

**FISHERY AND BIOLOGY OF THE CARANGID FISH
MEGALASPIS CORDYLA (LINNAEUS) OFF COCHIN**

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ABSTRACT

The paper embodies the fishery and biology of the Horse mackerel *Megalaspis cordyla* off Cochin. West coast of India contributes to the bulk of the catches in All India landings. The species is caught mainly in trawls, drift gill nets and purse seine from the area and landed at Cochin Fisheries Harbour contributing upto 13.76% of the carangid landings of the centre. The catch of *M. cordyla* at Cochin forms upto 11.26% that of Kerala. Seasonally, at Cochin Fisheries Harbour, *M. cordyla* is caught during pre-monsoon (January - May), and post-monsoon period (October - November) in trawls, during monsoon and post-monsoon (May-December) in drift gill nets and only during September-October months in purse seine.

M. cordyla exhibits a food preference for fishes especially *Stolephorus* spp. The species has a prolonged breeding season extending from April to February with a peak during May to August, as has also been evidenced by Gonadosomatic index. Size at maturity of *M. cordyla* in both the sexes is 251-270 mm. Chi-square test of sex ratio showed an overall dominance of females in the population. Fecundity of the species ranged between 91854 to 324292. There was no significant difference in the length weight regression co-efficient in the two sizes. Therefore a pooled fit for both the sexes together was drawn as $\text{Log } W = -4.311030 + 2.687944 \text{ Log } L$.

INTRODUCTION

MEGALASPIS CORDYLA, popularly known as 'Torpedo trevally' or 'Horse mackerel' is an important carangid resource of Indian waters. This species which forms about 34.2% of the carangids, caught along Ratnagiri to the Gulf of Mannar area is reported to have tremendous scope for expansion of its fishery in the States of Karnataka, Tamil Nadu and Kerala (Rao *et al.*, 1977).

At Cochin Fisheries Harbour (09°57' N, 76°14' E) about 7.07% of the total marine landings is contributed by carangids of which *M. cordyla* constitutes 53 to 85% in trawl and

57% to 100% in drift gill net during different months (Sivakami *et al.*, 1994). Nevertheless, the species has not been studied for its fishery and biology from this centre, though similar attempts were made at Vizhinjam (Sreenivasan, 1975, 1978). The present work was therefore taken up to evaluate the fishery status of *M. cordyla* off Cochin with a note on some of its biological aspects.

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MATERIALS AND METHODS

The data for the present study was collected from Cochin Fisheries Harbour twice a week from July 1986 to March 1992. Details of catch, effort and catch per effort were computed based on a minimum of 10% of the boats landed on each observation day.

Contribution of *M. cordyla* to all India marine fish landings and to that of Cochin Fisheries Harbour was studied for the period 1981-90 based on the data collected by Fishery Resources Assessment Division, CMFRI, Cochin.

Samples of *M. cordyla* collected fortnightly during April 1991 to March 1992 were measured to the nearest mm and gm after which the maturity conditions were noted. Food and feeding habits of the species was studied using Index of preponderance method (Natarajan and Jhingran, 1961). Maturity stages were determined following the method adopted by Sreenivasan (1978) which is in agreement with the scale adopted by International Council for Exploration of sea (Lovern and Wood, 1937). Size at maturity was determined by grouping the gonads in different maturity stages into 10 mm size groups. Spawning season was ascertained by recording the percentage occurrence of gonads in various maturity stages every month. The gonadosomatic index (GSI) was determined following the formula

$$\frac{\text{Weight of gonad}}{\text{Weight of Fish}} \times 100.$$

Fecundity was worked out by raising the number of ova in a subsample of the ovary to its weight. The length-weight relationship was calculated by the method of least squares based on the formula

$$\text{Log } W = \text{Log } a + n \text{ log } L$$

TABLE 1. Statewise landings (in tonnes) of *Megalaspis cordyla* and its percentage contribution to total carangid landings during 1981-90

States	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	Total	%
West Bengal	—	—	—	47	—	—	—	—	—	17	64	0.07
Orissa	68	231	196	314	268	178	183	153	689	727	3007	3.43
Andhra Pradesh	275	708	810	764	535	454	1211	518	346	305	5926	6.76
Tamil Nadu	16	150	59	62	99	83	11	—	618	36	1134	1.29
Pondicherry	—	—	—	—	—	6	5	—	1	0	12	0.01
Kerala	55	921	398	188	91	1455	1265	4452	666	10928	20419	23.30
Karnataka	999	380	433	287	566	1638	2396	3867	1585	3805	15956	18.20
Goa	113	—	75	371	145	164	405	3980	721	2251	8225	9.38
Maharashtra	135	196	383	512	1167	4247	829	6505	5539	1928	21441	24.46
Gujarat	757	330	456	982	615	1636	990	1290	2289	2124	11469	13.08
Andamans	—	—	—	—	—	—	—	—	—	—	—	—
Lakshadweep	—	—	—	—	—	—	—	—	—	—	—	—
Total	2418	2916	2810	3527	3486	9861	7295	20765	12454	22121	87653	—
All India carangid landings	37345	40025	53012	58758	54703	135281	79963	126198	135606	141787	862677	—
% of Horse mackerel	6.47	7.29	5.30	6.00	6.37	7.29	9.12	16.45	9.18	15.60	10.16	—

Where W = Weight of the fish in gm, L = Length in mm, a = a constant and n = an exponent.

and Gujarat brought the bulk of the catch of *M. cordyla*. Of these, the States of Maharashtra with a total of 21441 tonnes (24.46%)

TABLE 2. Percentage contribution of *M. cordyla* to the total carangid landings (t) in different gears at Cochin Fisheries Harbour during 1981-'90

	Trawl		Drift gill net		Purse seine		Total	
	Total carangids	<i>M. cordyla</i>	Total carangids	<i>M. cordyla</i>	Total carangids	<i>M. cordyla</i>	Total carangids	<i>M. cordyla</i>
1981	22	—	125	5.6	397	4.28	544	4.41
1982	50	—	175	—	101	—	336	—
1983	143	—	208	—	405	0.25	756	0.132
1984	84	—	118	2.54	752	—	954	0.314
1985	208	—	136	0.74	37	2.70	381	0.525
1986	858	—	140	4.29	180	52.78	1327	7.61
1987	1161	0.95	145	1.38	138	61.59	1444	6.786
1988	2463	1.83	134	3.73	345	39.13	2942	6.29
1989	1949	2.98	86	9.38	138	5.79	2179	3.44
1990	4388	13.76	125	8.0	42	—	4555	13.48

TABLE 3. Catch per effort (kg/unit boat) of *M. cordyla* caught in different gears during different months in 1987-90 at Cochin Fisheries Harbour

	Trawl				Drift gill net				Purse seine			
	1987	1988	1989	1990	1987	1988	1989	1990	1987	1988	1989	1990
January	—	1.49	0.04	7.02	—	—	—	—	—	—	—	—
February	—	—	0.21	2.91	—	—	—	—	—	—	—	—
March	—	0.72	0.65	24.06	—	—	—	—	—	—	—	—
April	—	—	1.41	12.60	—	—	—	—	—	—	—	—
May	—	—	0.36	15.88	—	—	—	1.45	—	—	—	—
June	—	1.39	—	—	—	—	4.44	—	—	—	—	—
July	—	—	—	—	—	—	1.95	—	—	—	—	—
August	—	—	—	—	—	0.63	—	0.73	—	—	—	—
September	—	—	—	—	—	0.35	1.07	1.27	—	257.66	36.53	—
October	1.49	—	1.61	0.56	—	0.99	1.04	—	—	570.0	—	—
November	0.90	—	1.89	3.81	—	—	—	—	—	—	—	—
December	1.15	2.72	0.29	1.14	—	—	1.05	—	—	—	—	—

RESULTS AND DISCUSSION

Fishery

All India : It may be seen from Table 1 that maritime States bordering the west coast of India viz. Kerala, Karnataka, Goa, Maharashtra

brought the maximum landings followed by Kerala (20419 t; 23.30%), Karnataka (15956 t; 18.20%), Gujarat (11469 t; 13.08%) and Goa (8225 t; 9.38%).

Along the east coast, Andhra Pradesh brought the maximum catch of 5926 t (6.76%)

followed by Orissa (3007 t; 3.43%), Tamil Nadu (1134 t; 1.29%), West Bengal (64 t; 0.07%) and Pondicherry (12 t; 0.01%).

The contribution of *M. cordyla* to All India carangid landings ranged from 5.3% to 16.4% through 1981-'90, with a total percentage contribution 10.16%.

Cochin Fisheries Harbour : The percentage contribution of *M. cordyla* to the total carangid landings at Cochin Fisheries Harbour in different gears for the period 1981-'90 is given in Table 2.

In trawl net, *M. cordyla* which was totally absent upto 1986, had started contributing to the carangid landings, the percentage contribution increasing from 0.95 in 1987 to 13.76 in 1990. In drift gill nets, its contribution ranged from 0.74% in 1985 to 9.38% in 1989. On the other hand, in purse seine, the landings of *M. cordyla* formed upto 62% in 1987. An overall picture shows that in all the three gears together, the contribution of this species to total carangid landings showed a fluctuating pattern forming 4.41% in 1985, 7.61% in 1986, 3.44% in 1989 and 13.76% in 1990. However, during 1982 to 1984, the percentage contribution was nil or negligible.

The representation of *M. cordyla* in trawl, drift gill net and purse seine is indicative of its diurnal distribution pattern. According to Rao *et al.* (1978) true horse mackerel are found as dense vertically extended schools at or near the bottom during day when trawl net is operated and ascending to surface layers at night when they become vulnerable to drift gill net. In purse seines, operated during day time at a depth range of 16-20 m, smaller schools of *M. cordyla* is reported to be caught along with tuna schools (Dhulkhed *et al.*, 1982). It may also be pointed out that in hooks and line gears from this centre, carangids as a whole

and *M. cordyla* in particular are not well represented (Anon., 1986).

Seasonal distribution : The catch of *M. cordyla* in different gears during different months from 1987 to 1990 are given in Table 3. It may be seen from the Table that in trawls, it is caught during premonsoon period (January to May) and postmonsoon period (October and November) especially during 1989-'91 whereas in drift gill net, the species is mainly caught during monsoon and postmonsoon months (May to December). In purse seines, *M. cordyla*, represented only during 1988 and '89 was caught only during September and October. The restricted availability of *M. cordyla* in purse seine during September and October months probably coincides with the availability of schooling fishes in abundance especially at 20 m depth where this gear is operated during September to January period (Dhulkhed *et al.*, 1982).

Contribution of *M. cordyla* at Cochin Fisheries Harbour to that of Kerala : It may be seen from Table 4 that during 1981, with a total catch of 24 t, the landings of *M. cordyla* at Cochin Fisheries Harbour contributed to 43.64%

TABLE 4. Contribution of *M. cordyla* of Cochin Fisheries Harbour to that of Kerala

	Kerala (t)	Cochin Fisheries Harbour (t)	%
1981	55	24	43.64
1982	921	—	—
1983	398	1	0.11
1984	188	3	1.59
1985	91	2	2.20
1986	1455	101	6.94
1987	1265	98	7.75
1988	4452	185	4.15
1989	66	75	11.26
1990	10928	614	5.62

that of Kerala. However, during the subsequent years, the percentage contribution has decreased to a range of 0.11 in 1983 to 11.26 in 1989. Here, considering the higher percentage of 43.64 of 1981 as an exception attributable to the lesser landings of *M. cordyla* in Kerala, it may generally be surmised that the contribution of *M. cordyla* at Cochin Fisheries Harbour to that of Kerala ranged up to 11.26%.

TABLE 5. Food composition of *M. cordyla* using Index of preponderance method during 1991-92 (Ranks of food items in parentheses)

Food items	occurrence volume(ml)				
	01%	$V_i(\%)$	$V_1 01$	$\frac{V_1 01}{\sum V_1 01} \times 100$	
<i>Fishes</i>					
<i>Stolephorus</i> spp.	16.78	56.64	950.44	61.58	(1)
Silverbellies	3.85	11.31	43.54	2.82	(4)
Nemipterids	0.35	1.71	0.60	0.04	(11)
Flatfishes	1.40	0.21	0.29	0.02	(12)
Perches	0.70	0.35	0.25	0.02	(12)
Other fishes	18.88	8.97	169.35	10.97	(3)
<i>Crustaceans</i>					
Prawns	4.55	3.84	17.47	1.13	(5)
<i>Acetes</i> spp.	0.70	0.35	0.24	0.01	(13)
Cladocerans	0.35	0.04	0.01	—	
<i>Squilla</i> spp.	0.35	0.55	0.19	0.01	(14)
Alima larvae	1.05	0.90	0.94	0.06	(10)
Other crustaceans	7.00	2.22	15.54	1.00	(6)
<i>Molluscs</i>					
<i>Morula</i> sp.					
<i>Nucula</i> sp.	3.2	0.74	22.33	0.15	(8)
<i>Cavolina</i> sp.					
<i>Cephalopods</i>					
(squid juveniles)	1.43	1.97	2.82	0.18	(7)
<i>Others</i>					
detritus	3.5	0.52	1.82	0.12	(9)
Sand particles	1.05	0.04	0.042	—	
Digested matter	35.0	9.65	337.75	21.88	(2)
Total $\sum ni$	100	100	1543.28	100	

BIOLOGY

Food and feeding habits

Food composition : The qualitative and quantitative analysis of food items observed in *M. cordyla* are given in Table 5.

It may be seen that fishes mainly *Stolephorus* spp. formed the most preferred food item contributing upto 61.58%. Other fishes such as *Leiognathus* spp., *Nemipterus* spp., flatfishes and perches also were recorded occasionally. Prawns, *Acetes* spp., *Squilla* spp., Alima larva of *Squilla* and cladocerans were the important food items encountered. Molluscs as food item were represented by cephalopods (Squid juveniles) and other species like *Morula* sp., *Nucula* spp. and *Cavolina* spp. along with crushed shells. Besides detritus, sand particles and digested matter were also encountered in the gut contents of *M. cordyla*.

Food preference during different months : Percentage contribution of major food items of *M. cordyla* during different months from April 1991 to March '92 is depicted in Fig. 1.

It may be seen that *Stolephorus* spp. formed the most dominant food item during the months of September and November to March, while other fishes were present mainly during May to July and October to March. Crustaceans and molluscs formed occasional food items during April, June, August and February/March period.

A scrutiny of the food habits of *M. cordyla* shows that it is mainly a piscivore preferring *Stolephorus* spp., which forms about 62% of the diet. It has also been found that the occurrence of *Stolephorus* spp. in the diet coincides with the abundance of its landings at the centre (Fig. 1). Earlier observations by Sreenivasan (1978) on the food habits of *M. cordyla* at Vizhinjam also points to the fact that the availability of *Stolephorus* spp. in the

vicinity of the shoals of *M. cordyla* is the factor governing its preference by the latter. Further, according to Datar (1954) this species is a carnivorous feeder, feeding mainly on prawns, fish larvae, crustacean larvae, sagitta, etc., while Sreenivasan (1978), opines that *M. cordyla* prefers crustaceans next to *Stolephorus* spp. However, in the present case, it has been found that the species prefers

hand, at Cochin in hooks and line operated mainly for perches using hook No. 7 with smaller sharks, rays, sardine, etc. as bait (Menon and Joseph, 1969) carangids are poorly represented (Anon., 1986). The reason for this may be attributed to the selective fishing by hooks and line at Cochin mainly for perches. Nevertheless, it is felt that attempts may be made at Cochin area to exploit *M. cordyla* using hooks and line using *Stolephorus* spp.

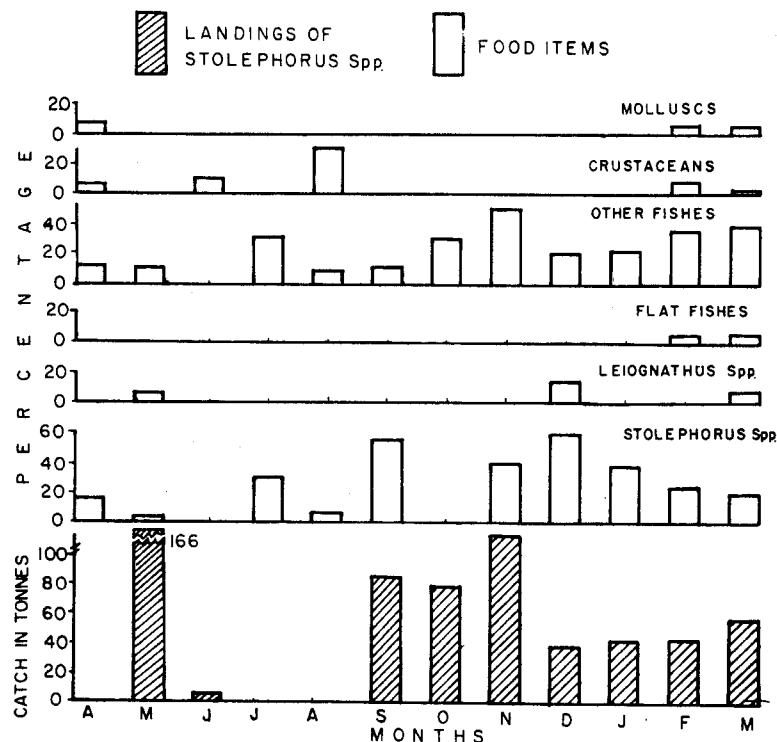


FIG. 1. Percentage composition of major food items of *Megalaspis cordyla* along with monthwise landings of *Stolephorus* spp. from Cochin Fisheries Harbour.

silverbellies and other fishes to prawns and other crustaceans (Table 5) indicating more of a piscivorous habit.

M. cordyla caught in hooks and line forms 56% of the species landed at Vizhinjam, Trivandrum (Luther *et al.*, 1982) where hook No. 14 is used with *Stolephorus* spp. as the main bait (Sreenivasan, 1978). On the other

as bait since line fishery can be made selective by choice of bait and size of hooks (Tait, 1972).

Breeding biology

Maturity stages : The gonads of *M. cordyla* were classified into the following maturity stages : I - immature (ovaries flat, leaf-like,

cream coloured, ova not yolked with a diameter range of 0.051 - 0.102 mm, testis thin, pale-cream coloured); II - maturing (ovary light yellowish with translucent ova, with size ranging upto 0.153 mm, testis flat, pinkish); III - maturing (ovaries thick, yellowish with ova yolk - laden within the size range upto 0.306 mm, testis flat, leaf-like, but slightly thick); IV - mature (ovaries oblong, yellowish with ova

(ovaries, flabby, dark yellowish with translucent ova of diameter upto 0.714 mm and a single oil globule of diameter range of 0.102 - 0.255 mm, testis dull whitish with lobules); VII - spent (ovaries in 3 sub stages - a. early spent - peashaped, shrunken, pale yellowish with ova diameter ranging between 0.204 - 0.352 mm; b. advanced spent - partially withered with blood vessels ramified having ova with

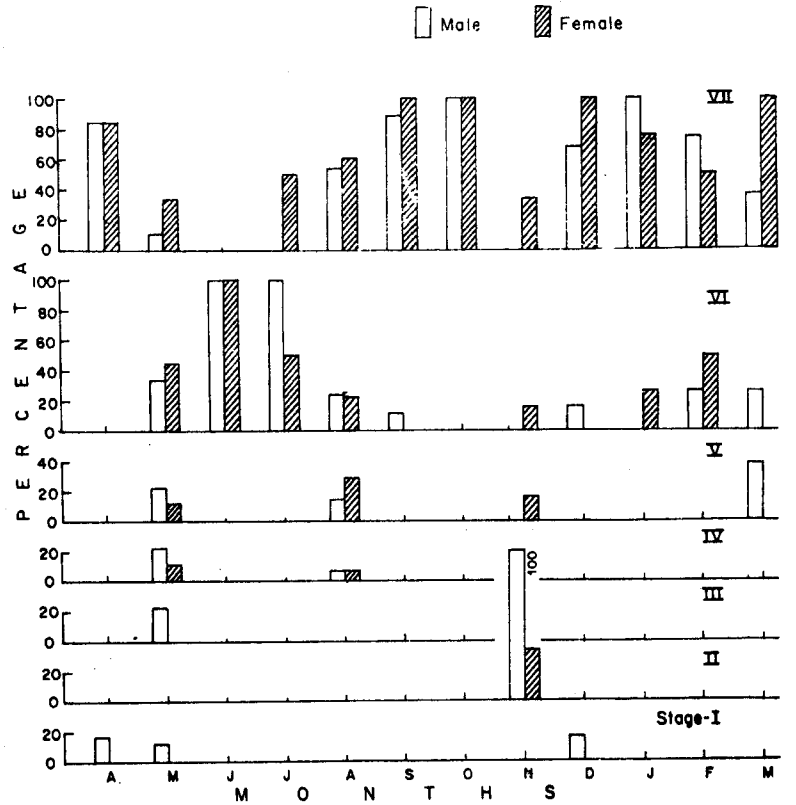


FIG. 2. Percentage frequency of godnads in different maturity stage of *M. cordyla*.

diameter ranging upto 0.408 mm, testis slightly swollen and pinkish); V - ripe (ovaries almost identical with stage IV except for the increased size, majority of the eggs fully yolk-laden with the diameter range upto 0.612 mm, testis flabby, cream coloured with lobules); VI - running

diameter range upto 0.153 - 0.306 mm; c. fully spent - dull brownish to pale with a hollow appearance, ova diameter ranging between 0.102 - 0.153 mm, testis light green coloured, withered and roughly 'V' shaped); II R - spent recovering (ovary pinkish with egg size ranging

upto 0.051 - 0.255 mm, testis in this stage was not obtained).

Spawning season : Percentage composition of gonads in different maturity stages in males and females during April '91 to March '92 is depicted in Fig. 2. It may be seen from the figure that the occurrence of gonads in stage I to IV was less frequent in both the sexes off Cochin. Nevertheless, ovaries in stage V formed 12% to 29% during May, August and November, while testis in this stage formed 14% to 38% during May, August and March. Females with gonads in stage VI were predominant during May to August and also

The occurrence of ovaries in stage VI during May to August and again in January to February and spent gonads during most of the months of the year is suggestive of a prolonged breeding season extending between April to February with peak breeding during May to August. The report on the larval abundance of *M. cordyla* along the Southwest coast of India from March to July with a peak in June (Premalatha, 1988) and during May - August along Cochin - Cape Comorin area (Anon., 1975) is in agreement with the present study.

The year round availability of spent gonads and the less frequent occurrence of gonads in

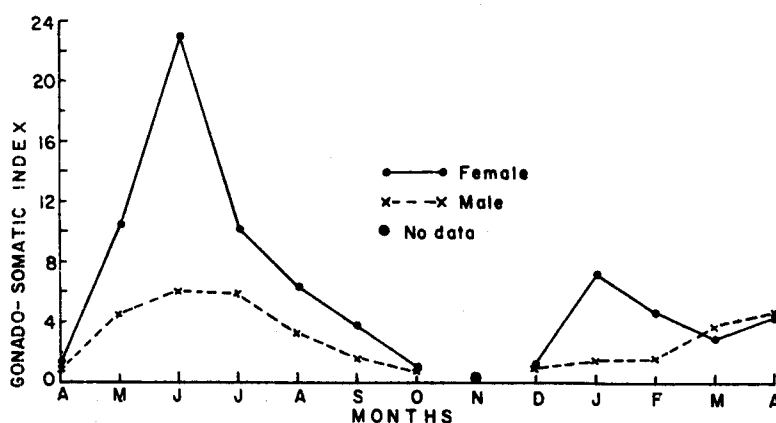


FIG. 3. Gonadosomatic index of male and female *M. cordyla*.

during November, January and February. Ovaries in this stage formed upto 100% during June. Testis in stage VI also were obtained during May to August, December, February and March. It is worth mentioning that gonads in spent stages were encountered during most of the months of the year forming upto 100% during September, October, December and March in females and during April, October and January in males.

stage I to IV along Cochin area deserves attention, since at Vizhinjam towards the southern part of Kerala, a reverse trend with more frequent occurrence of immature and maturing gonads and scanty occurrence of spent gonads of *M. cordyla* is reported (Sreenivasan, 1978). A scrutiny of the probable pattern of movement of shoals of *M. cordyla* along the southwest coast shows that maximum accumulation of Horse mackerel along the central and northern shelf areas of Kerala occurs during May - June (Rao *et al.*, 1978) which

is the peak spawning season of the species. The larval abundance of *M. cordyla* was maximum in Calicut region with moderate abundance in Cochin and Quilon region and minimum abundance in Cape Comorin was reported by Premalatha (1988). Further, according to Sreenivasan (1978), the dearth of adult Horse mackerel with stage IV - VI and the absence of planktonic eggs, larvae and postlarvae suggest that *M. cordyla* spawns far away from 5 km fishing zone of Vizhinjam. All these facts lead one to conclude that the probable breeding ground of Horse mackerel

higher values during May to September with the peak index of 23.8 recorded in females during June. This is in agreement with the peak season of spawning observed in the species.

Size at maturity : Specimens of *M. cordyla* collected during the study period were grouped into 10 mm sizes and the percentage of gonads in different maturity stages were assorted as immature (stage I), maturing (II - III) and mature (IV - VII) for males and females. The details are presented in Table 6.

TABLE 6. Size at maturity of male and female *M. cordyla*

Size groups (mm)	Males				Females			
	Numbers examined	Immature (I)	Maturing (II-III)	Mature (IV-VII)	Numbers examined	Immature (I)	Maturing (II-III)	Mature (IV-VII)
211-220	3	33.33	—	66.66	1	—	—	100
221-230	—	—	—	—	—	—	—	—
231-240	3	66.66	—	33.33	2	—	—	100
241-250	—	—	—	—	2	—	—	100
251-260	6	16.66	—	83.33	14	7.14	—	93.86
261-270	13	23.08	23.08	53.83	12	—	—	100
271-280	19	10.53	—	89.42	23	—	—	100
281-290	11	9.0	9.0	82.00	12	—	8.3	91.7
291-300	11	—	—	100	15	—	—	100
301-310	4	—	—	100	17	—	—	100
311-320	14	—	—	100	11	7	—	100
321-330	2	—	—	100	5	—	—	100
331-340	1	—	—	100	1	—	—	100
351-360	—	—	—	—	2	—	—	100
Total	86				118			

is towards the northern belt near Calicut with a moderate intensity at Cochin from where the spent fish migrate towards the south with gonads in spent recovering condition which form good percentage of the gonads examined at Vizhinjam (Sreenivasan, 1978).

Gonadosomatic index : It may be seen from Fig. 3 that both males and females show

It may be seen that in males, gonads in stages I, V and VII were represented from size group 251 - 260 mm onwards, with spent testis forming 53.83% of the specimens in the size group 261 - 270 mm. In females, however, since majority of the ovaries examined were in mature condition a clear demarcation could not be made. Nevertheless, in size group 251-

260 mm, of the specimens examined about 92.86% was in mature condition and therefore the size group 251 - 260 mm may be considered as the size at maturity in female *M. cordyla*. Therefore, it may be concluded that both the sexes of *M. cordyla* attains maturity in the size range of 251 - 270 mm at Cochin.

TABLE 7. Chi-square test for *M. cordyla* in monthly samples during 1991-92

	Male	Female	Total	χ^2
April '91	17	16	33	2.03
May	11	9	20	0.20
June	2	6	8	2.0
July	2	8	10	2.42
August	13	16	29	0.32
September	7	3	10	1.6
October	2	4	6	0.67
November	2	6	8	2.0
December	6	10	16	1.0
January '92	1	7	8	4.5*
February	4	16	20	7.2*
March	8	8	16	0.0
pooled	75	109	184	6.28*

* significant at 5% level

Sex ratio : Monthly ratio of male and female *M. cordyla* during the period 1990-'91 along with the Chi-square values are given in Table 7. It could be seen that females were significantly dominant only during January and February months. However, the pooled data for the year showed a Chi-square value of 6.28 which was significant at 5% level thereby showing an overall dominance of females in the population.

Fecundity : Ripe ovaries from 13 specimens of *M. cordyla* ranging in total length from 295 to 360 mm were used for this study. The number of ova per gram weight of mature ovary ranged from 9120 to 20100 with an average of 12388. The number of ova per gram body weight (fecundity factor) ranged from 306 to 1069, the average being 717. The total fecundity ranged between 91854 to 324292.

Length-weight relationship : The length-weight relationship was studied based on 89 males ranging in length from 213 to 335 mm and in weight from 107 to 320 gm and 118 females

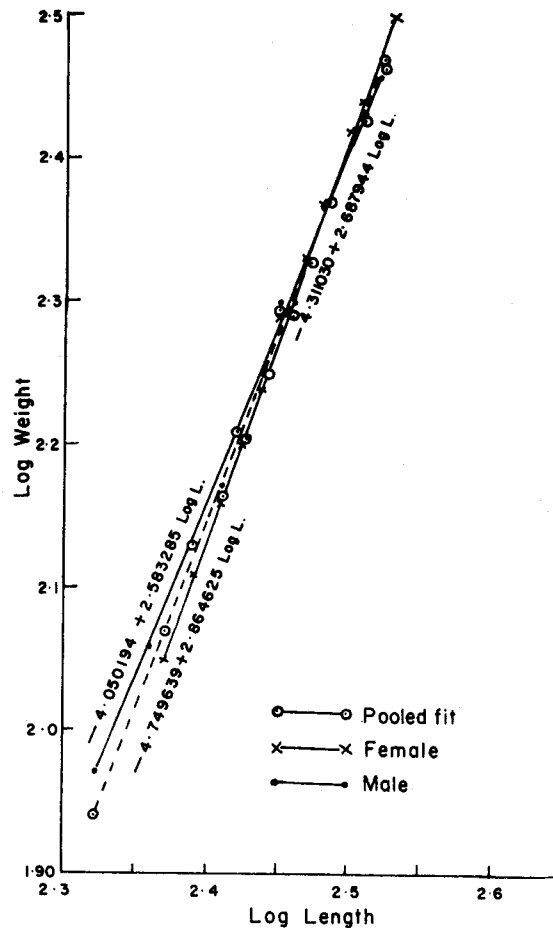


FIG. 4. Length-weight relationship of *M. cordyla*.

with a length range of 236 - 360 mm and weight range of 112 to 455 gm. They were grouped into 10 mm size groups for deriving the equation. The equation for males and females are : Males $\text{Log } W = -4.050194 + 2.583285 \text{ Log } L$ ($r = 0.962795$) and Females $\text{Log } W = -4.749639 + 2.864025 \text{ Log } L$ ($r = 0.993228$) (Fig. 4).

TABLE 8. Analysis of covariance of male and female *M. cordyla* off Cochin

	d.f. (n-1)	Σy^2	Σx^2	Σxy	$b = \frac{\Sigma xy}{\Sigma x^2}$	Reg. ss $b \Sigma xy$	Deviation from ss $\Sigma y^2 - b \Sigma xy$	d.f. (n-2)
Male	10	0.27352	0.03799	0.09814	2.583285	0.25352	0.02000	9
Females	10	0.20645	0.02482	0.0711	2.864625	0.20367	0.00278	9
					Individual regression Total		0.02278	18
Pooled (within)	20	0.47997	0.06281	0.16924	2.69447	0.45601	0.02396	19

TABLE 9. Tested of significance of equality of regression coefficient of *M. cordyla*

Source of variation	d.f.	SS	MSS	Cal.F.	Inference
Average regression	19	0.02396	0.0012610		Not significant at
Individual regression	18	0.02278	0.0012655	0.932437	5% level
Deviation	1	0.00118	0.00118		

The data subjected to analysis of covariance (Snedecor, 1961) showed that there is no significant difference in the 'n' values (calculated F ratio = 0.932437 on 1, 18;

Table 8, 9). Therefore, a common equation was fitted for both the sexes together as : $\text{Log } W = -4.311030 + 2.687944 \text{ Log } L$ ($r = 0.974293$).

REFERENCES

- ANON. 1975. UNDP/FAO pelagic Fishery Project. Progress Report, 18 : 22.
- . 1986. Marine Fish production in India 1983-84 and 1984-85. *Mar. Fish. Infor. Serv., T & E Ser.*, 67 : 31.
- DATAR, G. S. 1954. The food and feeding habits of *Caranx rotterli* (Cuv. & Val.). *Proc. 41st Session Indian Sci. Congr.*, 3 : 181.
- DHULKHED, M. H., C. MUTHIAH, G. SYDA RAO AND N. S. RADHAKRISHNAN 1982. The purse seine fishery off Mangalore (Karnataka). *Mar. Fish Infor. Serv., T & E Ser.*, 37 : 4.
- LOVERN, J. A. AND H. WOOD 1937. Variations in the Chemical composition of herring *J. Mar. Biol. Assoc. U.K.*, 22 : 231-293.
- LUTHER, G., P. N. RADHAKRISHNAN NAIR, G. GOPAKUMAR AND K. PRABHAKARAN NAIR 1982. The present status of small-scale traditional fishery at Vizhinjam. *Mar. Fish. Infor. Serv. T & E Ser.*, 38 : 1-16.
- MENON, M. D. AND K. M. JOSEPH 1969. Development of Kalava (Rock cod) fishery off the Southwest coast of India - a prospectus. *Seafood Export Journ.*, 1 (2) : 7-28.
- NATARAJAN, A. V. AND V. G. JHINGRAN 1961. Index of preponderance. A method of grading the food element in the stomach analysis of fishes. *Indian J. Fish.*, 8 : 54-59.
- PREMALATHA, P. 1988. Studies on the Carangid fish larvae of the Southwest Coast of India. 1. *Megalaspis cordyla* (Linnaeus, 1750). *J. mar. biol. Ass. India.*, 30 (1 & 2) : 83-92.
- RAO, K. V. N., M. KUMARAN AND J. SANKARA-SUBRAHMANIAN 1977. Resources of Horse mackerel off the Southwest Coast of India. *Seafood Export Jour.*, 9 (8) : 9-28.
- SNEDECOR, G. W. 1961. *Statistical methods*. Oxford and IBH Publishing Co., Calcutta, Bombay, New Delhi.

SREENIVASAN, P. V. 1975. Observations on the food and feeding habits of the Torpedo Trevally *Megalaspis cordyla* (Linnaeus) from Vizhinjam Bay. *Indian J. Fish.*, **21** (1) : 76-84.

——— 1978. Observations on the fishery and biology of *Megalaspis cordyla* (Linnaeus) at Vizhinjam. *Ibid.*, **25** (1 & 2) : 122-146.

SIVAKAMI, S., T. V. SATYANANDAN AND P. K. SEETHA 1994. On the carangid fishery off Cochin with a note on the biology of *Decapterus russelli* (Ruppell). *Ibid.*, **41** (3) : 33-42.

TAIT, R. V. 1972. *Elements of Marine Ecology*. London, Butter worth. pp. 218.