J. mar. biol. Ass. India, 1989, 31 (1 & 2) : 287-296

LARVAE OF *CROSSORHOMBUS VALDE-ROSTRATUS* (ALCOCK) AND *C. AZUREUS* (ALCOCK) (*HETEROSOMATA* : *PISCES*) COLLECTED DURING THE INTERNATIONAL INDIAN OCEAN EXPEDITION AND NAGA EXPEDITION*

C. B. Lalithambika Devi

National Institute of Oceanography, Regional Centre, Cochin-682 018, *India*

Abstract

Larvae of *Crossorhombus valde-rostratus* (Alcock) and *C. azureus* (Alcock) containing post-flexion stages ranging in size from 6.0 mm to 12.9 mm SL and 7.5 mm to 18.8 mm SL respectively were found in the zooplankton collected during the International Indian Ocean Expedition (IIOE) (196-605) and Naga Expedition (1959-61).

The flat leaf-like body, continuous dorsal and anal fins with soft rays, presence of spines (serrations) on posterior basipterygial processes and their absence on cleithra and urohyal distinguish the larvae from others. The larvae of *C. azureus* and those of *C. valde-rostratus* resemble very closely with each other in general shape and meristics. But they can be distinguished by the presence of a tiny spinous process on the urohyal at its anterior end in *C. azureus*. The larval stages of both these species are reported and described for the first time.

In the Indian Ocean the larvae of *C. valde-rostratus* appear to prefer open ocean, found in the stratum sampled during day time as well as during SW monsoon period whereas *C. azureus* showed a decided liking to coastal or nearshore waters and occurred in the stratum mostly during night. However they also preferred SW monsoon season as the other species. Naga samples also showed identical preferences in so far as diel variation is considered but they, were mostly found in open ocean. A significant negative correlation was found between the distribution of *C. valde-rostratus* and the dissolved oxygen values indicating their tolerance to low oxygen concentrations.

Introduction

The Adult flat fishes of the genus *Crossorhombus* reported from Indo-Pacific region are *Crossorhombus valde-rostratus*, *C. azureus*, *C. kobensis* and *C. kanekonis* (Norman, 1934 ; Amaoka, 1969). Of these only the larvae of *C. kobensis* and *C. kanekonis* from Japanese waters are studied and reported (Ozawa and Fukeri, 1986). The present report refers to the descriptions of the post-larvae of *C. valde-rostratus* and *C. azureus* and their distribution and abundance in the Indian Ocean, Gulf of Thailand and South China Sea.

The author is very grateful to Prof. (Dr.) N. Balakrishnan Nair, Chairman, State Committee on Science, Technology and Environment, Kerala State, Trivandrum for his valuable suggestions ; to the Director, National Institute of Oceanography, Goa and Scientist-in-Charge, Regional Centre of NIO, Cochin for their constant encouragement. The author expresses her sincere gratitude to late Prof. E. H. Ahlstrom, Southwest Fisheries Centre, La Jolla, California, USA for his technical support and guidance in finalising the identification and to Prof.

* Presented at the 'Symposium on Tropical Marine Living Resources' held by the Marine Biological Association of India at Cochin from January 12—16, 1988.

(Dr.) K. P. Balakrishnan, School of Environmental Studies, Cochin University of Science & Technology, Cochin for all the help throughout the studies. She is grateful to the members of the Consultative Committee IIOE, staff of IOBC as well as to Naga Expedition authorities for placing the study material at her disposal.

Material and Methods

The flat fish larvae contained in the zooplankton sampled from the Indian Ocean during IIOE (1960-65) from the Gulf of Thailand and South China Sea during Naga Expedition (1959-61), were sorted out and identified. A set of larvae were used to take morphometric data using stage and ocular micrometer. The numerical counts were also made with the microscope. Another set of specimens were sacrificed to study the development of bone and cartilage using alizarine red and alcian blue which stained bone and cartilage differentially and cleared the flesh with enzyme trypsin (Dingerkus and Uhler, 1977). Projectine Optik Switzerland was used to draw details of the larval stages. The larval distribution and abundance were represented by way of charts for which the samples were compared on the basis of number per 1000 m^3 of water filtered and represented by selected notations for different grades of density. Wherever the number of larvae could not be assessed as for instance in some of the Naga samples, their presence is marked by the sign '+'. Statistical analysis of data were made wherever possible.

Description

Crossorhombus valde-rostratus (Alcock, 1890)

Larval forms ranging from 6.0 mm SL to 12.9 mm SL are found in the IIOE and Naga Expedition zooplankton collections. Only Post-flexion stages were available in these collection (Fig. 1, Tables 1a, b).

Morphology

The larval body is thin, transparent, translucent, symmetrical and ovoid. The eyes are

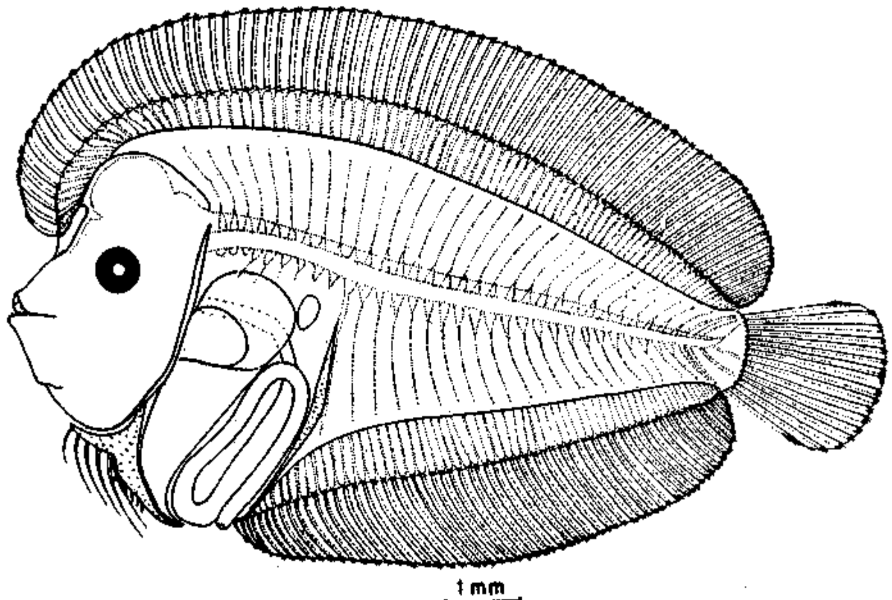

FIG. 1. Postlarva of *Crossorhombus valde-rostratus* — 9.6 mm SL.

TABLE 1 a. *Morphometrics* (in mm) *of larvae of* Crossorhombus valde-rostratus

Station	Body Length (SL)	Right Eye	Noto-chord	Snout to Anus	Head Length	Snout Length	Eye Width	Eye Height	Body Depth at: Pectoral Base	Body Depth at: Anus	Caudal Depth	Peduncle Length	Snout to Origin of Pelvic Fin
S8—23B ..	6.0	SYM	FLD	2.1	2.0	0.63	0.35	0.35	3.8	3.8	0.84	0.32	1.00
,, ..	6.9	,,	,,	2.3	2.4	1.29	0.39	0.40	4.1	4.2	1.06	0.43	1.30
Ki-407 ..	8.0	,,	,,	2.5	2.2	0.97	0.50	0.55	4.5	4.4	1.00	0.42	0.80
S10-7 ..	8.9	,,	,,	2.4	2.4	1.09	0.45	0.48	5.9	5.9	1.70	0.68	0.80
S11C-100 ..	9.8	,,	,,	2.5	2.5	1.16	0.45	0.48	6.2	6.2	2.00	0.64	0.80
Di-5514 ..	10.2	,,	,,	2.5	2.2	1.09	0.48	0.53	6.7	6.5	2.10	0.68	0.80
S11C-34 ..	12.2	,,	,,	3.1	3.3	1.29	0.58	0.64	8.1	7.9	2.50	1.09	0.90
S11C-53 ..	12.9	,,	,,	3.1	3.2	1.29	0.58	0.61	8.8	8.3	2.80	1.00	1.00

TABLE 1 b. *Meristics of larvae of* Crossorhombus valde-rostratus

Station	Size (mm) (SL)	Stage	Noto-chord	Right Eye	Fin rays: Dorsal	Fin rays: Anal	Fin rays: Caudal	Fin rays: Left Pelvic	Vertebrae: Pre-caudal	Vertebrae: Cau-dal	Vertebrae: Total	Spines: Uro-hyal	Spines: Clei-thra	Spines: Posterior basi-pterygial processes
S8-23B ..	6.0	Postfl.	Flexed.	Sym.	85	66	17	3+3	10	26	36	0	0	3
,, ..	6.9	,,	,,	,,	89	66	17	,,	10	26	36	0	0	4
Di-5505 ..	8.1	,,	,,	,,	86	68	17	,,	10	26	36	0	0	3
Di-5543 ..	9.2	,,	,,	,,	85	66	17	,,	10	26	36	0	0	6
S11C-80 ..	10.8	,,	,,	,,	86	64	17	,,	10	24	34	0	0	6
S11C-34 ..	12.2	,,	,,	,,	82	62	17	,,	10	24	34	0	0	6
S11C-53 ..	12.9	,,	,,	,,	84	64	17	,,	10	25	35	0	0	8

black. Eyes remain symmetrical even in the largest specimen found in the collections. Jaws carry small teeth. The anterior portion of the alimentary canal runs almost parallel to the vertebral column upto the level of the 7th vertebral segment, there after runs down making a single elliptical coil. In the largest specimen available in the collection the anus opens at the level of the 5th vertebral segment. The liver is not massive as in *Engyprosopon, Bothus, Psettina* and *Arnoglossus* spp. Its dorsoventral axis is twice its anteroposterior axis along its greatest width. The ventral portion papers and is placed below the intestinal coil. The swim bladder occupies the space between 8th and 10th vertebral segments. The swim bladder does not appear to push the alimentary canal down as is seen in some species.

Spines are found only on the left ramus of the posterior basipterygial processes and are few in number. The spines get reduced in size towards distal end.

Fin and supporting structures

The median fins are continuous. The forward extension of the dorsal fin fold has reached up to the level of the snout, but it is not fused with the cranium. The tiny first dorsal ray is discernible in 6.0 mm SL in which the full complement of the median rays characteristic of the species are found. In the dorsal fin there are 82-89 rays and in the anal fin 62-68 rays. The second elongtaed dorsal ray so characteristic of bothids is hardly distinguishable even in the earliest larva available. The caudal fin rays are 17 in number which are distributed on hypural plates as follows: Inferior hypural lower 3, inferior hypural middle 4, superior hypural middle 5, superior hypural upper 3 and one ray each on neural and haemal processes of the penultimate vertebra.

The pelvic fin radial, fin rays and posterior basipterygial processes are well differentiated in 6.0 mm SL. The pelvic fin radial of the left side is longer than the right and three left pelvic fin rays are seen in advance of the right fin. In 8.9 mm SL larvae, the fourth pelvic fin ray lies opposite the tip of the cleithra. The posterior basipterygial processes lie along the ventral aspect of the abdominal wall. The distal extremity of the left ramus tapers and reaches almost upto the middle level of the intestinal loop, while that of the right ramus before reaching the level of the distal end of the left ramus curves dorsalwards and forwards and stops infront of the tip of the liver.

Axial skeleton

In the absence of preflexion and flexion stages, it was not possible to study the progress of ossification in detail. In 6.0 mm larvae the vertebral segments are clearly marked. The neural processes are bony. The haemal processes of the caudal region are also bony. The spines of the precaudal haemal arches are reduced in the last three, fairly well developed in the preceeding three and absent in others. The first neural arch remains cartilaginous even in the largest specimen of the present account. The number of vertebrae ranges from $10 + 24 - 26$ including urostyle (Table 1 b).

Crossorhombus azureus (Alcock 1889)

Larval forms ranging from 7.5 mm SL to 18.8 mm SL are found in the plankton collections taken during the IIOE and Naga Expedition. The plankton samples contained only postflexion stages (Fig. 2, Tables 2 a, b).

Morphology

The larval body is thin, symmetrical, ovoid and translucent in early postflexion stages. In advanced forms the body gets more elongate. The eyes are black and symmetrical. No sign of migration is observed even in the largest specimens available in the plankton collections. The jaws are equal and carry small teeth. The anterior portion of the alimentary canal runs parallel to the notochord only for a very short distance and then runs down obliquely. The intestinal coil is elliptical and is placed at the posterior ventral aspect of the abdominal cavity. The rectal portion of the alimentary canal is pushed forwards and the anus opens at the level of the fifth vertebral segment in the largest specimen. The liver is not massive as in *Engyprosopon, Bothus, Psettina* and *Arnoglossus* spp. Its dorsoventral axis is more than twice the anterior-posterior axis. The swim bladder occupies the space between eighth and tenth vertebral segments. It does not seem to interfere with the orientation of the intestinal loop and is placed obliquely downwards almost touching the posterior border of the abdominal cavity.

Spines are found only on the left ramus of the posterior basipterygial processes, less in number when compared to many other species. The spines decrease in prominence and size posteriorly. A small spinuous process is found on the urohyal at its anterior end near the notch upto which left ventral fin radial extends.

Fin and supporting structures

The forward extension of the dorsal fin fold has reached upto the level of the snout and is not fused with the ethmoidal region of the cranium. The elongated ray is comparatively shorter than in other species and it can be distinguished only with great difficulty from the remaining rays in postflexion stages beyond 11.2 mm SL. The first ray is tiny and discernible even in the smallest larvae (7.5 mm SL) of the collections. Full complement of the median and caudal fin rays are found in 7.5 mm SL larvae and above. There are 82-92 dorsal and 61-73 anal rays (Table 2 b). Of the 17 caudal rays, three are borne on

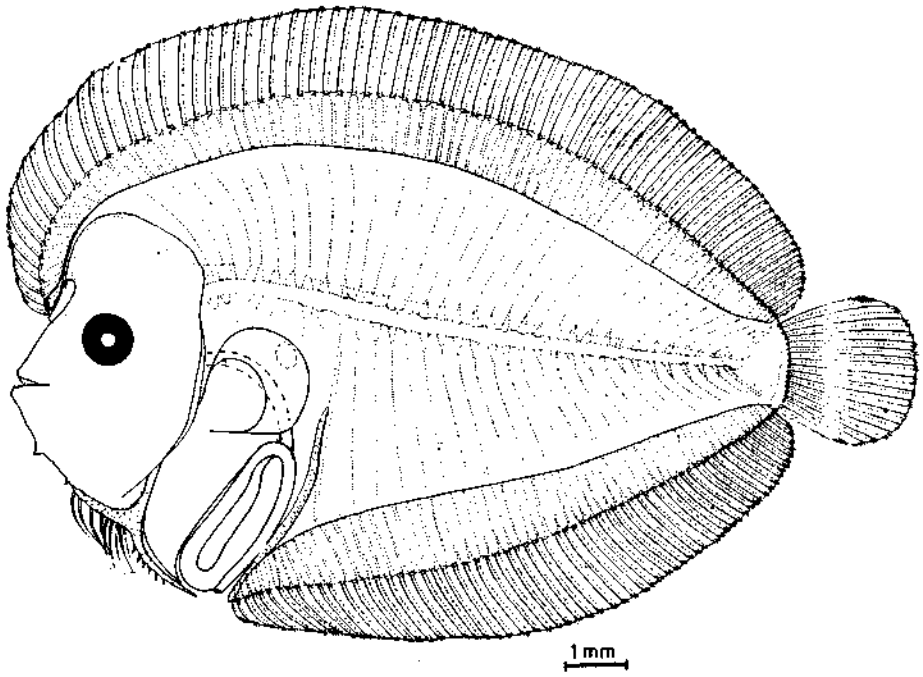

FIG. 2. Postlarva of *C. azureus* — 12.4 mm SL.

TABLE 2 a. *Morphometrics (in mm) of larvae of* Crossorhombus azureus

Station	Body Length (SL)	Right Eye	Noto-chord	Snout to Anus	Head Length	Snout Length	Eye width	Eye Height	Body Depth at		Caudal Depth	Peduncle Length	Snout to Origin of Pelvic Fin
									Pectoral Base	Anus			
S4-8 ..	7.5	SYM	FLD	2.20	2.20	0.90	0.48	0.53	4.9	4.9	1.6	0.67	0.64
Ki-363 ..	9.2	,,	,,	2.50	2.70	1.19	0.48	0.58	6.2	6.1	1.7	0.68	0.80
OS-4 ..	10.4	,,	,,	2.70	2.90	1.14	0.55	0.61	6.9	6.7	2.2	0.81	1.00
S11C-46 ..	11.2	,,	,,	2.60	2.90	1.24	0.52	0.55	7.8	7.4	2.5	0.93	1.10
S11C-80 ..	12.3	,,	,,	2.80	2.90	1.19	0.55	0.55	8.3	8.1	2.5	0.97	1.10
S11C-53 ..	13.5	,,	,,	2.70	2.80	1.13	0.58	0.61	8.8	8.9	2.8	1.01	0.80
NH-40 ..	14.8	,,	,,	3.60	3.40	1.40	0.58	0.62	11.1	11.1	—	1.32	0.90
DM 1/57A/64 ..	15.8	,,	,,	3.10	3.80	1.29	0.61	0.71	9.8	9.3	3.4	1.21	0.70
Di 6608 ..	17.0	,,	,,	3.90	4.50	1.70	0.64	0.64	10.5	11.0	3.7	1.21	0.90
Pi 20 ..	18.0	,,	,,	4.70	4.30	1.60	0.87	0.87	9.8	9.9	3.5	1.33	1.30

TABLE 2 b. *Meristics of larvae of* Crossorhombus azureus

Station	Size (mm) (SL)	Stage	Noto-chord	Right Eye	Fin rays				Vertebrae			Spines		
					Dorsal	Anal	Caudal	Left Pelvic	Pre-caudal	Cau-dal	Total	Uro-hyal	Clei-thra	Posterior basip-terygial processes
S4-8 ..	7.5	Postfl.	Flexed	SYM	86	63	17	3+3	10	26	36	1	0	6
S4-6 ..	8.9	,,	,,	,,	87	68	17	,,	10	27	37	1	0	6
Ki-363 ..	9.2	,,	,,	,,	85	67	17	,,	10	26	36	1	0	5
S11C-90 ..	9.8	,,	,,	,,	86	61	17	,,	10	26	36	1	0	7
S11C-53	11.0	,,	,,	,,	82	63	17	,,	10	25	35	1	0	10
S4-6 ..	12.6	,,	,,	,,	90	70	17	,,	10	26	36	1	0	9
,, ..	13.5	,,	,,	,,	92	72	17	,,	10	26	36	1	0	7
Dm1/57A/64	15.8	,,	,,	,,	86	68	17	,,	10	25	35	1	0	6
Di 5508 ..	17.0	,,	,,	,,	92	73	17	,,	10	26	36	1	0	4+
Pi 20	18.0	,,	,,	,,	90	67	17	,,	10	26	36	1	0	7
Na 143	18.8	,,	,,	,,	89	67	17	,,	10	26	36	1	0	7

inferior hypural lower, four on inferior hypural middle, five on superior hypural middle, three on superior hypural upper and one ray each on either Side borne directly by the neural and haemal processes of the vertebrae just in front of the urostyle.

The pelvic fin radials, rays and posterior basipterygial processes are well differentiated in 7.5 mm SL larvae. The left pelvic fin radial is longer than the right and three rays of the left lie in advance of that of the right fin. In 13.8 mm SL larvae fourth pelvic fin ray lies opposite the cleithral tip. The left ramus of the posterior basipterygial processes extend up to the middle level of the intestinal loop where it tapers. The right ramus before reaching the terminal portion of the left curves like a tendril and stops in front of the tip of the liver.

Axial skeleton

As there is no preflexion and flexion stages available in the plankton collections, the stages at which the notochord gets segmented into vertebrae are not described in the present report. There are 10 percaudal and 26 caudal vertebrae including the urostyle, discernible in 7.5 mm SL larva (Table 2 b). The neural processes of the precaudal and caudal region as well as the haemal processes of the caudal region are distinguishable in 7.5 mm SL larvae. The haemal processes of the precaudal region are small in the last three vertebrae, fairly large in the seventh, sixth and fifth, but in advance stages the haemal spines are the same size they are not traceable in the first four, however, arches are found except in the first vertebrae. The centre of the vertebrae are also distinguishable in 7.5 mm SL larvae and ossification seems to have commenced in 11.0 mm SL and not completed even in 18.8 mm SL. The first neural arch remains cartilaginous even in the largest specimen (18.8 mm SL) available in the collection.

Distribution

Crossorhombus valde-rostratus

In the samples from the Indian Ocean, the larvae of *C. valde-rostratus* were found in stations situated in the open ocean (Fig. 3). They were contained in the plankton samples taken from stations off the coast of East Africa, Somali Coast, north of Madagascar, in the central part of the Bay of Bengal, and north-west coast of Australia. They were conspiculously absent from the plankton samples taken from the Arabian Sea. They were mostly found in the collections taken during day time. They were also found in the collections taken during SW monsoon period. The depths of the stations from were the samples were collected ranged between 997 and 4970 m. Only post-flexion stages were available in the collections. Temperature ranged between 13.02 and 28.6°C. The salinity ranged between 32.05 and 35.59‰ and dissolved oxygen varied between 0.18 and 5.10 ml/1. A significant negative correlation was found between the larvae and dissolved oxygen values ($R = -0.5907$, $P < 0.05$). The zooplankton biomass (volume) ranged between 13.5 and 100.0 ml/1000 m^3.

The observations from the Naga samples also revealed that this species showed preference to open sea (Fig. 3). None of the stations from the Gulf of Thailand contained larvae of *C. valde-rostratus*. The depth of the stations from where the larvae of *C. valde-rostratus* were collected ranged between 1350 and 5413 m. In Naga collections most of the samples (7/8) containing the larvae of this species were taken during day time. They were found in the months of March, April, May and September. Only postflexion stages were found in the plankton collections. The temperature, salinity and dissolved oxygen data were available only for a few stations where it is found to vary between 9.61 and 28.05°C, 33.22 and 34.69‰ and 1.78 and 4.65 ml/l respectively.

Crossorhombus azureus

The larvae of *C. azureus* also appears to have a wide range of distribution, but they are mostly confined to coastal or nearshore waters. They were found in the Indian Ocean along the coast of South Africa, northern tip of Madagascar, east coast of Sri Lanka, east coast of India, south-west coast of Australia (Fig. 4). They were also found in the open ocean. The depths of the stations from where the samples were collected ranged between 110 and 5504 m. The larvae were found mostly in the plankton samples taken at night (7/13). Nine out of 13 samples were taken during SW monsoon period. All the larvae were confined to postflexion stages. Preflexion, flexion and midflexion stages were being absent in the collections. The temperature was found to vary between 12.55° and 29.60°C. The salinity ranged between 28.69 and 35.90‰ and the dissolved oxygen showed a variation of 0.20 and 5.43 ml/1. The zooplankton biomass (volume) varied between 20.0 and 215.0 ml/1000 m³. The coefficient of correlation between plankton and postlarvae showed significant positive correlation ($R=0.7646$, $P<0.01$).

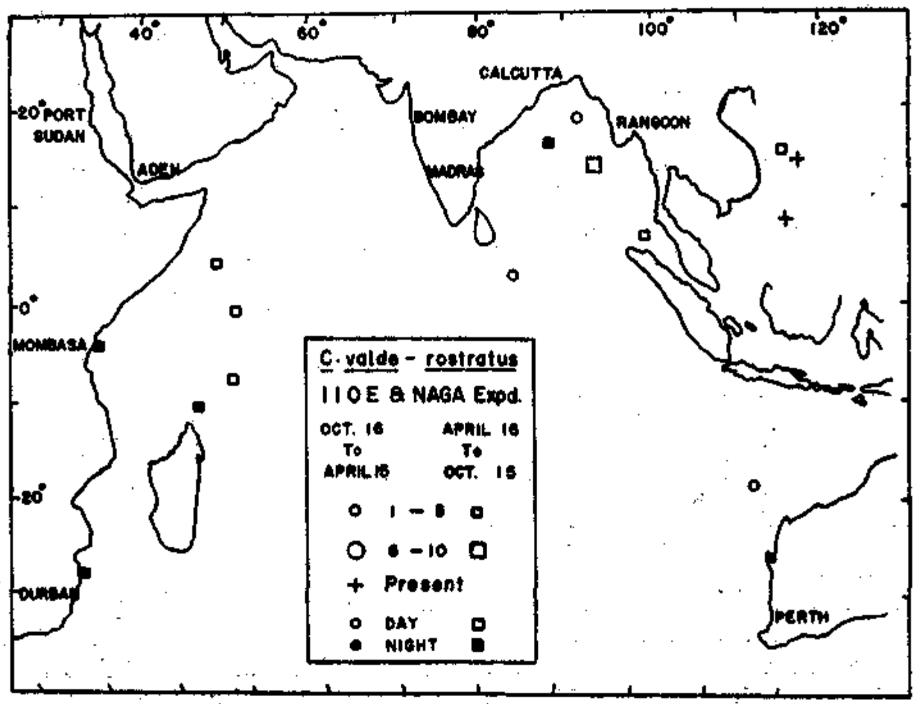

FIG. 3. Distribution of larvae of *C. valde-rostratus* in the Indian Ocean, the Gulf of Thailand and South China Sea.

In the Naga Expedition samples, the larvae of this species were found in the collections taken from open sea (Fig. 4). As in the case of *C. valde-rostratus* they were absent from the samples taken from the Gulf of Thailand. They were found only in collections taken during night and were confind to the months of March and May. The depth of the stations from which the samples containing larvae of this species were taken ranged between 77 m and 5358 m. No preflexion and flexion stages were available in the collection. The temperature, salinity and dissolved oxygen data were available only for a few stations and ranged between 9.61 and 28.02°C, 33.50 and 34.66 ‰ and 2.07 and 4.77 ml/1 respectively.

elongated dorsal ray at the anterior end of the dorsal fin, the meristics as well as general shape of the postlarval body help to place the larval stages described here under the genus *Crossorhombus*.

The presence of tiny spinous process at the

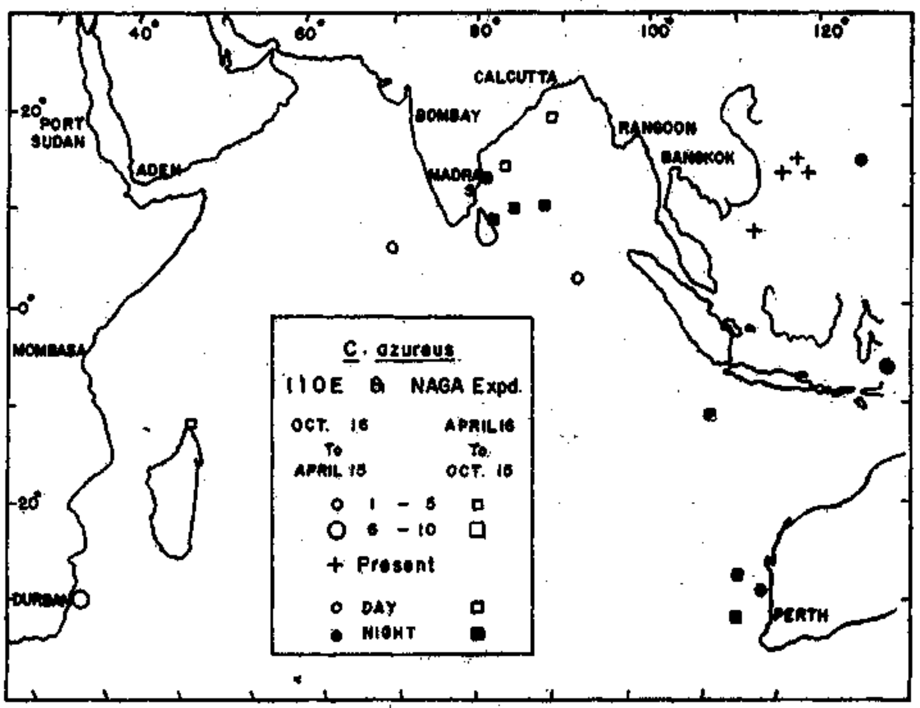

FIG. 4. Distribution of larvae of *C. azureus* in the Indian Ocean the Gulf of Thailand and South China Sea.

Discussion

The larval forms contained in the IIOE and Naga Expedition plankton sample discribed herein possess the general characters shared by the bothid larvae. Absence of preflexion and flexion stages in the plankton collections limits details of characters useful in identifying early larval forms. However, the restriction of spines to the posertior basipterygial processes, and their absence on cleithra and urohyal, the short length of the anterior end of the urohyal (sciatic portion) near its notch in *C. azureus* together with the meristics provide some clue to distinguish them from *C. valde-rostratus*.

Ochiai and Amaoka (1963) described three postlarval forms of *C. valde-rostratus* ranging from 16.0 to 17.5 mm from Japanese waters. From their description it is seen that spines are present on the urohyal, cleithra and posterior basipterygial processes. Perteseva-Ostroumova (1965) has described larval stages ranging from 2.90 to 13.14 mm and placed them under *C. azureus.* The descriptions as well as figures published on these larval forms reveal that spines are present on urohyal, cleithra and posterior basipterygial processes. The present oservations on the larval characteristic of *Crossorhombus* species from the Indian Ocean, South China Sea and Gulf of Thailand have been confirmed by Dr. Ahlstrom (per. comm., 1977) who has examined the larval materials critically. Ozawa and Fukui (1986) also reported spines only on the posterior basipterygial processes for *C. kobensis* and *C. kanekonis.* The larval forms described by Ochiai and Amaoka (1963) as well as Pertseva-Ostroumova (1965) may therefore be referrable to *Engyprosopon* spp. and not to *Crossorhombus* spp.

Amaoka (1969) has stated that eventhough *C. valde-rostratus* is synonymised with *C. kobensis* (*Engybrosopon kobensis* Hubbs, 1915 by Norman (1934), the specimens of *C. kobensis* from Japanese waters differ from *C. valde-rostratus* collected from waters off Sri Lanka and East Africa. Amaoka (1969) has also reported that *C. azureus* obtained from Sri Lanka and South Eastern Indian waters resemble closely with *C. kanekonis* from Japan waters. But he is of the view that these two species are separable from each other in adult characteristics. The adults of *C. valde-rostratus* and *C. azureus* are recorded from Indian waters. The larvae of these species are described and reported for the first time.

The distribution of larvae of *C. valde-rostratus* and *C. azureus* suggest that the latter, though widely distributed prefer to be in coastal or nearshore whereas the former is found in open ocean. Eventhough both of them preferred SW monsoon period *C. valde-rostratus* showed an interest to day light, but *C. azureus* preferred darkness. The significant negative correlation between *C. valde-rostratus* and oxygen indicate its capacity to tolerate low oxygen concentration at bottom layers of the sea where the adults live. The positive correlation between *C. azureus* and zooplankton indicate their preferred food item is contained in the zooplankton. The larvae were also performing vertical migration as in many of the zooplankton species.

REFERENCES

ALCOCK, A. 1889. List of Pleuronectidae from the Bay of Bengal. *Jour. Asiat. Soc. Bengal*, **58** (2) : 283.

——— 1890. On some undescribed shore fishes from the Bay of Bengal. *Ann. Mag. Nat. Hist.*, **6** (6) : 435.

AMOAKA, K. 1969. Studies on the sinistral flounders found in the waters around Japan. Taxonomy, Anatomy and Phylogeny. *J. Shim. Univ. Fish.*, **18** (2) : 1-276.

DINGERKUS, G. AND L. D. UHLER 1977. Enzyme clearing of Alcian Blue stained whole small vertebrates for demonstration of cartilage. *Stain. Tech.*, **52** : 229-232.

HUBBS, C. L. 1915. Flounders and soles from Japan collected by the United States Bureau of Fisheries Steamer 'Albatross' in 1906. *Proc. U.S. Nat. Mus.*, **48** (2082) : 449-496.

NORMAN, J. R. 1934. A systematic monograph of the flat fishes (Heterosomata). *British Mus., N.H.*, **1** : 1-459.

OCHIAI, A. AND K. AMAOKA 1963. Description of larvae and young of 4 species of flat fishes referrable to subfamily Bothidae. *Bull. Jap. Soc. Sci. Fish.*, **29** (2) : 127-134 (in Japanese).

OZAWA, T. AND A. FUKUI 1986. Studies on the development and distribution of the Bothid larvae in the western North Pacific. *In* : T. Ozawa (Ed). *Studies on the Oceanic Ichthyoplankton in the Western North Pacific.* Kyushu Univ. Press, pp. 322-420.

PERTSEVA-OSTROUMOVA, T. A. 1965. Flat fish larvae from the Gulf of Tonkin. *Acad. Nauk. USSR, Trudy Inst. Okeanologi*, **80** : 177-220 (in Russian).