Marine Crab Fisheries of Karnataka State - A Retrospect

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Marine crabs form 0.47 % of the marine fish production and 2.1 % of the trawl landings in Karnataka State. The annual average crab production of the State during 1983-1993 was to the tune of 1179 tonnes which forms about 5.1 % of the annual average marine crab production of our country for the same period.

The marine crab fishery of Karnataka State showed remarkable improvement in recent years due to the expansion and extension of fishing grounds together with change in pattern of trawl fishing. Despite its commercial importance, our knowledge of the biology and related aspects of these crabs is limited. The present account highlights the results of the investigations carried out by the author on the biology and stock of commercially important species of crabs of the Karnataka State.

Exploitation

Although crabs are caught along with others practically in all types of gears operating along this coast, bulk of the catch is obtained by shrimp trawlers. The fishing ground exploited by the indigenous gears are mostly restricted to shallow water regions of the coast at depths upto 15 m. During the S.W. monsoon period, fishing is generally carried out very close to the shore by indigenous gears, i.e., shore seine, mini trawl, gillnet etc.

Trawl fishing is done in areas extending upto 100 m depth during non-monsoon months by two categories of boats. One category consists of smaller boats (<9.75 m) undertaking daily cruises, now known as single day fleets (SDF), which generally operate within 25 m depth, and the second category consists of medium sized boats (> 9.75 m) making 2-7 days cruises, of late known as multi-day fleets (MDF) (previously known as night boats) which operate their nets upto 100 m depth. This changed pattern of fishing has been first reported from South Kanara coast by Sukumaran *et al.* (1982), and Sukumaran (1985), and described more recently by Zacharia *et al.* (1996) for the same region.

Although the trawling season extends from September to May, crabs generally start appearing in the catch from December onwards only. As the fishing season advances, the crab landings also show an upward trend. Crabs are caught in SDF as well as MDF units, with the difference that relatively large sized crabs are landed by the latter particularly during April-May period.

Commercial species

The commercial species contributing to the crab fishery are *Portunus sanguinolentus*, *P. pelagicus*, and *Charybdis feriatus*. Among them, the first two are commercially very important as these two species together contribute to about 90% of the crab landings in the State and also fetch high price in the local market.

Annual catch and effort trends

The annual crab landings and fishing effort during 1983-1995 is shown in Fig.1. The annual catches show sharp fluctuations. The minimum and the maximum landings were recorded in 1985 (595 tonnes) and 1987 (2575 tonnes) respectively.

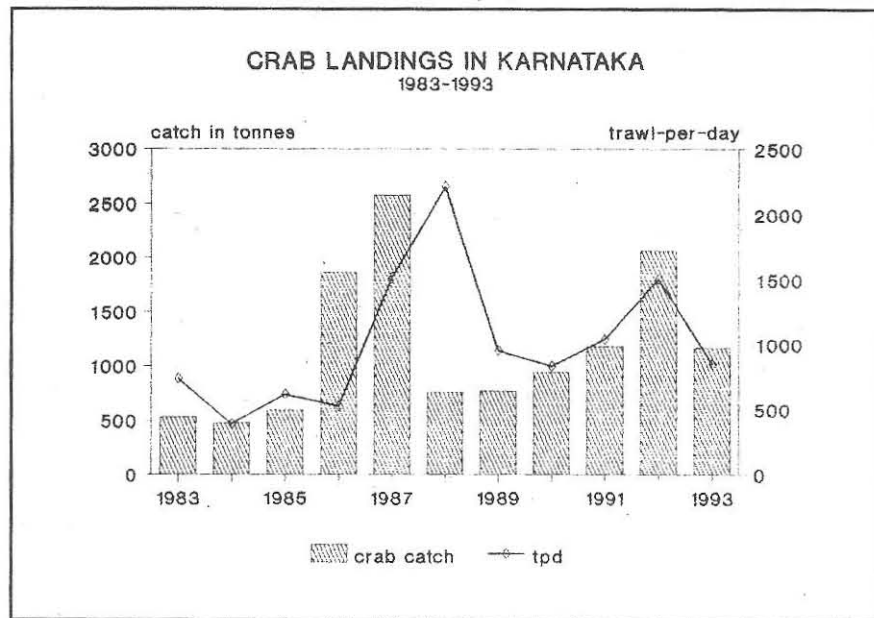The annual fishing effort ranged from a minimum of 390 trawler-day ☞

CRAB LANDINGS IN KARNATAKA
1983-1993

Fig.1

(tpd) or 83,800 boat days (bd) in 1984 to a maximum of 2215 tpd or 476,200 bd in 1988. Fishing effort of 8 hours duration is reckoned as the effort by one boat or one fishing unit.

Biology of *Portunus sanguinolentus* and *P. pelagicus*

The biological details of *P.Sanguinolentus* and *P.Pelagicus* are given in Table 1. The sexes are separate and males grow to a larger size than females. The breeding season extends from August to May for both the species with peak activity during December-February in *P. sanguinolentus* and during January, February and September in the case of *P.pelagicus* along the Karnataka coast. The size (carapace width) at sexual maturity in female is at 92 mm in the former species and 99 mm in the later. In males of the former species it is 97 mm and 105 mm in the later (Sukumaran and Neelakantan, ms). Peak mating activity was observed during December-March in the former and during December-February in the latter species. An individual female may spawn atleast 2-3 times in a spawning season. Spawning population is mainly supported by size ranging 100-130 mm carapace width (cw) in *P.sanguinolentus* and 100-160 mm cw in *P. pelagicus*. There is a significant variation in sex ratio in these crabs. The fecundity ranges from 0.044 to 1.19 million eggs in *P. pelagicus* (Sukumaran and Neelakantan, 1996c). The larval development takes place in the marine environment. The young crabs migrate to the inshore zone and thereafter into estuaries too. The inshore fishery is supported by crabs measuring 18-168 mm cw in *P. sanguinolentus* and 23-173 mm cw in *P. pelagicus*. The mean monthly growth rates in males and females were 10.3 mm and 8.8 mm in *P. sanguinolentus* and 11mm and 9.6 mm in *P. pelagicus* attains a carapace

Table 1. Biological characteristics of *P. Sanguinolentus* and *P. pelagicus* for Karnataka waters				
	P. sanguinolentus		*P. pelagicus*	
	male	female	male	female
Size * range (mm)	18-168	18-163	23-173	23 -168
Commercial size*(mm)	83-153	83-153	88-163	88-158
Food habit	Omnivorous		Omnivorous	
Food items	crustaceans, fishes molluscs, debris miscellaneous items		crustaceans, fishes molluscs, debris miscellaneous items	
Size at maturity (mm)	98	92	105	100
Age at maturity (months)	7-8	8-9	7-8	8-9
Spawning season	August-may		August-May	
Peak breeding period	December-February		January-February, and September.	
Sex ratio	Unequal		Unequal	
Fecundity (Million eggs)	0.44 - 1.19		0.56 - 1.07	
Growth rate/month (mm)	10.3	8.8	11.0	9.6
Size at one year (mm)	124.1	112.5	145.2	132.5
*for size carapace width is given				

width of 124.1 mm and 112.5 mm in the former and 145.2 mm and 132.5 mm in the latter on completion of one year. The life span is around 2.5 years in both species (Sukumaran and Neelakantan, 1997).

Economics and marketing

There is a lot of demand for crab meat since it is a delicacy among the people of Karnataka. Bulk of the crab catch landed here is consumed locally and a part of it is taken to nearby markets where it is sold at a premium. The landing price varies from Rs. 5 to 15 / kg depending on freshness, size and demand.

Growth, mortality and stock assessment

Growth in weight in relation to size (cw) is allometric with an exponential value nearer to 3 or more in adult crabs (Sukumaran and Neelakantan, 19966). The general growth pattern in these crabs can well be explained by the Von Bertalanffy's growth equation. The growth parameters estimated for males and females

of *P. sanguinolentus* and *P. pelagicus* to fit this growth model are presented in Table 2. The present status of the crab stocks was studied using Beverton and Holt yield-per-recruit (BHYR) model by Sukumaran and Neelakantan recently (1996). The vital parameters used as input in the study are given in Table 2.

For Karnataka waters, the annual average stock was 2106 tonnes (for these two species together) whereas the maximum sustainable yield (MSY) was estimated at 1343 tonnes by BHYR model which is very close to the annual average yield of 1335 tonnes for these crabs during 1991-93. The optimum level of effort, f(msy) for these crabs was estimated at 1190 tpd.

Conservation and management options

A recent study by Sukumaran and Neelakantan (1996d) indicated that male crabs are subjected to more fishing pressure as compared to that of females. However, since the current yield of males and females of these

Table 2. Population characteristics of *P. sanguinolentus* and *P. pelagicus* for Karnataka waters

	P. sanguinolentus male	P. sanguinolentus female	P. pelagicus male	P. pelagicus female
Auymptotic size, $L\alpha$ (mm)	195	188	211	204
Growth coefficient, Kyr^{-1}	0.99	0.82	1.4	0.97
Age at size zero, t_o (yr)	-0.013	-0.097	-0.019	-0.069
Life span (years)	2.5	2.5	2.5	2.5
Maximum observed size(mm)	169	166	174	171
Asymptotic weight, $W\alpha$ (g)	457.6	355.6	816.2	535.5
Size * at capture, I_c(mm)	72.5	82.5	92.5	97.5
Age at capture, tc(yr)	0.46	0.61	0.49	0.60
Size at recruitment, i_r (mm)	22.5	17.5	35..0	32.5
Age at recruitment, t_c (yr)	0.11	0.02	0.12	0.11
Mortality				
Total mortality, Z	4.2	3.9	5.6	4.8
Natural mortality, M	1.6	1.5	1.7	1.6
Fishing mortality, F	2.6	2.4	3.9	3.2
Exploitation ratio, E	0.62	0.62	0.70	0.67

*for size, carapace width is given

two species are very close to MSY level, it will be advantageous if the fishing effort is maintained at the present level itself to obtain biologically optimum yields.

Moreover, since the cod-end mesh is small (28-35 mm) a large quantity of juveniles of these crabs are retained by the trawl net which is detrimental to the crab stocks. As a conservation measure, the size at capture (1_c) should be increased by 20% by effecting an increase in cod-end mesh size by 20%. ie., from present 33 mm to 40 mm (mean) which in turn will optimise the yield. In addition, there is an urgent need to restrict the fishing effort at the 1991-93 level, ie., 1130 tpd as a management strategy to prevent overexploitation of these valuable resources in the coastal waters of Karnataka.

Need for further studies

Of late, there has been drastic reduction in the cod-end mesh size of shrimp trawls to a range of 10-24 mm along this coast. This will undoubtedly affect the fishery adversely as a large quantity of smaller juveniles are bound to be trapped in the net resulting in further fall in mean size and 1_c. To ascertain the magnitude of the damage caused to the stock by this reduction in cod-end mesh size, further studies have to be carried out based on more recent data collected from this area.

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