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Fishery of the blue swimming crab, *Portunus pelagicus* (Linn.) in Gujarat

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Abstract

The blue swimming crab, *Portunus pelagicus*, a hitherto insignificant commodity in the marine fishery of Gujarat, has suddenly gained importance as a high value export item. The promotion of targeted fishery for this crab, by trawl nets and gill nets, especially in the Gulf of Kutch region has resulted in large-scale exploitation of the same since 1997. Peak landings from trawl grounds off the Gulf of Kutch are in March – May while gill net landings are maximum in June – September. The total landing of *P. pelagicus* in the Gulf of Kutch region was about 550 tonnes in the year 2001. Small-scale fishery for this crab exists in the creeks of Patanbara and Vanakbara in Peninsular Saurashtra. The mean size of the samples from landings at Jakhau in the Gulf of Kutch was 141.3 mm (males) and 141.77 mm (females). The mean size at Patanbara was 64.25 mm (males) and 63.67 mm (females) and at Vanakbara, it was 33.59 mm (males) and 35.33 mm (females). Adult and breeding stages were encountered in the landings at Jakhau during March - May. Gut content analysis of the samples from Patanbara (56 – 75 mm CL) showed poor feeding rate, with a pre-dominance of molluscan shell remains in detritus. The Vanakbara samples (16 – 60 mm CL) showed better feeding rates, with more of fish remains in their gut contents.

Introduction

The blue swimming crab, *Portunus pelagicus* (Linnaeus, 1758) which enjoys a wide distribution in the Indo-Pacific waters (Chhapgar, 1957) forms a good fishery along the coasts of Karnataka, Kerala and Tamil Nadu. However this crab lacks prominence in the marine fisheries of Gujarat. In spite of the fact that the state actually leads in marine crab production in India (C.M.F.R.I., 1997-2001) (Fig. 1), crab fishery as a whole had not been accorded much significance in the fisheries scenario of the state. It was at the most a subsistence fishery in the creeks of Peninsular Saurashtra and in the Gulf of Kutch, where it was fished by spears, traps and other traditional gear like umbrella nets and fence nets, and it hardly secured dominance in the trawl fishery. With increasing demand for more seafood and dwindling catches following increased exploitation, the situation along the coast of Gujarat soon reached a crescendo wherein even the fishes

that were of no commercial value earlier began to fetch the least possible market value. This brought about marked changes in utilization of catches, especially the by-catch brought in by trawl nets. Crabs were one of the major groups to benefit by this change and over the last few years, a consistent fishery and market for this commodity was developed, though on a small scale.

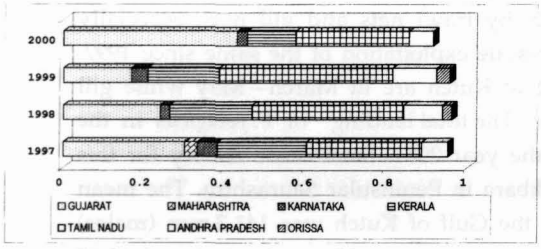

Fig 1. *State-wise contribution (%) to all-India crab landings (1997 – 2001)*

An export market for crabs has not really been established in the state, though some industrialists have tried to promote various crab products in the past. With stray landings of the mud crab and other crabs of lesser value which could be disposed of in the domestic markets, no serious efforts were made to study the availability of crab resources along the coast or to explore good market avenues for the commodity. In 1997, attempts made by a seafood plant based at Veraval to market the *P. pelagicus* caught by traditional fishermen in the Gulf of Kutch showed promise, and since then, some attention was directed towards exploiting *P. pelagicus* on a larger scale.

Preliminary surveys conducted by some private entrepreneurs suggest that there is a good potential for exploiting *P. pelagicus* in the trawling grounds in the Gulf of Kutch, particularly off Jakhau and Dwaraka, as also in the waters of the Gulf itself. A preliminary survey conducted during the course of the present study in other parts of Peninsular Saurashtra reveals that this resource is also available in the shallow creeks of Vanakbara/Diu, Navabander, and Patanbara/Veraval.

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Material and methods

Study area

Coastal Gujarat is broadly divided into south Gujarat, Peninsular Saurashtra and Kutch (Fig.2). Major trawling grounds exist off the coast of Saurashtra and Kutch. The present study was based on trawl landings off the Gulf of Kutch and Veraval and the catches

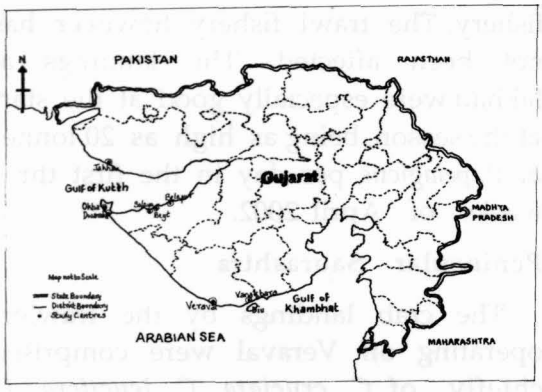

Fig 2. *Map of Gujarat showing the study areas*

by gill nets and other artisanal gears operated in the Gulf of Kutch, in the coastal reef along Patanbara (Veraval) and the saline creek and mangrove areas of Vanakbara/Diu.

Results and discussion

Fishery

Gulf of Kutch

The shallow coastal trawl grounds (5-15 fathoms) on the north-western side of the Gulf of Kutch are tidal mudflats with sandy/muddy beds, rich in crustacean resources, well-known particularly for shrimps during September – December. Trawling activities are centred mainly in the fishing grounds off the Gulf of Kutch (Fig.1). Gill net activities are concentrated in different areas within the gulf like Bedi, Beyt, Belapur, Lakh island, Bida island, Bhayter island, all within easy access to the processing plant set up at Dwaraka. Peak landings of crabs by trawl nets are in March – May while the gill nets bring in better catches after trawl activities cease, i.e., from July to September. There is an increased incidence of crab aggregation in the coastal waters during the pre-monsoon months for most of the species. With a relatively low yield of shrimps and other fishes from the trawl grounds during this period, and a growing demand for crabs, trawl operations have been directed towards exploiting this resource during this period. The crab catches off the Gulf of Kutch are mostly *P. pelagicus, P. sanguinolentes* and *Charybdis natator.*

The prospects for fruitful exploitation of *P. pelagicus* from these grounds promoted the establishment of a meat extraction unit for processing soft-shelled crabs by a multi-national group at Dwaraka. Trawling activities in the coastal waters off the Gulf of Kutch was directed towards this activity, especially from March to May and the catches found a place in the export market. This gave the necessary boost to the fishermen and soon even the artisanal fishermen joined the race for the blue swimming crab. Detailed surveys and introduction of new/improvised techniques by private entrepreneurs has been largely responsible for the intensification of fishing activities for *P. pelagicus* in this region. The fishery spread to different parts of the Gulf of Kutch, especially Bedi, Beyt and Belapur and, by the year 2000, the fishery had become an established one.

Gill nets are operated in the Gulf of Kutch at a depth of 3 - 4 m. Monofila-

ment nylon nets of 40 – 90 mm mesh size are used. The nets are about 2.5 – 3.5 m broad. Depending on the length of the nets, 5 – 10 pieces are tied to make up one unit of about 400 – 500 m length. The nets are operated from FRP boats or wooden canoes. During the peak periods (Aug – Sep), about 30 units operate at a time, landing approximately 500 kg of *P. pelagicus* per day. The size groups caught from the Gulf of Kutch include mostly baby crabs and juveniles. Other fish groups that came in with this catch included *Mugil*_spp., *Gerres* spp., *Arius* spp. and *Sillago* spp. Table 1 lists the landings of *P. pelagicus* by trawl nets and gill nets from the Gulf of Kutch region in the years 2000 and 2001.

By the end of August 2001, there was a sudden reversal of trends in the quantum of catches and demand for this commodity too suffered due to operational problems at the processing plant set up at Dwaraka. Following this, the gill net fishery for *P. pelagicus* has slackened and practically reverted to the earlier status of a subsistence fishery. The trawl fishery however has not been affected. The landings at Jakhau were especially good at the start of the season, being as high as 20 tonnes of *P. pelagicus* per day in the first three weeks of April 2002.

Table 1 *Landings of P. pelagicus (in tonnes) in the Gulf of Kutch region*

	Trawl nets	Gill nets
1997	53	27
1998	101	35
1999	64	31
2000	110	89
2001	300	250

Peninsular Saurashtra

The crab landings by the trawlers operating off Veraval were comprised chiefly of *C. cruciata, C. leucifera, P. sanguinolentes, Thalamita* spp., *Attergatis* spp. and other small crabs of low economic value. Traditional fishing efforts were mainly directed towards the mud crab *Scylla serrata, P. pelagicus. P. planipes, Attergatis*_spp. and other small crabs. As in the case of trawl landings off the Gulf of Kutch, there is an increase in the crab landings during the months of April and May, when the landings of shrimps and other fishes are less.

The fishery at Patanbara resembles the gill net fishery in the Gulf of Kutch. The catches, especially in May, indicate the dominance of adult and breeding stages in the fishery. These landings also hold a good percentage of other crabs like *Thalamita* spp. and *Attergatis* spp., but not much effort is directed towards developing the prospects of crab fishery and the fishery lasts for barely 20 – 30 days, yielding about 4 – 6 tonnes of crabs per annum.

There is a special fishery for juvenile *P. pelagicus* at Vanakbara/Diu from July-September, landing about 4-5 tonnes per annum. The fishermen here employ gill nets , umbrella nets and drag nets

in the waters of the creek at low tides. The umbrella nets are mostly employed to catch crabs from water-inundated areas in the shallow mangroves. One fisherman operates about 30-40 such nets repeatedly, as and when the crabs are trapped and there are about 100 fishermen actively engaged in this operation in and around Vanakbara/Diu. Fish offal (mostly of sharks) from the markets and drying yards is used as bait. The crabs are also collected from the creek at wading depths by operating drag nets, locally called *"vedi jal"*, which is usually employed for catching fish and shrimp.

Exploratory trawl operations along the coast of north-west coast of India began as early as the turn of the 20th century, as documented by Nair (1974), and commercial trawling was in play by the early fifties. Vivid descriptions of the trawling grounds off Gujarat and the resources available have been given by Jayaraman *et al.* (1959), Bhatt *et al.* (1964) and Rao *et al.* (1966) for ground depth upto 80 m and by Bapat *et al.* (1982) for ground depth of 55 – 360 m, identifying five major trawling grounds along the Gujarat coast, *viz.*, Cambay, Veraval, Porbander, Dwaraka and Kutch. These studies have established the richness of the grounds off Dwaraka (Jayaraman *et al.*, 1959) and Kutch (Rao *et al.*, 1966), especially in relation to fishery of large-sized demersal fishes. A significant point of similarity in these earlier studies is the relative unimportance or omission of crustaceans as a potential resource. One of the reasons for this must be that early exploratory and commercial bottom trawling activities were done primarily with large – mesh fish trawls. Hence crustaceans occurred only as an incidental catch and Bapat *et al.* (1982) reported that crustaceans formed only 0.15% of the total catch during exploratory surveys in the waters off Gujarat in 1977. Identification of shrimp resource grounds along the north-west coast of India (Kagwade, 1965) and the emergence of shrimps as a highly valued seafood delicacy diversified efforts towards targeted trawling for shrimps, paving the way for exploring the availability of potential benthic resources. However, even while shrimps and soon, lobsters and cephalopods, gained in importance along the Gujarat coast, crabs virtually remained in the shadows, often being grouped with the by-catch. The first reference to this group as a commercially viable group was made by Rao and Kasim (1985) in a description of the trawl fishery of Veraval. The study records the occurrence of several species of *Charybdis* in the trawl landings, during the period 1979 –'82, when crabs averaged about 5.3 % of the total trawl catch. However, there is no mention of the occurrence of *P. pelagicus* off Veraval.

The first reference to this species off the Gujarat coast has perhaps been made by Bhatt *et al.* (1964), in a study of the food and feeding habits of two large demersal fishes, "Dara" *(Polynemus indicus)* and "Koth" *(Otolithoides biauritus)*. The authors found *Neptunus (=Portunus)*

pelagicus formed about 3% of the gut contents of "Dara" in 1960, *Charybdis* spp. formed about 2% in 1961 while unidentified crab remains formed 1-3% in the two years. While most of the "Koth" specimens they studied had empty guts, a few were found to have prawns and crabs. These studies were conducted on "Dara" and "Koth" landed by gill net operations off Bedi Port in the Gulf of Kutch. The authors mention the existence of the "Koth"-"Dara" fishery for six weeks from March to May every year. The timing of this fishery and the occurrence of *P. pelagicus* and other crabs in the gut contents of these fishes tally with the findings of the present study which records trawl operations for *P. pelagicus* just off the Gulf of Kutch from March to May.

Length composition and biology

The landings at three centres – Jakhau in the Gulf of Kutch and Vanakbara and Patanbara in Peninsular Saurashtra were sampled during peak fishery periods from 1997 to 2002. The landings at Jakhau comprised of larger sizes, ranging from 86 – 175 mm CL. The sizes were smaller at Patanbara (51 – 75 mm CL) while the landings at Vanakbara (16 – 60 mm CL) were mostly made up of juveniles. (Fig. 3). The total numbers sampled during 1997 – 2001 from the landings at Jakhau, Patanbara and Vanakbara were 1186, 594 and 1773, respectively. The average sex-wise mean sizes at the three centres are given in Table 2.

Table 2. Mean size of *P. pelagicus* in Gujarat waters

Centre	Gear	Mean size (mm) Male	Female
Jakhau	Trawl net	141.3	141.77
Patanbara	Gill net	64.25	63.67
Vanakbara	Gill net, Umbrella net & Drag net	33.59	35.33

Adult and breeding individuals were seen in the landings at Jakhau. Breeding males dominated these landings (Sex ratio – 1.5 : 1) Berried females were encountered more in May and spent females were more during June - September. The male population comprised of two distinct variants with respect to the patterns on the dorsal surface of the carapace. (Plate 1). The sex ratio at Patanbara was 1.1 M : 1 F. Almost 90% of the females encountered were

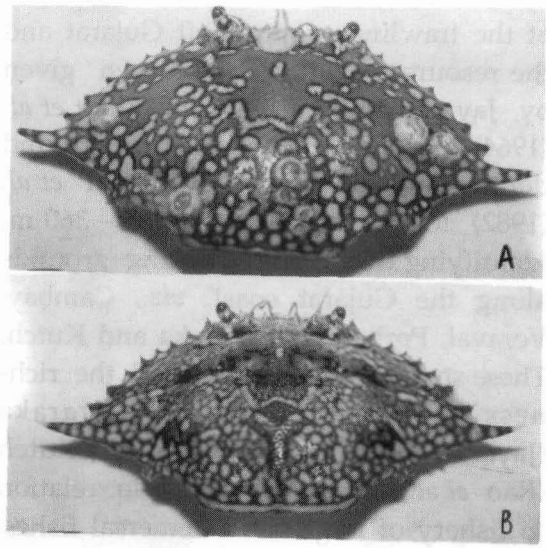

Plate I A & B. *Dorsal view of the carapace of two male P. pelagicus from Jakhau showing variation in pattern*

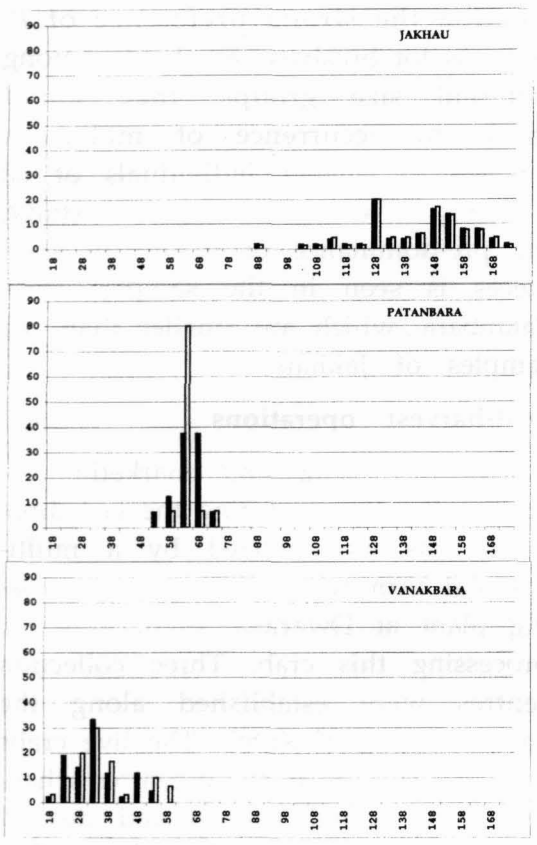

Fig 3. *Size frequency distribution of P. pelagicus at various landing centres in Gujarat (1997 – 2002)*

spent. The sex ratio at Vanakbara was 1.4 M : 1 F.

While comparing the mean sizes landed at the three centres, it must be noted that the landings at Jakhau are by trawl fishing while at Patanbara and Vanakbara/Diu, the landings are of gill net and other traditional gear operations. The availability of adult sizes in trawl grounds off the Gulf of Kutch is mostly during the months of April – May, when there is a lag in the availability of shrimp and other fishes. The fishery at Patanbara (in May) is done in the coastal waters and the sizes, though not as large as the sizes seen in the trawl landings at Jakhau, are nevertheless, of breeding stages - mostly spent (Plate II). At Vanakbara, however, where the fishery (from July – September) is almost entirely restricted to water-inundated inshore man-

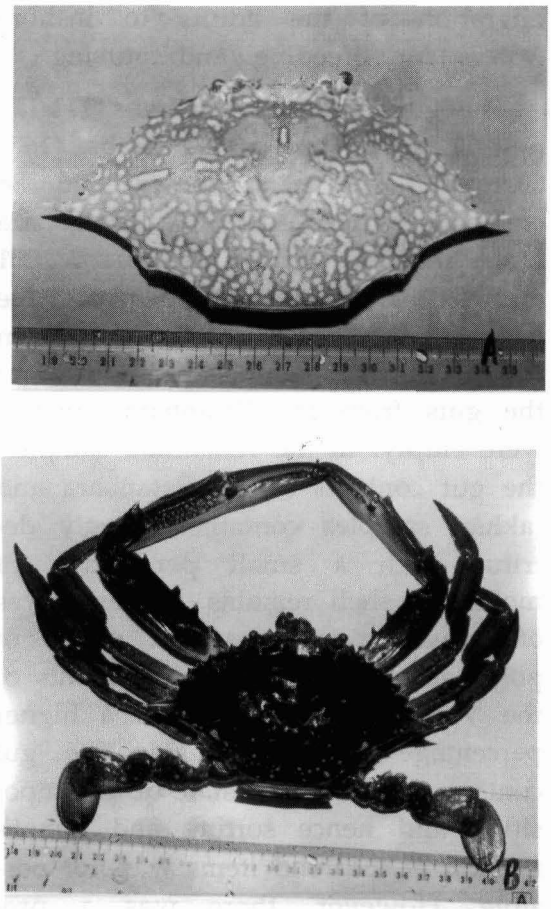

Plate II. *A Dorsal view of the carapace of male P. pelagicus from Patanbara*

B Dorsal view of a live male P. pelagicus from Patanbara

grove areas and the adjoining creek mouths, the population is composed of only baby and juvenile crabs. The gill net fishery in the Gulf of Kutch, which is initiated after trawl operation are halted in May, also yield juvenile crabs. Such a distinct difference in the sizes available in different grounds and months suggests the abundant availability of this resource in coastal waters all along the Gujarat coast, and a mass migration of the adults to inshore waters for breeding and nursing.

The gut contents of 150 crabs (111-175 mm CL) from Jakhau, 94 crabs (16 – 60 mm CL) from Vanakbara and 86 crabs (56 – 75 mm CL) from Patanbara were analysed during the years 2001 and 2002. 96% of the guts from the Jakhau samples, 35% of the guts from the Vanakbara samples and 88% of the guts from the Patanbara samples were empty. In the remaining samples, the gut contents of the Patanbara and Jakhau samples contained mostly detritus with a small percentage of molluscan shell remains, broken pieces of prawn appendages and pieces of polychaete worms. The gut contents of the Vanakbara samples held a higher percentage of fish remains. The gut contents were in a state of decomposition and hence sorting and quantification of the food items was not possible. However, there was a predominance of molluscan shell remains in the samples from Patanbara. Sukumuran and Neelakantan (1977) mention the strong preference of *P. pelagicus* for bivalves as food. Among different size groups, they found maximum occurrence of molluscan remains in smaller individuals of 60 – 80 mm CW. In the present study, the pre-dominance of molluscan shell pieces is seen in the samples from Patanbara , which are smaller than the samples of Jakhau.

Post-harvest operations

The processing and marketing/export of *P. pelagicus* during the last three years was monopolized by a multinational firm which set up a processing plant at Dwaraka, exclusively for processing this crab. Three collection centres were established along the banks of Gulf of Kutch. The live crabs were transported to these centres where they were sorted, cooked and cleaned before being transported to the mother plant at Dwaraka for meat extraction, pasteurization and packing. Information gathered by local enquiry suggests that the harvest went up many folds and the daily yield went up to as much as 3 tonnes of partially processed crabs at each small centre in April 2001. However, marketing channels and market values could not be monopolized for long and the processing plant was closed down for various reasons. This in turn affected the gill net fishery for *P. pelagicus*. The trawl landings at Jakhau remained more or less unaffected and, with closure of the plant at Dwaraka, the bulk of the

material from Jakhau is now transported to Veraval and processed for export as free-cuts by some seafood processing plants.

The crabs caught from the creeks of Patanbara and Vanakbara/Diu are sold exclusively in the local markets. The baby crabs of Vanakbara/Diu hold a special status as a delicacy – the locals relish the baby crabs fried entire, with shells and appendages.

The price structure varies with region - at Patanbara, *P. pelagicus* fetches Rs. 20/- to 30/- per kg while at Vanakbara/Diu, it fetches Rs. 30/- to 40/- per kg. The price ranges from Rs. 15/- to 20/- per kg at Jakhau. In the gill net centres of the Gulf of Kutch, *P. pelagicus* used to fetch only Rs. 4/- to 6/- per kg earlier. With the commencement of targeted fishery for this commodity, it now fetches Rs. 36/- per kg.

Crab resources had probably been abundant in the trawl grounds off the Gulf of Kutch even during the early days of trawling history in this area, but had hitherto gone unnoticed primarily due to the dominance of bottom fish trawls in this area since early times. Secondly, the lack of relative demand for this commodity, in comparison with shrimps, cephalopods and fishes did not induce the fishermen to target their operations for exploiting this resource. A sudden demand for soft-shelled blue swimming crabs towards the end of the century and the incentives promised by private entrepreneurs reversed this approach.

A detailed survey through peninsular Saurashtra and Kutch is required to assess the actual landings of *P. pelagicus* and to arrive at the potential estimates for exploiting this resource judiciously and, to advantage. The fact that this crab supports a good fishery in Pakistan (Tirmizi and Kazmi, 1996) suggests the possibility of establishing a steady fishery off the Gulf of Kutch too. It is necessary to explore and establish market avenues for the crab if a good fishery is to be established. It is also necessary to understand why the gill net fishery for this group in the Gulf of Kutch picks up only after the trawl operations in the area cease for the monsoon. The variability in the males landed at Jakhau and difference in the size groups exploited at different centres (Fig. 2) also need to be studied closely to understand the population structure and distributions of this resource along the Gujarat coast.

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