J. mar. biol. Ass. India, 1988, 30 (1 & 2) : 83-92

STUDIES ON THE CARANGID FISH LARVAE OF THE SOUTHWEST COAST OF INDIA — I. *MEGALASPIS CORDYLA* (LINNEAUS, 1758)

P. PREMALATHA
Integrated Fisheries Project, Cochin-682 016

ABSTRACT

Studies on the larvae of *Megalaspis cordyla* along the southwest coast of India were carried out based on the plankton collections of UNDP/FAO/Pelagic Fishery Project, Cochin during September 1971 to 1975. The larvae of *Megalaspis cordyla* contributed 20% of the total carangid fish larvae. Larvae were identified on the basis of meristic and morphometric characters of the adults. Larval characters of selected stages were described. An attempt was also made to study the seasonal abundance and area of distribution of the larvae and to correlate the same with hydrographic parameters.

INTRODUCTION

INVESTIGATIONS on fish eggs and larvae were initiated during the later half of the 19th century with the intention of knowing the identity of the spawn products and to study the early life history of the commercially important fishes. Later on, attention was further extended to acquire more knowledge on the quantity of eggs laid and the number of larvae survived. Holt (1893) initiated the study on the structure of eggs and larvae of European carangid *Caranx trachurus*. Delsman (1926) made the pioneer attempt on eggs and larvae of the Indo-Pacific region.

Eggs and early stages of some species of carangids from the southwest coast and lower east coast of India have been described by Devanesan and Chidambaram (1941), Chidambaram (1943), Gopinath (1946), Chacko (1950), Bapat and Prasad (1952), Nair (1952), Chacko and Mathew (1955), Vijayaraghavan (1957), Basheeruddin and Nayar (1962), Rao (1963), Subrahmanyam (1964), Rao and Girijavallabhan (1973), and Venkataramanujam and Ramamoorthy (1974).

The study on the larvae of *M. cordyla* is highly significant, since this species is one of the most important group in the commercial fishes. Early life history of *M. cordyla* has not been fully investigated. Kuthalingam (1959) described partially the life history and feeding habits of larvae of *M. cordyla* and *Caranx mate*. Basheeruddin and Nayar (1962) reported the occurrence of juveniles of *M. cordyla* along with other carangids from the coastal waters off Madras.

I wish to express my deep sense of gratitude to Prof. Dr. C. V. Kurian, Retired Professor and Head of the Department of Marine Sciences, Cochin University of Science and Technology for guiding me in this work and for the valuable suggestions. The above work was carried out in the Pelagic Fishery Project as a part of the UNDP/FAO programme during 1974-77 period in partial fulfilment of the Ph.D. Degree of the University. I take this opportunity to thank the authorities for the same. I am also grateful to the Director, Integrated Fisheries Project, Cochin-16 for granting permission to work as a part time research scholar, while being employed as a regular staff of the project.

Material and Methods

The material studied are from the regular plankton collections of UNDP/FAO/Pelagic Fishery Project at Cochin from a wide area extending from Ratnagiri to Cape Comorin and also Tuticorin for a period of 4 years (September 1971 to September 1975). Samples were collected from fixed profiles (Fig. 1). Programmes of collections were charted in such a way that each station covered once in every six or seven week's time and from each station data regarding hydrography as well as plankton were collected. The Research Vessels 'Rastrelliger' and 'Sardinella' were deployed for the investigation. Collections were

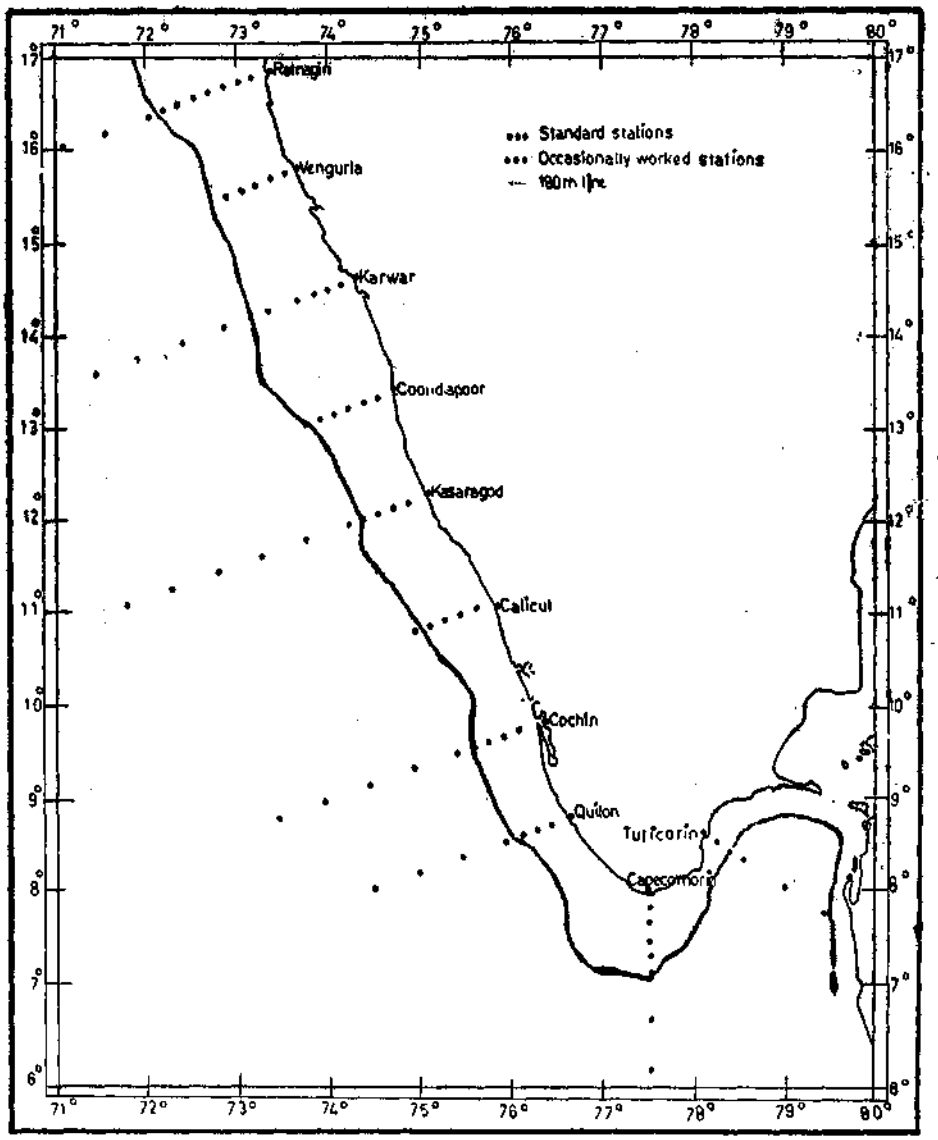

Fig. 1. Sampling stations along the southwest coast of India.

made by continuous oblique hauls by Bongo nets (20 cm and 60 cm ring diameter with 0.505 mm meshes) while the ship moved at a speed of 2-3 knots. Out of the 1284 plankton stations worked, 2686 samples were collected during the period of survey. The samples were preserved in 4% neutral formalin prepared in sea water.

In general, larvae were identified on the basis of meristic and morphometric characters of the adults. The methods, measurements and nomenclature used in the identification of larvae were mainly that of Schmidt (1905), Delsman (1926), John (1951), Ahlstrom and Ball (1954) and Vatanachai (1974). Alizarine technique was also used to study the osteological and meristic features of the larvae.

About 115 plankton samples contained a total of 660 larvae and post-larvae measuring from 2.2 mm to 12.5 mm in length (Table 1). From 35 pelagic trawl collections 150 juveniles measuring upto 40 mm were also included in the study. Larval characters of selected stages are described in detail.

2.2 *mm stage* (Fig. 2 a)

Larva with a blunt head and rather short and broad body. Upper jaw margins serrated, with distinct teeth. Branchiostegals absent. Two rows of pre-opercular spines visible, first row with 5 minute spines and the second with 3 moderately elongated spines, of which the middle one being the longest. Fin folds present on dorsal and ventral sides of the body. Gill filaments begin to form. Supra occipital crest present. Myotome number 10+14 closely arranged toward caudal end. A wide chromatophore present in between the eleventh and twelfth myotome on dorsal margin of the body, little anterior to it a small chromatophore present. Along the ventral side, post anal pigments present upto caudal tip. Region of

TABLE 1. *Average body measurements (mm) of the larvae*

Size range in (TL)	No. of specimens	Standard length	Head length	Eye diameter	Snout to anus	Depth
2.1— 2.5 ..	98	2.0	0.8	0.2	1.3	0.5
2.6— 3.0 ..	91	2.5	1.0	0.3	1.6	1.0
3.1— 3.5 ..	64	2.8	1.2	0.3	2.0	1.1
3.6— 4.0 ..	66	3.1	1.3	0.4	2.1	1.2
4.1— 4.5 ..	42	3.8	1.4	0.4	2.4	1.4
4.6— 5.0 ..	40	4.1	1.5	0.4	2.7	1.7
5.1— 5.5 ..	28	4.5	1.8	0.6	3.0	1.9
5.6— 6.0 ..	28	5.2	2.0	0.6	3.4	2.2
6.1— 6.5 ..	40	5.6	2.1	0.6	3.4	2.3
6.6— 7.0 ..	35	5.8	2.2	0.7	3.6	2.5
7.1— 7.5 ..	24	6.5	2.7	0.9	4.0	3.0
7.6— 8.0 ..	13	6.7	2.8	0.9	4.0	3.0
8.6— 9.0 ..	3	7.5	3.0	1.1	4.6	3.1
9.1— 9.5 ..	3	8.7	3.5	1.2	5.0	3.7
9.6—10.0 ..	2	8.9	3.5	1.3	5.5	3.7
10.1—10.5 ..	20	9.0	3.7	1.3	5.5	3.7
10.6—11.0 ..	19	9.2	3.8	1.3	5.5	3.8
11.1—11.5 ..	10	9.4	3.8	1.4	5.5	3.9
11.6—12.0 ..	7	9.7	3.9	1.4	5.5	4.0
12.1—12.5 ..	12	10.0	4.0	1.5	5.5	4.2
12.6—13.0 ..	15	10.3	4.0	1.5	5.5	4.3

DESCRIPTION OF DEVELOPMENTAL STAGES

Larvae of *M. cordyla* outnumbered all the rest of the group in percentage of abundance, contributing to 20% of the total carangid fish larvae. It has been possible to obtain a continuous series of larvae, post-larvae and juveniles.

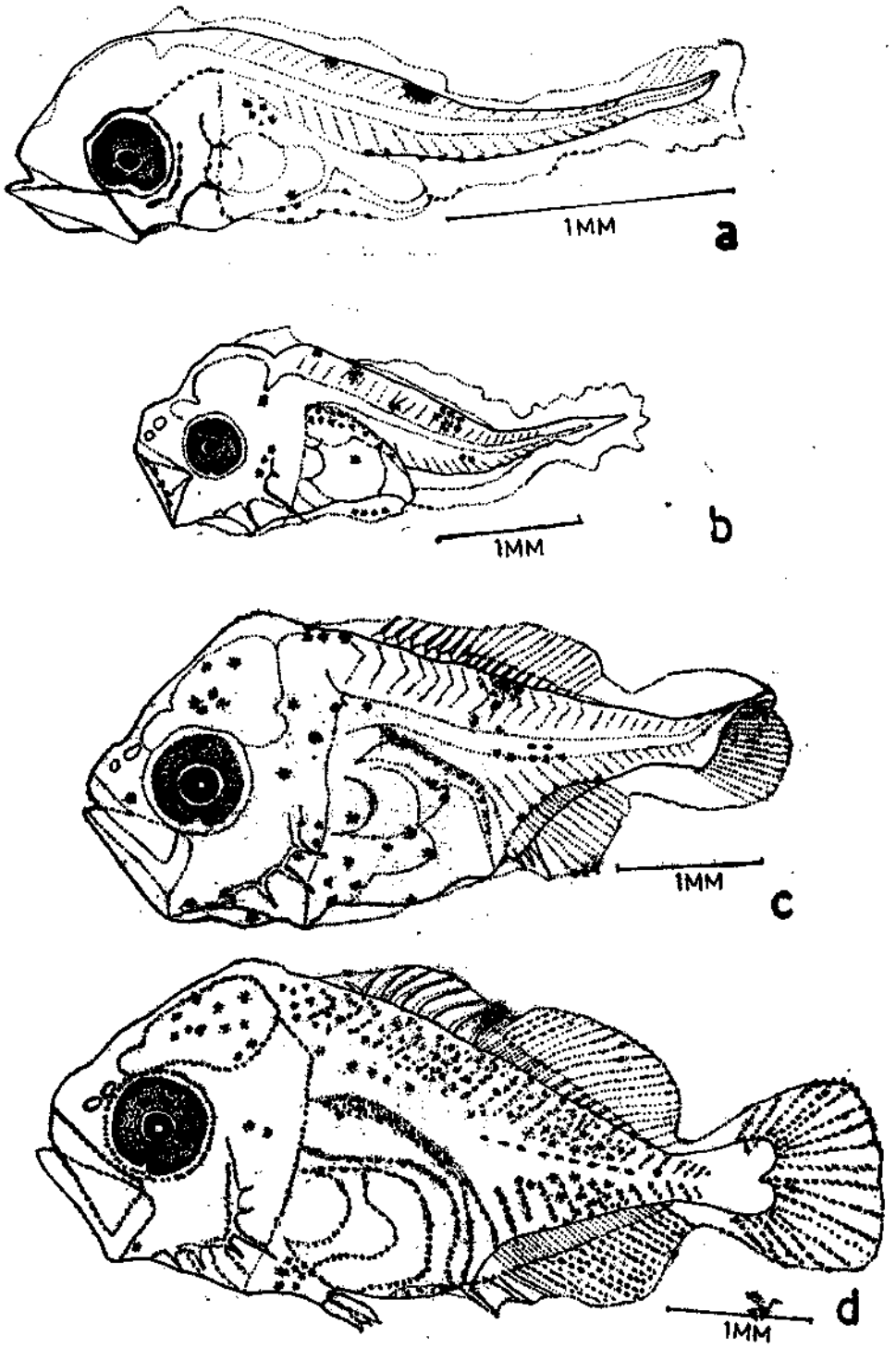

FIG. 2. Larval stages of *Megalaspis cordyla* : a. 2, 2 mm, b. 3,7 mm, c. 5.1 mm and d. 7,0 mm.

air bladder with few pigment spots. So also the ventral margin of the stomach region with pigments in a line. Pectoral fin buds with a flat base.

3.7 *mm stage* (Fig. 2 b)

Slightly serrated supraoccipital crest present. Branchiostegals 7 in number. Fin folds present on both the sides. Caudal tip with a flexion or bent on ventral side, urostyle slightly turned upwards. Only upper jaw margin serrated. Two small spines at the tip of cliethrum, the upper one shorter than the lower. Slight notch on head in front of the nostril. Two chromatophores on the posterior lobe of occipital and the region just above the pre-opercle. Pigmentation in two blotches on dorsal side and spread toward lateral sides. Roof of the body cavity and ventral margin of the stomach with thick pigments. Single dash line of pigment on lateral mid line appears at this stage, below which the post anal pigment lies. Line of pigment on the lower jaw bones quite distinct.

5.1 *mm stage* (Fig. 2 c)

Fin rays develop rapidly at this stage. Spines and ray basals are differentiated, but rays not separated. Six spine bases and thirteen rays on dorsal side and twelve rays on anal fin are clear at this stage. Anal spines not clear. Rays are yet to be formed hence fin folds on sides. Urostyle turned upwards. Pre-opercular spines seven in lower margin, fourth one in the corner being the longest. Upper margins with seven minute spines. No teeth on lower jaw margin. Scattered chromatophores on almost all parts, except on caudal region. Occipital region and its posterior part with many chromatophores.

7 *mm stage* (Fig. 2 d)

Pre-opercular margin with double serrations. Nine spines in lower margin, 6th one at the corner longest. Alternating the lower ones above are eight minute spines on the upper row. Two small teeth appear on the lower jaw. Gills 4, filaments more in the middle ones. Lower and upper gill arches with rudimentary filaments. Dorsal spines VIII, I, 16-17 rays. Anal spines II, I, 15-16 rays, Pectoral 14-15 rays. Caudal with 9+8 rays. Interspinous membranes slightly pigmented. Body pigmented all over. Dorsal pigment upto eighteenth myotome. Post anal pigment upto caudal tip. Snout, pre-opercle and stomach region with few scattered pigments superficially.

8.0 *mm stage* (Fig. 3 a)

D. I, VIII, I, 18, A.II, I, 15-16. V.5, P. 15-16. Pre-opercular spines nine in number, upper row with minute serrations. Superficial pigments more on trunk region. Stellate chromatophores on occipital and punctate forms on interspinous membrane. Five pigment dots along the margin of lower jaw. In between the eye orbit and pectoral are the punctate and reticulostellate pigments. Caudal peduncle and the base remain without any pigments until the fin formation is complete. Dorsal pigment is more upto the last ten to twelfth myotome region, whereas the lateral mid line pigment extends upto the last sixth myotome.

10.3 *mm stage* (Fig. 3 b)

Teeth distinct on both jaws. More spines on pre-opercle (7+5). Lateral line arch not clear. Few of the fin rays on the posterior side of soft dorsal and anal with thick bases. Body thickly pigmented all over except the caudal portion (last seven myotome region). Three chromatophores on caudal base. Spiny dorsal fin with black pigmented membrane.

14.0 *mm stage*

D.I, VIII, I, 18, A.II, I, 15. Lateral line arch straightened below the middle portion of the 1st dorsal fin. Fin rays branched at its tip posteriorly. Pre-opercular spines present. Procumbent spines on dorsal side directed anteriorly. Straightened part of lateral line with 40-45 minute scutes. Caudal base with pigments. Only last six vertebral region free of pigment. Other portions with brownish black pigments.

19.0 *mm stage* (Fig. 3 c)

Posterior 9 rays on dorsal fin and 8 rays on anal fin with thick bases in the form of finlets. Pre-opercular spines much reduced than in the previous stage, 2 anal spines separated from the anal fin. A small spine at the corner of the pre-opercle present. straightened portion of lateral line with 48-50 scutes. Finlets are free. Only the caudal end and snout region with less pigments.

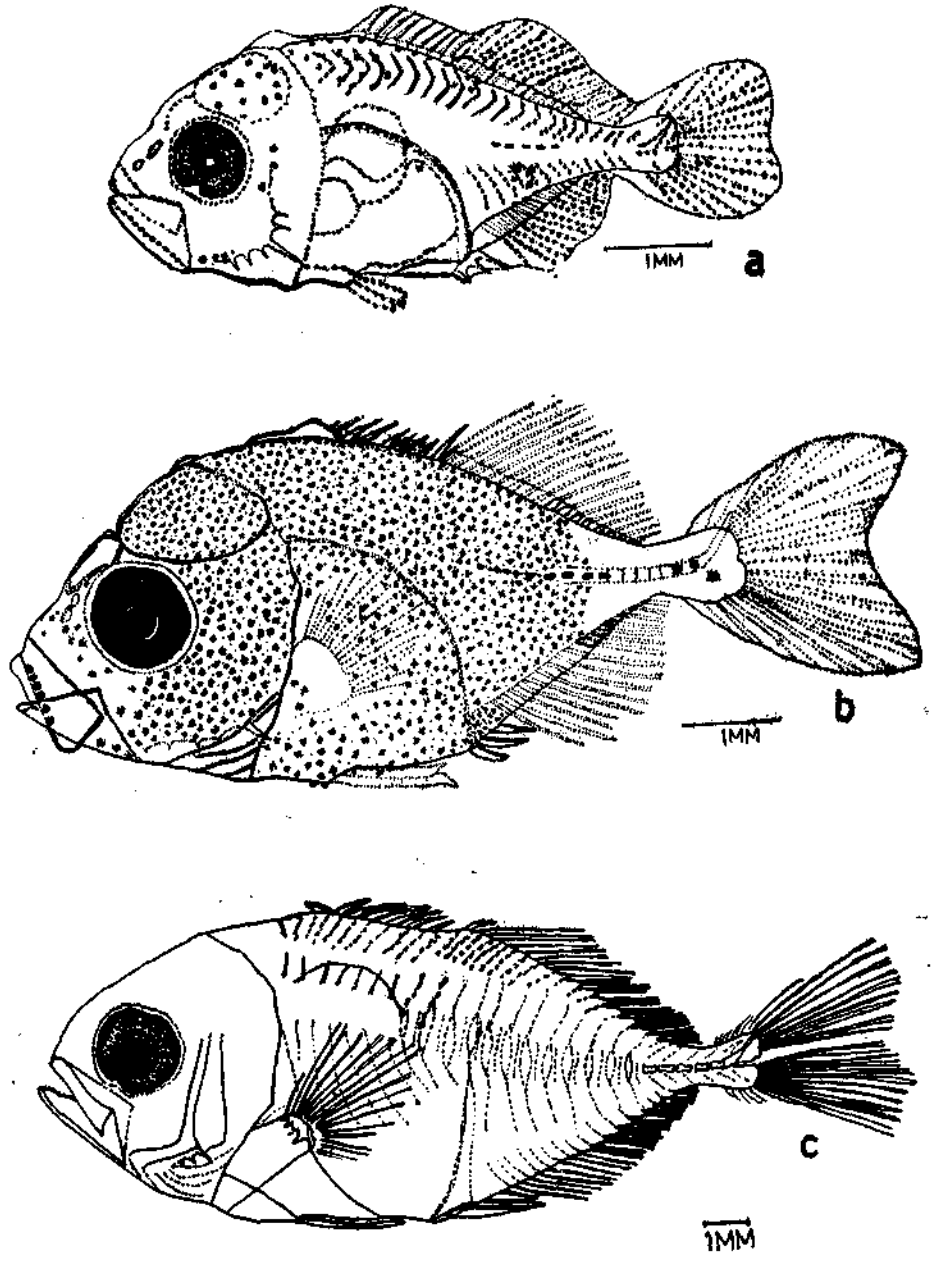

FIG. 3, Larval stages of *Megalaspis cordyla*: a. 8.0 mm, b. 10.3 and c. 19. 0 mm,

Distribution of Larvae

It has been observed that larval occurrence is directly related to seasonal variations. In the case of *M. cordyla* there is an increase in the abundance of larvae from March onwards and reaches a maximum in the month of June. (Fig. 4 a) when nearly 50% of the larvae were collected. From July to September a decrease in value was noticed. Here the season fall with the south west monsoon. The effect of temperature on larval distribution showed that maximum number of larvae was obtained at a temperature range of 29.00°C to 30.00°C, which coincide with the season March to June (Fig. 4 b).

The areas where the density of larvae was more correspond to the region of more productivity (Anon., 76) Larvae of *M. cordyla* occurred in most part of the shelf. Relatively high core densities were located between the latitudes 10°00'N to 12°00'N and also between 16°00'N to 17°00'N. Larval abundance was maximum

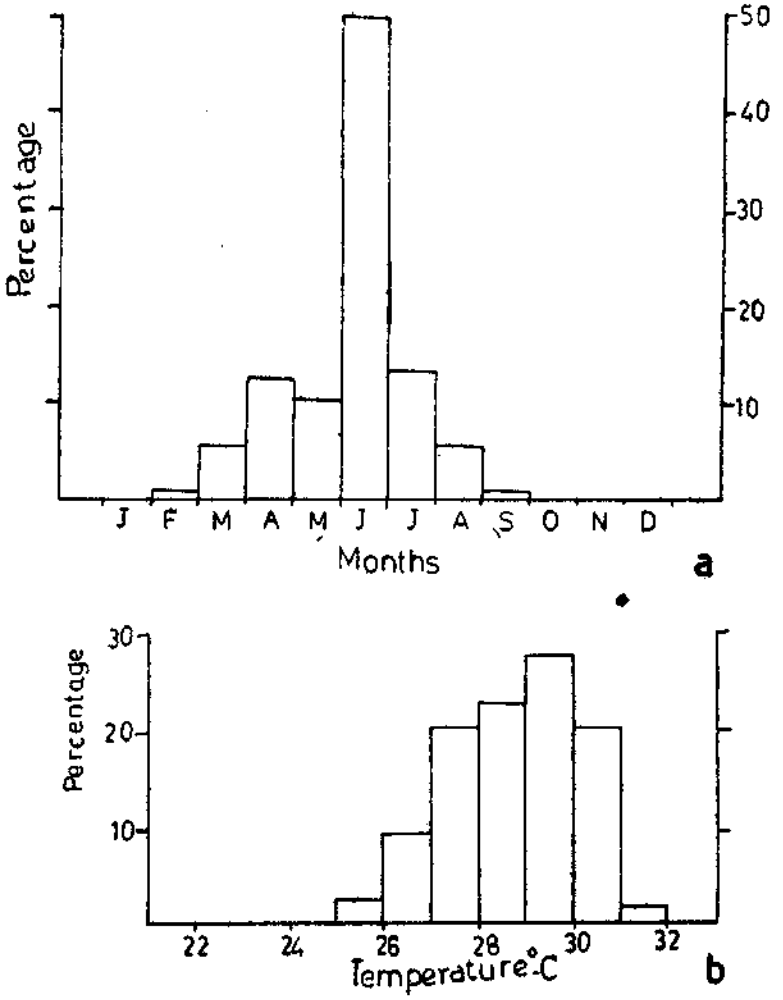

Fig. 4. a. Monthwise abundance of the larvae of *M. cordyla* from 1972 to 1975 and b. effect of temperature in the distribution of the larvae of *M. cordyla*.

in Calicut region (48.6%), Single collection from a shelf station off Calicut contained good number of just hatched and young stages of *M. cordyla* between 2.0 to 3.5 mm length. Karwar was the next area of abundance (11.4%). Kasaragod and Ratnagiri in the north and Cochin and Quilon in the south were found to be the areas of moderate abundance. Larval occurrence of this species was minimum in Cape-Comorin and Tuticorin area (Table 2).

TABLE 2. *Total number of* M. cordyla *larvae obtained from different profiles during* 1971 *to* 1975

Area	Total hauls	Hauls with carangid fish larvae	*M. cordyla* larvae numbers
Tuticorin ..	77	36	2
Cape Comorin ..	141	75	2
Quilon ..	173	85	71
Cochin ..	236	98	64
Calicut ..	55	24	321
Kasaragod ..	176	79	60
Coondapur ..	7	7	23
Karwar ..	206	67	75
Vengurla ..	5	3	0
Ratnagiri ..	208	57	42

For charting out the annual pattern of horizontal distribution and abundance, the average larval numbers per M^2 for each station in different sections were worked out. It was seen that larval concentrations were maximum in 20-50 mile stations. No larva was obtained from near shore stations. High density values were encountered in the shelf edge of Calicut and Ratnagiri area (Fig. 5).

Usually certain planktonic organisms show diurnal migration. In order to find out any changes in day and night collections larvae were segregated. It was found that *M. cordyla* larvae were more in day collections. 42% of the collections were made at day time and nearly 66% of *M. cordyla* larvae were present in day collections. Though 58% of the sampling were done at night only 34% of larvae were obtained. Russel (1928) observed that not only different species react differently but different stages of development and the sexes also have their own characteristic behaviour with respect to diurnal migration (Table 3).

TABLE 3. *Day and night collections of* M. cordyla *larva*

Year	Station worked		Number of larvae	
	day	night	day	night
1972 ..	15	19	54	65
1973 ..	18	24	355	102
1974 ..	7	5	13	9
1975 ..	13	25	15	47
Total ..	53	73	437	223

DISCUSSION

Among carangids major genera contributing to the fishery were *Megalaspis*, *Decapterus*, *Alepes*, *Caranx*, *Alectis* and *Atropus*, whose larvae were numerous in the collections. It has been possible to obtain different stages in development and the specific characters of these stages were linked together and their identity was confirmed.

In the present study a continuous series of larvae, post-larvae and juveniles of *M. cordyla* were obtained and it had been possible to link them to adults. It was also observed that there was difference in the morphometry of the larvae, juveniles and adults. The larvae and juveniles were rather short and broad bodied, whereas the adult was easily recognised by the tropedo-shaped body with free finlets.

The larvae were deep bodied and stubby with 24 myotomes. In the newly hatched larvae (2.2 mm) pigments were localised on mid-dorsal and ventral part of the body. Lateral line pigment appeared between 3.5 to 4.0 mm length. Fin counts were more or less clear from 5.0 mm length. Thick bases

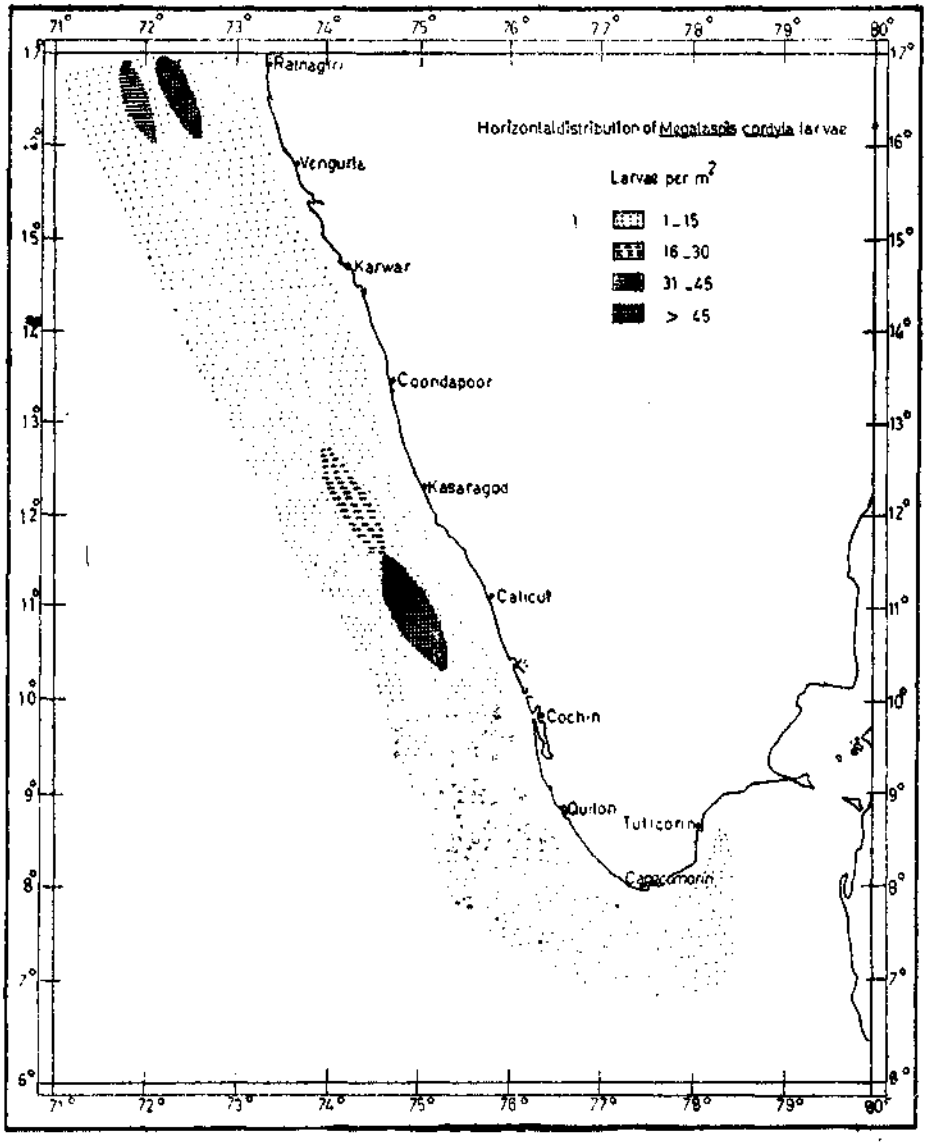

FIG. 5. Horizontal and quantitative distribution of the larvae of *M. cordyla*.

for the finlets were seen from 7.5 mm stage. Ossification appeared to complete by 10.0 mm stage. Anterior arch of the lateral line was clear in 10.5 mm stage and by about 20.0 mm length free finlets which was the characteristic of this species appeared.

The distribution study was helpful to delineate the spawning ground and season. The concentration of the larvae were more towards northern area between the latitudes 11°00' to 12°00'N and also 14°00' to 17°00'N. Larvae of *M. cordyla* were most abundant during March to July with a peak in June, which is associated with the south west monsoon season. Day and night variations in abundance showed that more larvae were present in the day collections than during night.

References

AHLSTROM, E. H. AND O. P. BALL 1954. Descriptions of eggs and larvae of Jack mackerel (*Trachurus symmetricus*) and distribution and abundance of larvae in 1950 and 1951. *U. S. Fish Bull.*, **56** : 210.

ANON. 1976. Plankton—Fish eggs and larval studies. *UNDP/FAO/Pelagic Fishery Project*, **17** : 22.

BASHEERUDDIN, S. AND K. N. NAYAR 1962. A preliminary study of the juvenile fishes of the coastal waters off Madras city. *Indian J. Fish.*, **8** (1) : 169-188.

BAPAT, S. V. AND R. R. PRASAD 1952. On some developmental stages of *Caranx kalla* Cuv. and val. *J. Bombay Nat. Hist. Soc.*, **51** : 111-115.

CHACKO, P. I. 1950. Marine plankton from the waters around Krusadi Island. *Proc. Indian Acad. Sci.*, **31** (3) : 162-174.

——— AND M. J. MATHEW 1955. Biology and fisheries of the horse mackerels of the west coast of Madras State. *Congr. Mar. Biol. Stn. West Hill*, **2** : 1-12.

CHIDAMBARAM, K. 1943. On two types of Horse mackerel eggs found in the plankton from the sea opposite to West Hill (Malabar). *Proc. 30th Indian Sci. Congr. (Calcutta), pt.* 3 Abst. 62.

DELSMAN, H. C. 1926. Fish eggs and larvae of the Java sea. 5. *Caranx kurra, C. macrosoma, C. crumenophthalmus. Treubia*, **8** : 199-211.

DEVANESAN, D. W. AND K. CHIDAMBARAM 1941. On two kinds of eggs hatched out in the laboratory of the West Hill Biological Station, Calicut. *Curr. Sci.*, **10** (5) : 259-261.

GOPINATH, K. 1946. Notes on the larval and post larval stages of fishes found along the Trivandrum Coast. *Proc. Nat. Inst. Sci. India*, **12** (1) : 7-21.

HOLT, E. W. L. 1893. On the eggs and larval and postlarval stages of teleostans. *Scient. Trans. R. Dublin. Soc.*, **2** : 5-9.

JOHN, M. A. 1951. Pelagic Fish eggs and larvae of the Madras coast. *J. Zool. Sco. India*, 3 (1) : 41-69.

KUTHALINGAM, M. D. K. 1959. A contribution to the life histories and feeding habits of Horse mackerels *Megalaspis cordyla* (Linn.) and *Caranx mate* (Cuv. and Val.) and notes on the development and feeding habits of larvae and postlarvae of *Megalaspis cordyla*. *J. Madras. Univ.*, **29** (2) : 79-96.

NAIR, R. V. 1952. Studies on some fish eggs and larvae of the Madras Plankton. *Proc. Indian Acad. Sci.*, **35** : 181-208.

RAO, K. S. P. BHUSHANA 1963. The eggs and early development of *Caranx* sp. from Porto Novo Coast. *Zool. Soc. India*, **14** (2) : 198-202.

RAO, K. SATYANARAYANA AND K. G. GIRIJAVALLABHAN 1973. On the eggs larvae of an engraulid and two carangids from Madras plankton. *Indian J. Fish.*, **20** (2) : 551-561.

RUSSELL, F. S. 1928. The vertical distribution of macroplankton. VII. Observations on the behaviour of *Calanus finmarchicus*. *J. Mar. Biol. Ass. U.K.*, **15** : 429-454.

SCHMIDT, J. 1905. The pelagic postlarvae of the Atlantic specimen of Gadus. *Medd. Kommiss. Havunders. Ser. Fiskerei*, **1** : 4

SUBRAHMANYAM, C. B. 1964. Eggs and early development of a carangid from Madras. *J. mar. biol. Ass. India*, **6** (1) : 142-146.

VATNACHAI, S. 1974. The identification of fish eggs and larvae obtained from the survey cruise in the South China Sea. *Proc. IPFC*, **15th Session**, 1972, pp. 111-130.

VENKATARAMANUJAM, K. AND K. RAMAMOORTHI 1974. Seasonal variation in fish eggs and larvae of Porto Novo coastal waters. *Indian J. Fish.*, **21** : 254-262.

VIJAYARAGHAVAN, P. 1957. Studies, on fish eggs and larvae of Madras Coast. *Publ. Madras University Madras*, p. 79.