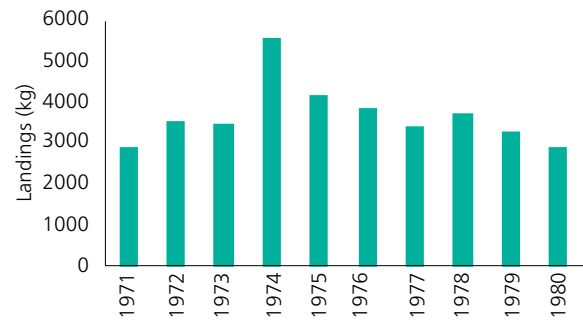


Fig. 4. Prawn landing in Mangalore during 1971-1980

boat-days during 1971-72 to 48812 boat-days during 1976-77. The highest catch of 3644.6 t and catch per unit of effort (CPUE) of 120.9 kg were obtained during 1973-74 (Ramamurthy and Sukumaran, 1984). Annual catch trend of prawns from landing centres of Mangalore is given in the fig.4.

The important species contributing to the fishery were *M. dobsoni* (42.4%), *P. styliifera* (43.4%), *M. monoceros* (5.8%), *P. indicus* (4.6%) and *M. affinis* (3.5%) (Fig.5) Of these, *M. dobsoni* and *P. styliifera* together contributed to the bulk of the prawn catch (about 85%) and one or the other species was always found to dominate the fishery. Prawns like *P. monodon*, *P. merguensis*, *Parapenaeus longipes*, *Trachysalambria curvirostris*, *M. moyebi* and *P. acclivirostris* were recorded in stray catches.

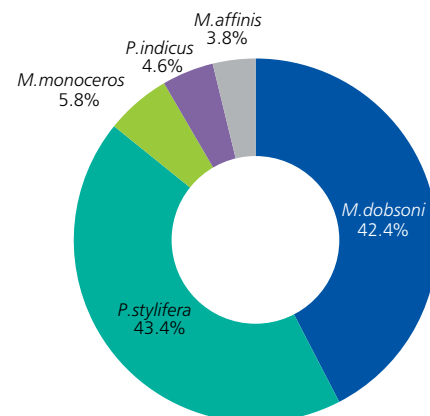


Fig. 5. Species composition of prawns caught from Mangalore during 1971-1980.

### Multiday trawl fishing

Multi-day trawl fishing (MDT) in the deeper waters started during the early 1980s with introduction of "night trawling". Initially the fishing trips extended up to three days and the number of stay-over fishing days

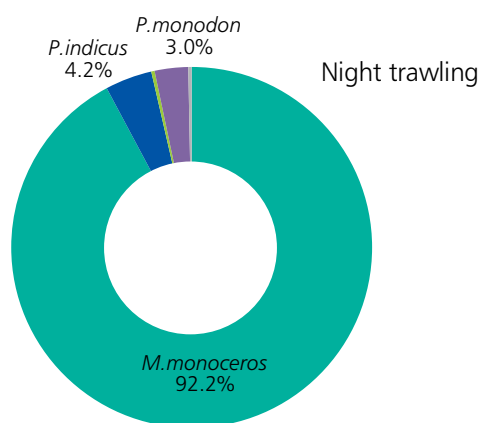
gradually increased, due to more profitability of fishing operations in the distant waters by finding new resources in the far off fishing grounds. This led to extend the fishing operations up to 12 days with advancements in the navigational aids and gear materials aiding multi-day trawl fishing for the highly valued prawns.

## Night trawling

Exploitation of prawn resources by mechanised trawling has been intensified since the beginning of seventies due to the ever-increasing demand for prawns for export. Even among prawns, there has been greater demand for larger varieties since they fetch very high price. This is prompting more and more entrepreneurs to go in for different types of fishing for catching large sized prawns. Trawl fishing during night time was adopted by trawler owners of Mangalore area and this has been found to yield promising results. Generally, trawlers set out for fishing in the early morning and return by afternoon, sometimes landing even up to 15 or 16 hours. The boats engaged in day fishing are comparatively smaller in size (less than 9.75 m) and usually fish within 25 m depth zone. These units make 1 to 3 hauls per day, each lasting 2-3 hours. Apart from these vessels, there are a good number of larger boats (above 9.75 m) engaged in night fishing, upto a depth zone of 55 m. These units generally set out for fishing in the evening and return after 1-2 days' night fishing. These night units usually make 2 hauls per night, each lasting 4 to 5 hours. In order to keep the prawns and quality fishes in good condition, these boats generally carry 2-3 large ice boxes.

## Species composition

The prawn catch in night trawling was composed



of larger species, *Metapenaeus monoceros*, *Penaeus indicus*, *P. monodon* and *M. affinis* in the order of their abundance. *P. stylifera* ('karikadi') was the major species of the prawn landings by day trawling. *M. dobsoni* ('poovalan') was the second important species followed by *M. affinis* and *P. indicus*. *P. monodon*, *Parapenaeus longipes*, *Trachysalambria curvirostris*, *Metapenaeus moyebi*, *Parapenaeopsis acclivirostris*, *Solenocera crassicornis*, *Nematopalaemon tenuipes* and *Exhippolysmata ensirostris* also occurred in the catch in stray numbers. Species composition of day trawling and trawling prawn catch from Mangalore during 1983-1990 (Fig.6).

During 1980s, as a result of night trawling, landing of *M. monoceros* an economically important species, increased substantially, (from 53 t in 1981 to 989 t in 1988) with a catch rate of 40 kg/unit during 1987-1988 period. During this period number of fishing hours operated annually ranged between 44,000 to 54,000 fishing hours which was three to four times more, than those operated during 1981 (13,000 hours). As a result of this high fishing pressure, catch per unit reduced from 40 kg in 1988 to 25 kg in 1990, which eventually lead to financial crisis for the trawlers in operation.

## III. Enhanced growth phase

To tide over this financial crisis, from 1991 onwards many trawlers extended their operation up to mid shelf region in a depth beyond 70 m which resulted in the landings of non-conventional prawn resources. The trend of prawn landing in trawls in Karnataka during 1991-2005 showed that catch was stagnated during

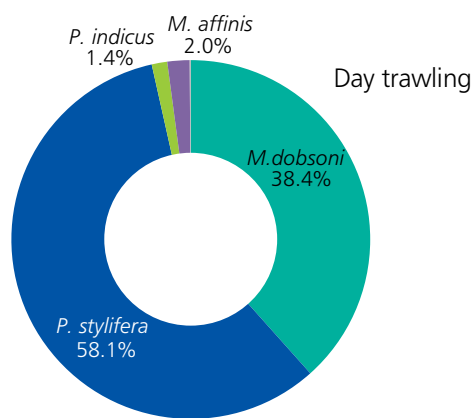


Fig. 6. Species composition in the 'Day' and 'Night' trawlers operated off Mangalore during 1980-1990.

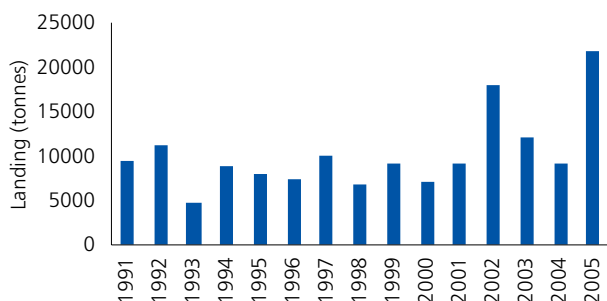


Fig. 7. The trend of prawn landing in Karnataka during 1991-2005

1991 to 2001, but showed improvement later (Fig. 7).

Till early 1990s, *Metapenaeus dobsoni*, *M. affinis*, *Parapenaeopsis stylifera*, *Penaeus indicus*, *P. monodon* and *P. merguensis* were the major species landed. During 1991-2015, 11 species of penaeid prawns contributed to the fishery among which *M. monoceros*, *M. dobsoni*, *P. stylifera*, *Solenocera choprai* and *Trachysalambria* spp. were netted in substantial quantities. Other species recorded were *M. affinis*, *P. indicus*, *P. monodon*, *P. canaliculatus*, *P. semisulcatus* and *Parapenaeus* spp. *M. monoceros* was the most important species as far as the economics of the prawn fishery was concerned. Even though substantial increase was noticed in the penaeid prawn landings during this period, *M. monoceros* did not show corresponding improvement in the catch volumes and even showed a decline later. The increase in prawn landing was mainly due to the economically less important species. In 1998, *M. monoceros* was the most important species contributing 38.1% of the penaeid landings, but by 2000, *S. choprai* became the most dominant species contributing 44.1%. The catch

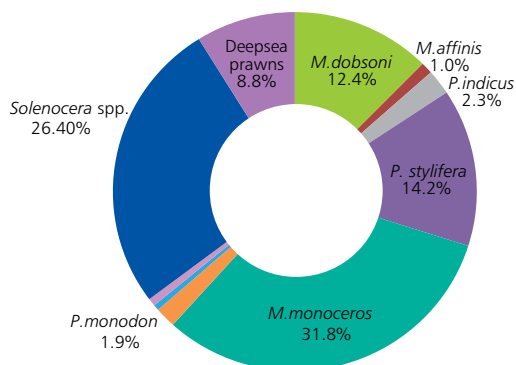


Fig. 8. Species composition of prawns caught from Karnataka during 1991-2005

composition during 1991-2005 is given in the Fig. 8. Deep sea trawling operation extending up to 500 m depth commenced during April, 2000 targeted mainly for other prawn species and lobsters using boats made of steel. The other modifications included increasing the warp length sufficient for operation upto 500m, fish hold capacity of about 10 t and engine capacity from 120 to 160 hp with endurance in the sea for 6 to 10 days. Many of them are equipped with GPS and fish finding equipments. The duration of fishing was 6 to 8 days depending on the availability of prawns and other fishes and sometimes operated at depths below 150 m also if the catches from deeper waters were not encouraging. In overall analysis *M. monoceros* formed 31% of the prawn catch during 2001-2015 period, followed by *S. choprai*, *M. dobsoni* and *P. stylifera*.

### Rise and fall of deep sea prawn fishery

Deep-sea prawn fishery which started from the year 2000 onwards was dominated by *Heterocarpus* species whereas the feasibility of the fishing operation was determined by "red ring", *Aristeus alcocki*. During 2002-2009, 1,449 t of deep sea prawns were landed by multi-day trawlers and major species landed were *A. alcocki* and *Heterocarpus chani*. After a promising start, "red ring" showed a diminishing trend in catch as well as in mean size which influenced the feasibility of the deepsea prawn fishery operations and the fishery ended by 2009. Decline of fishery after showing an increasing trend of *A. alcocki* and *Heterocarpus* spp. was attributed to the over exploitation of the virgin fishing ground and also to the low reproductive potential of deep sea prawns.

### IV. Stagnation phase (present status)

From 2006 onwards prawn catch in Karnataka showed a stagnation, the average catch for the period, 2006-2019 was 12,476 t with highest recorded in 2015 (16,217 t) and the lowest in 2018 (9,004 t). However in 2020 the lockdown and pandemic conditions affected fishing operation as a result of which fishing effort reduced considerably and consequently, in 2020 the prawn catch in Karnataka was the lowest recorded for the period (7,577 t). The trend of landing in 1991-2020 is given in fig. 9 to illustrate the stagnation on prawn fishery during recent years.

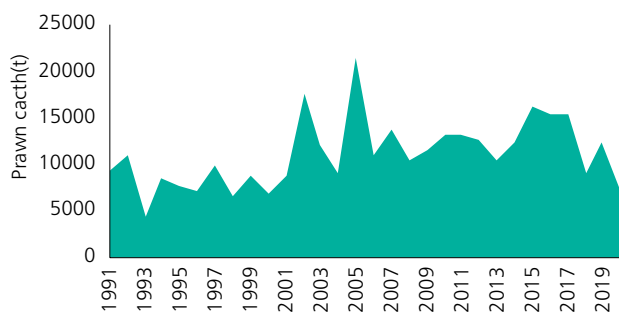


Fig. 9. Prawn landing (t) in Karnataka during 1991- 2020 showing phase of production enhancement (1991-2005) and later the stagnation (2006-2020)

The sharp reduction in catch of *M. monoceros* which was the financial backbone of prawn fishery of Karnataka declined from 3916 t in 2017 to 536 t in 2020 impacting the income from prawn fishery of the State.

## Species composition

In overall species analysis of 2016-2020, *P. stylifera* dominated with 25.4% followed by *M. dobsoni* (23.3%) and *M. monoceros* (14.3%). Deep-sea prawn fishery was not attempted during the period and species composition during the period is given in fig. 10.

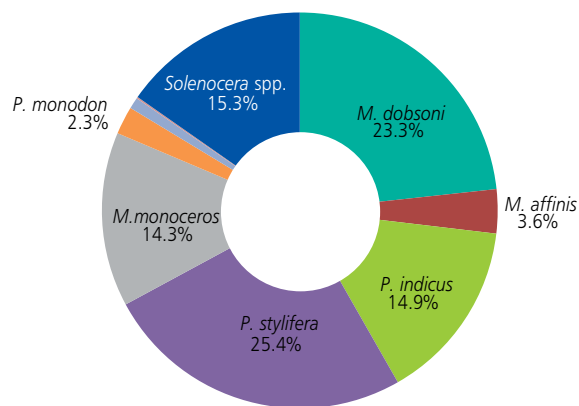


Fig. 10. Species composition of prawns

## Monsoon prawn fishery using indigenous gears

Along the Karnataka coast, monsoon fishery has been carried out using ring seines and gillnets operated from canoes fitted by out-board engines. The ring seiners locally known as “matabala” or “ranibala” are a miniature version of purse seine, measuring about 240 m in length and 10-12m in width, with a mesh

size of 18 mm which is operated using two canoes fitted with outboard engines. The number of crew vary from 16 to 30 and these units also engage a canoe for transporting part of their catch. Fishing is generally confined to near shore waters within 15 m depth with *M. dobsoni*, *P. indicus* being the major species landed. This monsoon fishery is highly variable and depending on the weather conditions of the sea.

## Prawn landing by other gears

Prawns caught by purse-seine units record good landings during December-January. *M. dobsoni* the major species landed showed annual catch that varied between 19 t (2001) and 34 t (1999). Along Karnataka

Table 1. Marine prawn species landed along Karnataka coast in order of abundance

Rank	Species
1	<i>Metapenaeus dobsoni</i>
2	<i>Parapenaeopsis stylifera</i>
3	<i>Penaeus indicus</i>
4	<i>Metapenaeus monoceros</i>
5	<i>Metapenaeus affinis</i>
6	<i>Solenocera choprai</i>
7	<i>Penaeus monodon</i>
8	<i>Penaeus merguensis</i>
9	<i>Penaeus semisulcatus</i>
10	<i>Penaeus japonicus</i>
11	<i>Penaeus penicillatus</i>
12	<i>Parapenaeopsis acclivirostris</i>
13	<i>Aristeus alcocki</i>
14	<i>Metapenaeus brevicornis</i>
15	<i>Trachysalambria curvirostris</i>
16	<i>Penaeus canaliculatus</i>
17	<i>Metapenaeopsis stridulans</i>
18	<i>Parapenaeopsis maxillipedo</i>
19	<i>Hymenopenaeus equalis</i>
20	<i>Parapenaeopsis hardwickii</i>
21	<i>Parapenaeopsis sculptilis</i>
22	<i>Solenocera crassicornis</i>
23	<i>Atypopenaeus stenodactylus</i>
24	<i>Aristeus semidentatus</i>
25	<i>Acetes indicus</i>
26	<i>Heterocarpus chani</i>
27	<i>Parapenaeus longipes</i>
28	<i>Parapenaeus fissuroides indicus</i>

coast, like other parts of the west coast, operation of mechanized vessels is banned during south west monsoon (June-August), but ring-seine operations allowed from country crafts (canoes) fitted with out-board engines. Fishing generally confined to near shore waters within 15 m depth indicate that as high as 90 to 95% of the prawn catch was constituted by *M. dobsoni* only. Hand trawls and cast-nets are also used by traditional fishermen for capturing prawns. 28 species of marine prawns were recorded along the Karnataka coast, which are listed below, in the order of the species abundance recorded.

## Estuarine prawn fishery

Total estimated estuarine area in three coastal districts of Karnataka of is around 7200 hectares. Since estuarine prawn fishery is a not an organized fishery catch data on estuarine fisheries of Karnataka is not available. However, there are number of studies conducted on availability of post larvae, juveniles and adult stages of prawns in Netravati, Gurupur, Gangoli, Sitanadi, Aghanasini, Kali and Sharavati estuaries. Estuaries and backwaters have an important role in the survival of many crustaceans. They provide permanent habitat for many of them and as many others utilize this area as their nursery and breeding ground. 19 species of prawns belonging to 4 families were collected exclusively

Table 2. List of prawn species reported from estuaries of Karnataka

Family	Species
Alpheidae	<i>Alpheus malabaricus</i>
	<i>A. paludicola</i>
	<i>A. rapax</i>
Atyidae	<i>Caridina gracilirostris</i>
Palaemonidae	<i>Macrobrachium equidens</i>
	<i>M. rosenbergii</i>
	<i>M. idae</i>
	<i>M. idella</i>
	<i>M. lamerrei</i>
	<i>M. malcolmsonii</i>
	<i>Leandrites celebensis</i>
Penaeidae	<i>Metapenaeus dobsoni</i>
	<i>M. affinis</i>
	<i>M. monoceros</i>
	<i>Penaeus indicus</i>
	<i>P. merguensis</i>
	<i>P. monodon</i>
	<i>P. canaliculatus</i>
<i>P. semisulcatus</i>	

from the eight estuarine systems in Karnataka during the biodiversity survey conducted during 2006 - 2007 period (Table 2).

## Prawn fishery economics

Single day trawling (SDT) with limited engine power did not show wide deviations in the operational area and prawn fishery found to influence substantially in SDT operational feasibility. Multiday trawlers (MDT) which were started as a modified version of SDT ventured to night trawling in early eighties (Sukumaran, 1985) was mainly focusing prawn catch beyond 50m depth. By 2000 the trawl fishing was extended to 500m aiming for increasing prawn catch to sustain the feasibility of trawl fishery, but deep sea fishery could not provide anticipated support to profitability of trawling operations thereby by 2006, trawl fishery target was diverted to other fishery resources. Market price is the most important economic driver that influence fishermen's preferences to target specific species modification of gears to catch the new target are derived from the comparative high market demand and better feasibility of operations. Huge differences in appreciation of market prices of finfishes and cephalopods when compared with prawns also become driving force for diversification of trawling from prawns to fishes and cephalopods.

In Karnataka, the influential role of prawn fishery for the ensuring the feasibility of the SDT operations is still prevailing, however due to the reduced economic performance of SDT operations the sector is phasing out gradually. In the case of MDT, which contributes more than 95% of the trawl production, the dependency over prawns is becoming insignificant.

The analysis of prawn landing data also cautions that stock assessment of resources with landing data need a scrutiny since the landing pattern does not necessarily reflect the stock position of the resources. The fishermen's decision to catch them or avoid them is purely depends up on the market demand and economic feasibility of its fishery. Shift in target fishery of deep sea prawns and reduction of *Solenocera* catch after a period of high production are noticeable examples to accentuate this fact. Change in target in Karnataka trawl fishery was evident from the reduction in percentage of prawn in trawl catch and more over the economic performance of prawn fishery was found to be far below to meet the operational cost of trawling.

Till 1990 prawns were invariably contributing more than 25% of the total revenue in trawlers, but over the period of time, the revenue has reduced substantially. An analysis of the trawl economics carried out based on Mangalore-Malpe fisheries harbors (which contribute more than 70% of Karnataka trawl fishery) showed that in 2000, prawns contributed 23% of the revenue of trawlers, that reduced to 11% in 2010 and to 6% in 2020 (Fig. 11). This is not because of reduction in catch of prawns during the period but diversification of trawlers to target other resources like finfishes and cephalopods. Trawl revenue showed multifold increase during 2000-2020 due to diversification in trawling and

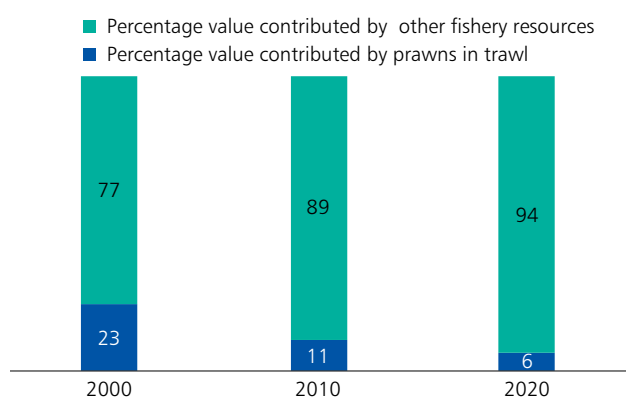


Fig. 11. Percentage contribution of revenue by prawns and other fishery resources in trawl fishery of Karnataka.

the dependency of trawlers on prawns for their revenue has reduced over the period of time.

The economic performance of prawn fishery also analysed in terms of value appreciation of prawns and other fishery resources caught from Karnataka. The economic performance of different groups of prawns and other important fishery resources from Karnataka are given in the table 3. Prawn value in the market is determined by the value in export market. This is highly applicable for the big sized prawns like *P. indicus* and *P. monodon*. The farmed prawns with their competition in the market,

Table. 3. Economic performance of prawn fishery of Karnataka during last 20 years when compared with other resources and diesel price

Group (market terminology)	Price ₹ per kg (1990)	Price ₹ per kg (2020)	Percentage of increase in value
Shrimps (tiny)	40	200	400
Shrimps (medium)	100	350	250
White shrimp	250	450	80
Tiger shrimp	300	550	83
Indian mackerel	30	300	900
White Pomfrets	80	700	775
Cephalopods	30	300	900
Diesel price ₹ per litre	10	80	700

buffered the increase in price of these species and during last 30 years they could not fetch 100% increase in procurement value. In the same time period, because of high domestic demand the value for the small shrimps comprising *M. dobsoni* and *P. stylifera* (called 'tiny' in market terms) achieved 400% increase in the price and the medium sized prawns like *M. monoceros* and *M. affinis* (called 'medium' in market terms) could fetch about 250% increase. In fishermen's perspective high demand for finfishes and cephalopods in the market and their price increase during the same period ranged between 775 to 900%. With trawlers contributing almost 70% of the fish catch in Karnataka, the diesel price is a major influencing factor for the economic feasibility of the fishing operation. While the diesel price showed an increase of 700% in last 30 years with price of diesel (₹ per litre) being 10 and 80 in 1990 and 2020 respectively, a proportional increase in the market prices of prawns was absent. Thus, the focus of target fishing has shifted from prawns, to finfish and cephalopods, along the Karnataka coast.

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