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Status of the Fishery and Resource Characteristics of Carangids along the Indian Coasts

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ABSTRACT

A consistent increase was observed in carangid production with minor fluctuations from a nominal 24,560 t in 1969 to 1,36,094 t in 2004 with a peak production of 1,96,832 t in 1995. Carangids were the third major pelagic resource constituting 5.5% of the total all India fish production next only to mackerel and oil sardine. The average annual catch of carangid was 1771.2, 4940.5, 922.6, 4199.5, and 1856.5 t at Veraval, Mangalore, Kochi, Tuticorin and Kakinada respectively. The small-mechanised trawl is the most effective gear in exploiting the carangids along both the coasts.

Among the several species, *Megalaspis cordyla* was the dominant species in both trawl and gillnet landings at all the Centres on both the coasts. *Decapterus russelli* is the most dominant species in trawl landings at all the Centres followed by *M. cordyla, D. macrosoma, Selar crumenophthalmus, Caranx para, C. carangus* and *Seleroides leptolepis*. In gillnet *M. cordyla* is the most dominant species followed by *Scombroides spp, Selar crumenophthalmus, Carangoides gymnostethoides, C. sexfasciatus, Elegatus bipinnulatus, S. tala* and *Alepes djedaba*. In purse seine landings *D. macrosoma* and *C. para* were dominant at Mangalore and *M. cordyla* and *A. djedaba* at Kochi. The growth parameters L μ, K, M, Z, F, E, U, annual yield, average annual stock and the standing stock for *D. russelli, D. macrosoma, S. crumenophthalmus* and *M. cordyla* from Kakinada and for C. *para* from Mangalore have been estimated. The exploitation rates indicate that *C. para, D. macrosoma* and *S. crumenophthalmus* are underfished and *M. cordyla* and *D. russelli* are fished just above the optimum level. This shows that there is scope to increase the production of the former three species.

Keywords : Carangids, trawl net, gill net, fishery

INTRODUCTION

Carangid resource is comprised of many species varying in size as small as the Seleroides leptolepis measuring 18 cm to as big as the leather jacket Chorenemus lyson measuring 200 cm. Carangid fishery is of considerable commercial and economic importance. Only a very few workers have studied the carangid fishery in India (Reuben et al., 1992, Nair, 1993, Sivakami et al., 1996; Kasim, 1999) and there are reports on the light fishing for carangids (Jacob Jerold Joel et al., 1987), emerging fishery of mackerel scad at Vizhinjam (Gopakumar and Thomas, 1991), unusual fishery of scad and Indian ruff (Yohannan and Balasubramanian, 1987) and of Selar crumenophthalmus (Nair and Pillai, 1987). Whereas, the growth, population dynamics and stock assessment of different dominant species have been reported by several workers Chacko and Mathew (1955), Kagwade (1971), Sreenivasan (1978, 1982), Ameer Hamsa and Kasim (1989), Kasim and Ameer Hamsa (1994) and Kasim (1999a & b and others). There has been a perceptible change in the catch composition due to ever-increasing fishing

pressure along the Indian coast over a period of time. Fishing down the food web (Vivekanandan et al., 2005) and ecosystem based studies have emerged as current field of importance to come out with appropriate applicable solutions on the effect of fishing. Present study on the biology, population dynamics and stock assessment of different component species is very much essential as the basic input for the above said studies of current importance.

MATERIAL AND METHODS

The data on the all India catch and species composition of carangids generated through multi stratum random sample method was obtained from the FRA Division, C.M.F.R.Institute. The data on the species composition, length frequency and biology of dominant species at different centres were obtained through weekly sampling. The weighted length frequency data were obtained by raising the basic data to the sampling day's catch and then to the month with respective raising factors. Weekly samples of dominant species were obtained from the landing centers for biological studies. The growth parameters L_∞ and K were estimated through ELEFAN I (Pauly and David, 1981). The natural mortality M was estimated as: $\log_{10} M = -0.0066-0.279 \log_{10} T$, where, T is the annual mean temperature (°C) of the water in which the stock in question lives (Pauly, 1983) and the total mortality rate Z was estimated by length converted catch curve analysis using LFSA package (Sparre, 1987). The exploitation ratio E was estimated as F/Z and the exploitation rate U by the formula $F/Z(1-e^{-z})$ and the annual average stock was obtained from the relation Y/U and the standing stock was estimated as Y/F.

RESULTS

Trend of the fishery

All India carangid production increased steadily with minor fluctuations from a nominal 24,560 t in 1969 to a phenomenal 1,96,832 t in 1995, but registered a decline to 1.10 lakh t in 2000 and then revived to 1.36 lakh t in 2004 **(Fig.1).** The main causes are the increased effort by the small-mechanized trawlers, introduction of purse seines and of late the introduction of small ring seines along the Kerala and Karnataka coasts. During 1998-2004, carangids were the third major pelagic resource constituting 5.5% of the total all India fish production next only to mackerel (8.7%) and oil sardine (7.6%). Carangid production by different maritime states varied from 713 t in Pondicherry (0.52%) to 53,038 t in Kerala (38.7%) on the main land and in the islands the catch was 66 t in Lakshadweep (0.05%) and 1455 t in Andaman and Nicobar islands (1.06%) **(Fig. 2).** The scads were single dominant group forming an average 27.7% of the total carangid production followed by horse mackerel (19.9%)

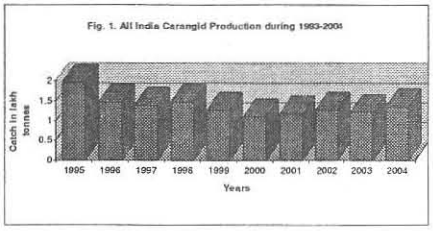
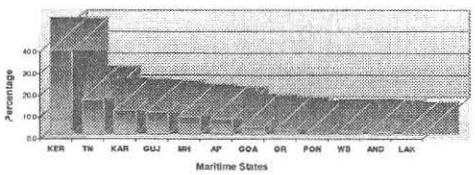


Fig. 2. Percentage Contribution by Different Maritime States to All India Carangid Production



and leather jackets (6.4%) and the rest (46%) was constituted by other carangids like the *Caranx spp., Atule spp., Alepes spp., Carangoides spp., Selar spp., Selaroides spp..* etc. Carangid production at Veraval, Mangalore and Kochi along the west coast and Tuticorin, Kakinada and Visakhapatnam alongthe east coast during 1999 – 2004 is given in **Table 1.** Along the west coast the catch fluctuated from 1232.3 t in 2003 to 2475 t in 2000 with an average annual catch of 1800.1 t at Veraval. At Mangalore the catch fluctuated from 4485 t in 2003 to 8883.4 t in 1999 with an average annual catch of 6644.9 t. At Kochi also the catch fluctuated from 586.3 t in 2003 to 1220.9 t in 2004 with an average annual catch of 972.3 t along the east coast, the catch varied from 3599 t in 2001 to 5068 t in 2000 with an average annual catch of 4202.1 t at Tuticorin. At Kakinada the variation in the catch was from 1303 t in 2001 to 2482.5 t in 1999 with an average catch of 1856.4 t and at Visakhapatnam the catch increased from 2533.2 t in 2002 to 5412.3 t in 2003 and then declined to 3901.3 t in 2004 with an average annual catch of 3948.9 t. The catch improved during 2004 at all the centres except Visakhapatnam (**Table 1).**

Table 1. Carangid landings at different observations centers along the west and east coast of India during 1999-2004

Year	Veraval	Mangalore	Kochi	Tuticorin	Kakinada	Visakhapatnam
1999	1335.5	8883.4	997.9	3985.4	2482.5	—
2000	2475.0	6392.0	917.0	5068.0	1784.0	—
2001	1976.0	6322.9	1028.9	3599.0	1303.0	—
2002	1836.5	6614.1	1083.0	4139.4	—	2533.2
2003	1232.3	4485.0	586.3	4205.7	—	5412.2
2004	1945.5	7127.0	1220.9	4215.0	—	3901.3
Average	1800.1	6644.9	972.3	4202.1	1856.4	3948.9

Gearwise catch trend

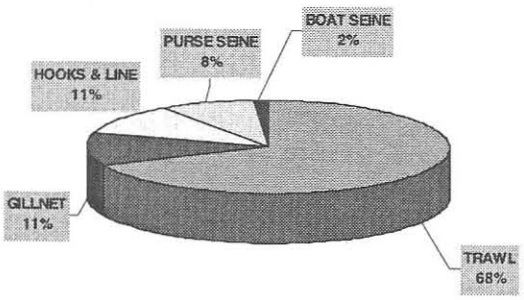
The gearwise catch composition reveals that the major portion of the catch was landed by trawl (68%), followed by gillnets and hooks &line (each 11%), purse seine (8%) and boat seine (2%) **(Fig. 3).** At Veraval the carangid landing increased both by trawl and gillnet by 55.7% and 44.1% respectively. At Mangalore, the catch declined by 0.21, 18.6, and 72.7% by trawl, gillnet and purse seine respectively, whereas, the catch by indigenous gear increased by 252.7%. At Kochi the trawl and ring seine catches declined by 51.9 and 96.3% respectively and that of gillnet and purse seine increased by 1.7 and 10.0% respectively. At Vizhinjam, the catch by all the gears registered a decline. The trawl, paruvalai and hooks & line catches increased by 14.4, 34.4 and 28.5% respectively at Tuticorin and that of podivalai declined by 18.2%. At Kakinada, the trawl catch increased

by 50.0% and that of gillnet decreased by 45.0%.

Trend in the effort input

The effort expenditure by trawl and gillnet increased by 3.9 and 9.0% respectively at Veraval. At Mangalore, the effort of purse seine and trawl increased by 4.6 and 13.9% respectively and that of gillnets declined by 3.5%. The effort of trawl, gillnet and ring seine increased by 3.5, 4.8 and 1.6% respectively and that of purse seine declined by 71.0% at Kochi. The effort of gillnet (1.5%) and boat seine (57.0%) alone increased and that of mechanised hooks & line (16.7%), non mechanised hooks & line (87.2%), chalavala (18.9%) and Konchvala (27.0%) declined. At Tuticorin the effort input by hooks & lines alone declined by 21.8% and that of trawl, *paruvalai* and *podivalai* increased by 3.5, 17.9 and 17.0% respectively. The trawl and gillnet effort declined respectively by 6.0 and 44.0% at Kakinada.

Fig. 3. Gearwise landings of carangid landings (%) in India (1999-2003)



Trend in the catch rate

The catch rates by trawl and gillnets increased by 49.9 and 32.1% respectively at Veraval. The catch rate by trawl, gillnets and purse seine declined by 12.4, 15.8 and 74.0% respectively at Mangalore. At Kochi the catch rate by trawl, gillnet and ring seine declined by 49.9, 1.9 and 94.8% respectively and that of purse seine alone increased by 39.3%. The catch rate of all the gears declined at Vizhinjam and it varied from 9.7% by chalavala to 86.1% by boat seine. The catch rate of trawl, *paruvalai* and hooks & lines improved by 10.6, 14.0 and

Table 2. Groupwise carangid landings during 1999-2004 in India.

Year	Horse Mackerel	Scads	Leather Jackets	Other Carangids	Total
1999	32679	32851	5646	55275	126451
2000	22178	25575	7335	55559	110647
2001	18982	40914	6957	50735	117588
2002	21280	38625	6238	60214	126307
2003	28674	28041	9040	56199	121954
2004	23101	38727	11994	62247	136069
Average	24474	34122	7868	56705	123169
Percentage	19.9	27.7	6.4	46.0	

64.6% respectively and that of podivalai declined by 30.3%. At Kakinada, the catch rates of trawl improved by 59.0% and that of gillnets declined by 2.0%.

Species composition

The groupwise species composition of all India carangid catch given in **Table 2** for the period 1999-2004 indicates that among the several species which support the carangid fishery the horse mackerel *M. cordyla* was the dominant individual species forming 19.9% followed by the group scads (27.7%), leather jackets (6.4%) and the rest 46% is constituted by other carangids. *M. cordyla* was landed in both trawl and gillnet landings at all the observation centers on both the coasts.

Table 3. The growth parameters, mortality rates, exploitation rates, annual average stock and standing stock of different dominant species of carangids.

CENTRE	SPECIES	L ∞ (mm)	K/yr	M	Z	F	E	U	YIELD (t)	AVERAGE ANNUAL STOCK (t)	STANDING STOCK (t)
MANGALORE	*Caranx para*	168.0	0.7	1.69	2.67	0.98	0.36	0.335	1823.2	5442.4	1860.4
KAKINADA	*D. russelli*	215.5	1.4	2.46	6.61	4.15	0.63	0.629	1557.7	2476.5	375.4
	D. macrosoma	220.0	2.05	3.14	5.95	2.81	0.47	0.469	358.2	763.8	127.5
	S.crumenophthalmus	280.0	1.05	1.89	3.40	1.51	0.44	0.425	177.2	416.9	117.4
	M. cordyla	710.0	1.4	1.76	4.26	2.5	0.59	0.582	125.8	216.2	50.3
KOCHI	*M. cordyla*	405	1.2	0.99	2.49	1.5	0.6	0.592	3524 Kerala	5952.7	2349.3
	D. russelli	245	1.1	1.07	5.35	4.28	0.8	0.792	1936 Kerala	2444.4	452.3
	S.crumenophthalmus	315	1.1	1.0	1.91	0.91	0.476	0.404	1284 Kerala	3178.2	1411

Decapterus russelli was the most dominant species in trawl landings at all the centers followed by *M. cordyla, D. macrosoma, Selar crumenophthalmus, Caranx para, C. carangus* and *S. leptolepis*. In gillnet *M. cordyla* is the most dominant species followed by *Scombroides spp, S. crumenophthalmus, C. gymnostethoides, C. sexfasciatus, E. bipinnulatus, S. tala* and *A. djedaba*. In purse seine landings *D. macrosoma* and *C. para* were dominant at Mangalore and *M. cordyla* and *A. djedaba* were dominant at Kochi.

Population dynamics and stock assessment

The growth parameters L μ, K/yr, natural mortality rate M, total mortality rate Z, fishing mortality rate F, exploitation ratio E, exploitation rate U, average yield, average annual stock and the standing stock for *D. russelli, D. macrosoma, S. crumenophthalmus* and *M. cordyla* from Kakinada; for C. *para* from Mangalore and for *M. cordyla, D. russelli* and *S. crumenophthalmus* at Kochi are given in **Table 3.** *D. russelli, M. cordyla* and *S.crumenophthalmus* have been studied at Kakinada and Kochi and the Lμ of these species differ from each other owing to the variation in the L_{max} of these species. The L μ of *D. russelli* and *S.crumenophthalmus* are smaller in Kakinada waters and that of *M. cordyla* was larger, whereas, the status of exploitation of these species are same in both the places as indicated by their exploitation rates. As seen from the exploitation rates, *C. para, D. macrosoma* and *S. crumenophthalmus* are exposed to lower fishing pressure. On the contrary *M. cordyla* and *D. russelli* are exposed to higher fishing pressure. This shows that there is scope to increase the production of the former three species.

DISCUSSION

In general, there is an increasing trend in the landings of pelagic fishery resources and currently it is 54% in 2004 (CMFRI, 2004). Review of earlier reports indicates that all India carangid production also reflects a similar increasing trend (Reuben et al., 1992, Nair, 1993, Sivakami et al., 1996; Kasim, 1999). Steady increase observed in the carangid production till recent past has now stabilized during the late 1990's and early 2000. The annual average carangid catch at Veraval has increased from 304.2 t during 1981-84 (Kasim, 1999) to 1800.1 t in 2004, mainly due to higher effort input and better abundance in the fishing grounds. At Mangalore and Kochi a declining trend is apparent mainly due to poor abundance of carangids in the fishing grounds as the effort input by trawl and purse seine was higher. Though the effort input by all the gears except purse seine increased, the catch declined due to poor abundance in all the fishing grounds except that of purse seine. Along the east coast the landings increased from 1256.3 t during 1984-87 (Kasim and Ameer Hamsa, 1994) to 4202.1 t in 2004 at Tuticorin due to better abundance and higher effort input by all the gears except hooks & line, whereas it decreased at Kakinada mainly due to decline in the effort input while the abundance of carangids was better.

Comparatively the northwest coast is more productive than the southwest coast and the east coast is moderately productive with regard to carangid production. The small mechanized trawl is the most effective gear in exploiting the carangids along both the coasts and the

contribution by this gear varied from 54.3% at Kochi to 98.5% at Kakinada. The other important gears are the drift gillnet, purse seine and hooks & line.

The concentration of nearly 90% of the mechanized vessels operation within 50m depth has caused a perceptible change in the succession of small pelagics in place of other larger species. The stocks of larger long living species with slow growth rates have declined and on the contrary the population of small, short lived, fast growing species have increased. Carangid being a group constituted more diverse species of small in size and faster growth (Sreenivasan, 1978, 1982; Kagwade, 1971; Reuben et al., 1992; Kasim and Ameer Hamsa, 1994; Kasim,1999 a & b) the production of this resource continued to increase and may be expected to increase further. Previous reports on the exploitation rates of *S. leptolepis, C. carangus* and *D.* russelli along east coast, *A. kalla, A. djedaba, M. cordyla* and *A. mate* along the west coast indicate that these species have been under fished during 1981-88 (Reuben et al., 1992; Kasim and Ameer Hamsa, 1994). Present study also indicate that *C. para, D. macrosoma* and *S. crumenophthalmus* are underfished and *M. cordyla* and *D. russelli* are fished just above the optimum level. This shows that there is scope to increase the production of the former three species. However, this expectation does not seem to be true owing to the ever-increasing fishing pressure on these resources. The fishery indicates either a saturation point or declining trend in some of the regions.

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