THE IDENTIFICATION OF FISH EGGS AND LARVAE OBTAINED FROM THE SURVEY CRUISES IN THE SOUTH CHINA SEA

by

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ABSTRACT

This paper presents the results of the identification of fish eggs and larvae which were obtained from ten survey cruises in the South China Sea during the period January 1970 to April 1971. A total of 4,959 fish larvae and 3,666 fish eggs was collected. They represented 137 species belonging to 64 families and 21 unknown species; most of the fish eggs, however, remain unidentified.

The author gives brief keys for the classification of fish larvae found in the South China Sea and also provides brief descriptions of some systematic characteristics of larval fish.

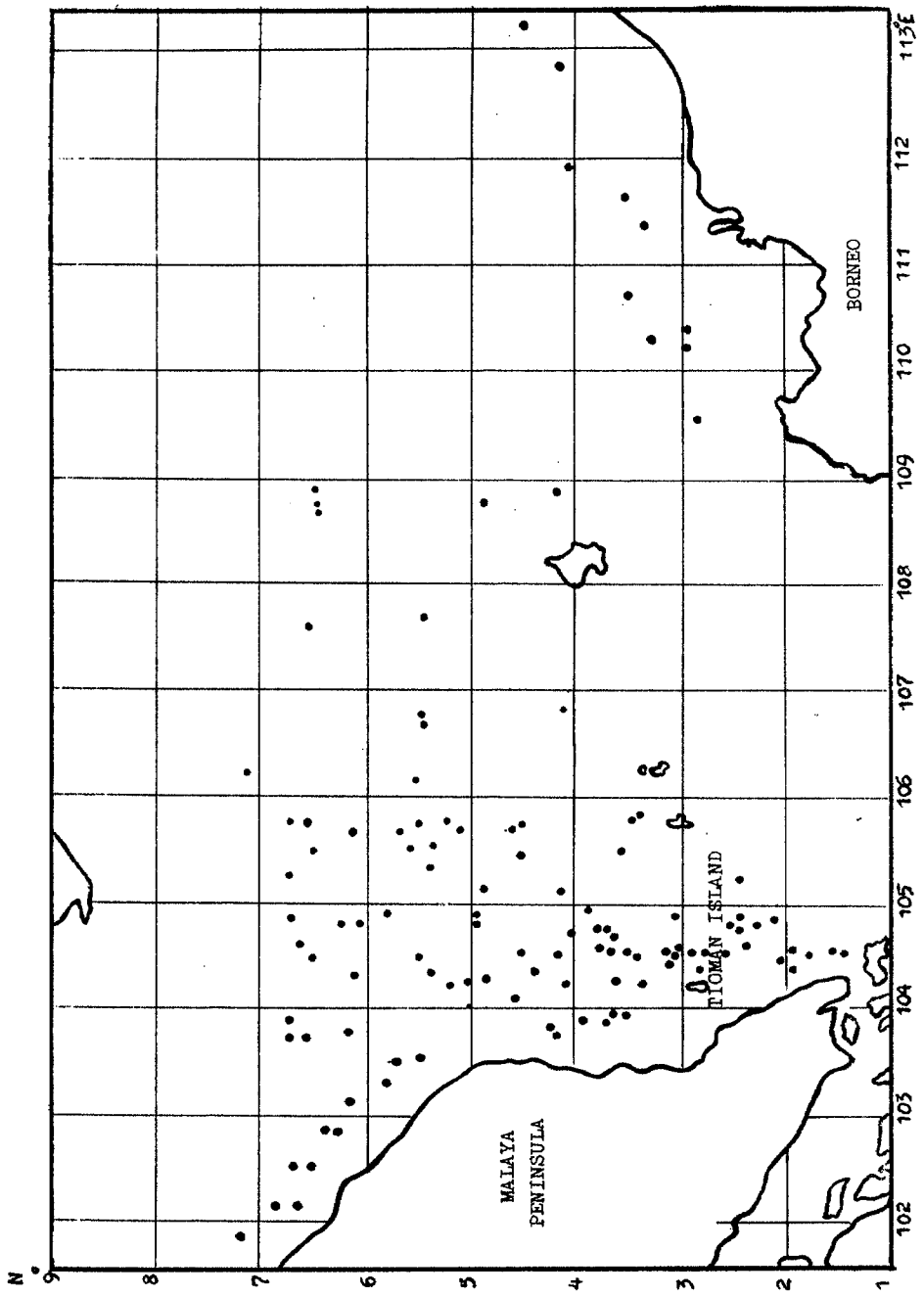


Fig. 1 Location of station

1. INTRODUCTION

The information on the identification of fish eggs and larvae, especially of those occurring in the South China Sea is still inadequate. Only Delsman (1921 - 1938) worked on the fish eggs and larvae of the Java Sea, but no publication is so far available on the material from the South China Sea. Recently, the author had the opportunity to study the fish eggs and larvae material available in the Southeast Asian Fisheries Development Centre under the guidance of Dr S. Mito and Dr T. Senta, specialists in this field. The publications of Delsman (1921 - 1938) and of Mito (1960 - 1966) on the identification of fish eggs and larvae of the Java Sea and Japan waters respectively, were very useful sources of information.

In this paper the author presents the results of identification of fish eggs and larvae obtained from 10 survey cruises in the South China Sea during the years of 1970 - 1971. Up to the present 137 species of fish larvae belonging to 64 families have been identified; however, most of the eggs remain unidentified. Also, most of the larvae were so far identified only to the genus and family level, but the author intends to carry out more detailed identification in the near future.

The author wishes to express his gratitude to Dr Mito for giving permission to use the data from the first 6 cruises for the present study and for his helpful advice, to Dr Senta for his encouragement, and to Yong Chong Teck for his intimate cooperation.

2. MATERIAL AND METHOD

Fish eggs and larvae were collected by using a larval net with a mouth opening of 1.3 m in diameter and 4.5 m in length. The net itself is divided into two parts: the anterior part is 3 m in length with 3 mm mesh size, whereas the posterior part is 1.5 m in length with very fine mesh (GG 38).

The area surveyed extended from 1° to 8°N latitude and 101° to 114°E longitude (Fig. 1). Within the area 107 horizontal hauls were made during the period from January 1970 to April 1971. With a few exceptions the horizontal tows of 10 minutes duration were carried out at the surface and at a speed of about 2 knots by the Research Vessel "Changi" (386 gross tonnage). The collections were made in day time as well as night-time.

The fish eggs and larvae collected were preserved in 4-10% formalin solution on board, together with other plankton organisms. The samples were sorted in the laboratory. The larvae were identified by genus or counted and measured.

During the survey period mentioned above, 4,959 fish larvae and 3,666 eggs were collected.

3. RESULTS

3.1 Fish eggs and larvae collected

A list of eggs and larvae of fish collected in the South China Sea during the 10 survey cruises in 1970/71 is given below:

	Species	Common name	Individual number ☆	Peak of Occurrence☆
1.	Clupeidae	Herring,	347(165)	Nov., Apr.
	(1-3) Clupea spp.	Sardines.		
2.	Dussumieridae	Round herring,	9	Apr., Oct.
	(4) Dussumieria hasselti BLEEKER	Sprat		
3.	Engraulidae	Anchovies	69(127)	Oct., (Apr.)
	(5) Engraulis spp.			
	(6-7) Stolepholus spp.			
4.	Chirocentridae	Dorab	(2)	(Oct.)
	(8) Chirocentrus spp.			
5.	Synodontidae	Lizzardfish	26(5)	Oct.-Nov.,(Oct.)
	(9) Saurida tumbil (BLOCH)			
	(10) Trachinocephalus myops (FORSTER)			
	(11) Synodus vaiegatus (LACEPEDE)			
6.	Myctophidae	Lanternfish	(2)	(Apr.)
	(12) Unknown spp.			
7.	Ophichthyidae	Snake eel	2	Oct.
	(13) Unknown spp.			
8.	Apodes	Eel	15(26)	Apr.,Jun.(Apr.)
	(14-16) Leptocephalus spp.			
9.	Belonidae	Gar fish		Feb.-Apr.
	(17) Ablennes spp.		3	
	(18) Tylosurus spp.		1	
	(19) Unknown spp.		3	
10.	Hemirhamphidae	Half beak		May
	(20) Hemirhamphus spp.		96	
	(21) Euletorhamphus longirostris CUVIER		2	
11.	Exocoetidae	Flying fish	(154)	May(Apr.-Oct.)
	(22-24) Cypselurus spp.		60	
	(25) Prognichthys sp.		1	
	(26) Hirundichthys sp.		24	
	*(27-30) Unknown sp.		144	
12.	Bregmacerotidae	Antena cod	8	Aug.
	(31) Bregmaceros sp.			
13.	Fistulariidae	Cornet fish	10	Oct.
	(32) Fistularia sp.			
14.	Syngnathidae	Pipe fish	1	Aug.
	(33) Syngnathus sp.			

15.	Holocentridae (34) Holocentrus sp.	Soldier fish	14	Apr.
16.	Sphyraenidae (35) Sphyraena sp.	Barracuda	11	Apr., Aug.
17.	Mugilidae (36) Mugil sp.	Grey mullet	32	May-Jun.
18.	Atherinidae (37) Atherina sp.	Silversides	12	Apr., Aug.
19.	Serranidae (38) Epinephelus sp.	Grouper	5	Jan.,Apr.,Jun.
20.	Theraponidae (39-40) Therapon spp.	Therapon	143	Apr., Jul.
21.	Apogonidae (41-42) Apogon spp.	Cardinalfish	27	Jun.-Aug.
22.	Sillaginidae (43) Sillago sp.	Whiting	2	Nov.
23.	Carangidae (44) Chorinemus orientalis TEMMINCK & SCHLEGEL (45-48) Caranx spp. (49-50) Seriola spp. (51-55) Unknown spp.	Horse mackerels, jacks, Travelly	2 68 57 268	Apr.,Nov.,(Apr.)
24.	Menidae (56) Mene maculata (BLOCH & SCHNEIDER)	Moon fish, Razor travelly	5	Jul.
25.	Coryphaenidae (57) Coryphaena spp.	Dolphin fish	1	May
26.	Lutianidae (58) Lutianus spp.	Snapper	8	Jun.-Nov.
27.	Lobotidae (59) Lobotes surinamensis (BLOCH)	Triple tail	4	Jul.
28.	Leiognathidae (60) Leiognathus spp.	Pony fish	19	Apr.
29.	Gerridae (61) Unknown sp.	Silver-biddies	1	Jun.
30.	Pomasyidae (62) Unknown sp.	Grunters, Javelin fish	1	Nov.
31.	Sciaenidae (63) Unknown sp.	Riverking fish Jaw fish	2	Nov.

32.	Sparidae	Silver breams	12	Apr.
	(64) Unknown sp.			
33.	Mullidae	Goat fish	2176	Jun.
	(65-67) Upeneus spp.			
34.	Cepolidae	Cepolas		Jun., Apr.
	(68) Acanthocepola sp.		1	
	(69) Unknown sp.		3	
35.	Pomacentridae	Anemone fish	1	Jul.
	(70) Unknown sp.			
36.	Amphiprionidae	Clown fish	2	Apr.
	(71) Unknown sp.			
37.	Labridae	Wrasses, Rainbow fish		Nov.
	(72) Novaculichthys sp.		4	
	(73) Unknown sp.		38	
38.	Opisthognathidae	Jaw fish	33	Aug.
	(74) Opisthognathus sp.			
39.	Champsodontidae	Champsodons	5	Jul.
	(75) Champsodon sp.			
40.	Blenniidae	Blennies		Jul.
	(76) Xiphasia setifer SWAINSON		14	
	(77) Dasson trossulus (JORDAN ET SNYDER)		1	
	(78) Unknown sp.		3	
41.	Callionymidae	Dragonets	5(65)	Nov.,(Apr.)
	(79-80) Callionymus spp.			
42.	Siganidae	Rabbit fish	2	Jan.-Apr.
	(81) Siganus sp.			
43.	Trichiuridae	Ribbon fish	(2)	(Nov.)
	(82) Trichiurus sp.			
44.	Scombridae	Mackerel		Apr.
	(83) Auxis sp.		2	
	(84) Unknown sp.		7	
45.	Thunnidae	Tuna	21	Jun.-Aug.
	(85-86) Unknown sp.			
46.	Scomberomoridae	Spanish mackerel	5	Aug.
	(87) Scomberomorus sp.			
47.	Histiophoridae	Sail fish		Apr.-May
	(88) Histiophorus sp.	Marlin	3	
	(89) Eumakaira niger NAKAMURA		3	

48.	Stromateidae	Pomfrets		
	(90) Parastromateus niger (BLOCH)		3	Jun.
	(91) Psenopsis sp.		2	Feb.,Apr.
49.	Gobiidae	Gobies	549	Apr., Oct.
	(92-98) Unknown sp.			
50.	Trypauchenidae	Gobies	9	Apr., Oct.
	(99) Unknown sp.			
51.	Scorpaenidae	Scorpion		
	(100-101) Unknown sp.	fish	5	Jul.
52.	Platycephalidae	Flat fish	6	Nov.
	(102) Platycephalus sp.			
53.	Cephalacanthidae	Flying		
	(103) Daicocus peterseni (NYSTROM)	Gurnard	51	Apr., Nov.
	(104) Dectylopterus sp.		11	
54.	Bothidae	Left handed		
	(105) Arnoglossus	flounder	9	..
	(106) Unknown sp.		34	
55.	Pleuronectidae	Right handed		
	(107) Unknown sp.	flounder	5	Apr.
56.	Soleidae	Soles		
	(108) Unknown sp.		1	Oct.
57.	Cynoglossidae	Tongue fish	15	Nov.
	(109) Unknown sp.			
58.	Echeneidae	Remoras,		
	(110) Echenis sp.	Shark suckers	(27)	(Apr.)
59.	Balistidae	Trigger fish	1	Nov.
	(111) Unknown sp.			
60.	Monacanthidae	File fish	5	Apr.
	(112) Unknown sp.			
61.	Aluteridae	File fish	25	Apr., Nov.
	(113) Stephanolepis sp.			
62.	Ostraciidae	Box fish	2	Jan.
	(114) Unknown sp.			
63.	Tetraodontidae	Puffer fish	9	Jul.
	(115) Unknown sp.			
64.	Pegasidae	Dragon fish	2	Jan.
	(116) Pegasus volitans LINNE			
65.	Unknown		(2990)	
	(117-137) Unknown sp.		302	

* Oxyporhamphus species is included (☆) Number of eggs and occurrence given in brackets

3.2 How to identify the larval fish

The larvae of marine fish are usually pelagic, and such larvae are easily collected by a larval net. However, the identification of these larvae is not always easy, because many characteristics which are available to identify the adult do not differentiate their larval stages. Therefore, speciel kinds of keys are necessary for identification of larval fish.

The following characteristics seem to be available for sorting the larval fish into groups or families; more detailed observations are needed for the identification of the species. Here, the author only gives brief keys available for identification of families or groups of fish larvae.

Body Shape

a_1 Body elongated;

body slender; Clupeidae, Dussumieridae, Engraulidae, Belonidae, Hemirhimphidae, Syngnathidae, Atherinidae, Synodontidae, Fistulariidae, Blenniidae.

body rather slender;
Sphyraenidae, Sillaginidae, Mullidae, Bregmacerotidae, Cepolidae, Labridae, Histiopholidae, Gobiidae, Gerridae, Trypauchenidae, Coryphaenidae, Cynoglossidae.

spear like body;
Belonidae, Hemirhamphidae.

ribbon like body;
Apodes, Ophichthyidae.

spindle like; Exocoetidae.

snake like; Bleniidae.

a_2 Body short;

moderate short; Mugilidae, Holocentridae, Serranidae, Theraponidae, Apogonidae, Carangidae, Menidae, Lutianidae, Lobotidae, Leiognathidae, Pomadasyidae, Sciaenidae, Sparidae, Pomacentridae, Amphiprionidae, Opisthognathidae, Thunnidae, Champsodontidae, Callionymidae, Siganidae, Scombridae, Scomberomoridae, Stromateidae, Scorpaenidae, Platycephalidae, Cephalacanthidae.

globular shape; Ostraciidae, Tetraodontidae.

oval shape; Monacanthidae, Stromateidae, Balistidae, Aluteridae.

triangular shape; Menidae.

a_3 Body deeply compressed;
Bothidae, Cynoglossidae, Pleuronectidae, Soleidae, Menidae.

a_4 Body slightly depressed;
Platycephalidae, Pegasidae, Dactylopteridae.

Body structure

b_1 body covered with bony structure;
Syngnathidae, Pegasidae, Ostraciidae, Dactylopteridae.

b_2 body encased with spiny scale:
Balistidae, Aluteridae, Cephalacanthidae, Diodontidae, Tetraodontidae.

Head

c_1 head with bony crest on the nape;
Lobotidae, Holocentridae, Cepolidae, Champsodontidae, Leiognathidae (some species), Coryphaenidae, Siganidae, Platycephalidae.

c_2 head with prominent spine;
Holocentridae, Histriophoridae, Cephalacanthidae, Dactylopteridae.

c_3 head with preopercular spines;
Holocentridae, Theraponidae, Carangidae, Coryphenidae, Scomberomoridae, Histiophoridae, Thunnidae, Lutianidae, Cepolidae, Serranidae, Siganidae, Lobotidae, Apogonidae, Leiognathidae, Menidae, Scianidae, Sparidae, Champsodontidae, Platycephalidae, Scorpaenidae.

c_4 head without preopercular spine;
Scombridae, Labridae, Gobiidae, Trypauchenidae.

c_5 head with bony ridge above the eye;
Sciaenidae, Carangidae (Seriola sp. and Naucrates sp.), Scorpaenidae, Stromateidae, Cephalacanthidae, Cepolidae, Holocentridae, Histriophoridae, Champsodontidae, Siganidae.

c_6 head with protruded snout;
Holocentridae, Histriophoridae, Pegasidae.

c_7 head with protruded lower jaw;
Hemirhamphidae, Belonidae, Exocoetidae.

c_8 presence of barbel on lower jaw;
Exocoetidae.

c_9 presence of elongated tentacle on operculum;
Champsodontidae.

Shape and position of mouth

d_1 oblique; Hemirhamphidae, Exocoetidae, Bregmacerotidae, Apognidae, Leiognathidae, Carangidae, Labridae, Lutianidae, Serranidae, Opisthognathidae.

d_2 inferior; Holocentridae, Cephalacanthidae.

d_3 subterminal; Engraulidae.

d_4 tube like mouth; Fistulariidae, Syngnathidae.

d_5 small mouth; Labridae, Balistidae, Monacanthidae, Alutheridae, Ostraciidae, Tetraodontidae.

d_6 wide mouth; Dussumieridae, Apodes, Sphyraenidae, Thunnidae, Scomberomoridae, Histiophoridae, Platycephalidae, Champsodontidae, Lutianidae, Serranidae, Opisthognathidae.

Appearance of fins

e_1 two separated dorsal fins;
Mugilidae, Apogonidae, Mullidae, Gobiidae, Atherinidae, Cephalacanthidae.

e_2 one long dorsal fin;
Bregmacerotidae, Serranidae, Theraponidae, Menidae, Carangidae, Coryphaenidae, Lutianidae, Lobotidae, Leiognathidae, Gerridae, Pomacentridae, Labridae, Sciaenidae, Cepolidae, Blenniidae, Opisthognathidae, Thunnidae, Histiophoridae, Stromateidae, Trypauchenidae, Bothidae, Soleidae, Pleuronectidae, Cynoglossidae.

e_3 big pectoral fins; Exocoetidae, Scorpaenidae, Platycephalidae, Cephalacanthidae.

e_4 big ventral fins; Exocoetidae, Stromateidae (lack in adult), Callionymidae, Platycephalidae, Champsodontidae.

e_5 ventral absent; Apodes, Syngnathidae, Tetraodontidae.

e_6 lower lobe of caudal fin somewhat elongated;
Exocoetidae.

e_7 elongated fin ray; Bothidae (1st dorsal ray), Soleidae (1st dorsal ray), Cynoglossidae (two of the anterior dorsal rays), Bregmacerotidae, Cephalacanthidae (Dactylopterus sp.).

e_8 elongated dorsal and ventral fin spines;
Lutianidae, Serranidae, Siganidae, Balistidae, Aluteridae.

e_9 absence of caudal fin;
Ophichthyidae.

e_{10} caudal fin with elongated filament;
Fistulariidae.

Position of anus

f_1 anus situated far backward;
Clupeidae, Dussumieridae, Engraulidae, Belonidae, Synodontidae.

f_2 anus situated far forward;
Bregmacerotidae, Atherinidae, Trypauchenidae, Blenniidae, (Xiphasia setifer).

f_3 annus situated nearly middle of body;
Holocentridae, Theraponidae, Apogonidae, Gobiidae, Larbridae, Sillaginidae, Carrangidae, Mullidae, Lutianidae, Thunnidae, Scorpaenidae, Cepolidae, Opisthognathidae, Scomberomoridae, Coryphaenidae, Sparidae, Champsodontidae, Pleuronectidae, Bothidae.

f_4 anus situated behind middle of body;
Apodes, Hemirhamphidae, Exocoetidae, Fistulariidae, Migilidae, Sphyraenidae, Coryphaenidae, Platycephalidae, Cephalacanthidae.

Digestive tract

g_1 alimentary canal showed in vertical muscle strands;
Clupeidae, Engraulidae, Dussumieridae, Synodontidae.

g_2 abdominal bulging out like a sac;
Cynoglossidae, Soleidae.

Pigmentation

h_1 all the body dark in colour;
Holocentridae, Belonidae, Carangidae, (Seriola sp.), Balistidae, Coryphaenidae, Blenniidae, Pegasidae, Histiophoridae, Cephalacanthidae.

h_2 some part of body densely pigmented;
Exocoetidae, Atherinidae, Theraponidae, Mullidae, Apogonidae (some member), Stromateidae, Lobotidae, Platycephalidae.

h_3 few pigments on the body;
Engraulidae, Dussumieridae, Bregmacerotidae, Synodontidae, Exocoetidae, Theraponidae, Apogonidae, Lutianidae, Menidae, Serranidae, Leiognathidae, Siganidae, Scomberomoridae, Thunnidae, Trypauchenidae, Pleuronectidae, Cynoglossidae, Gobiidae, Opisthognathidae.

h_4 almost without pigment;
Gobiidae, Trypauchenidae, Bothidae, Soleidae.

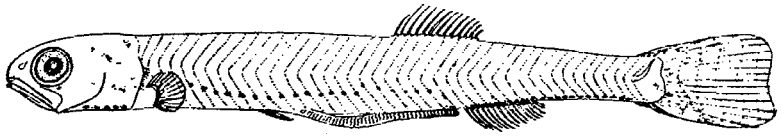
Myotome number

i_1 numerous myotomes (more than 50);
Synodontidae, Apodes, Belonidae, Hemirhamphidae, Dussumieridae, Cepolidae, Bregmacerotidae, Blenniidae, Cynoglossidae.

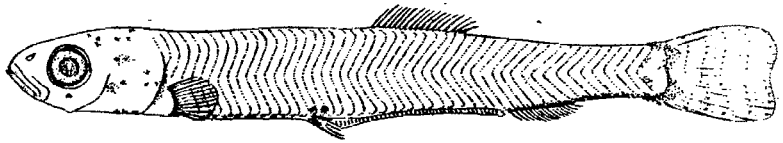
i_2 somewhat numerous myotomes (30-50);
Clupeidae, Engraulidae, Exocoetidae, Atherinidae, Thunnidae, Scomberomoridae, Sillaginidae, Scombridae, Trypauchenidae, Gobiidae, Coryphaenidae.

i_3 24 myotomes; Mugillidae, Sphyraenidae, Carangidae, Gobiidae, Mullidae, Histiophoridae, Theraponidae, Lobotidae, Leiognathidae, Serranidae, Lutianidae, Apogonidae, Sciaenidae, and many others.

Dussumieria hasselti Bleeker T.L 20.0 mm

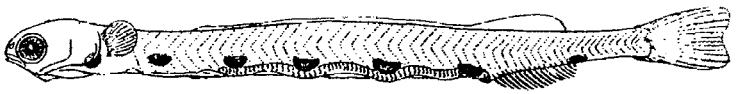


Stolephorus spp. T.L 21.0 mm

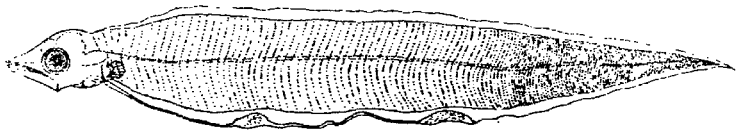


Clupea spp. T.L 22.3 mm

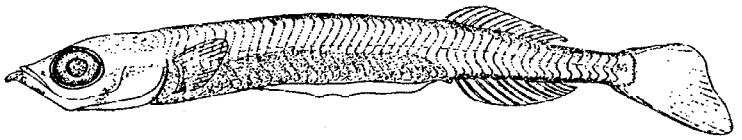
Fig. 2



Saurida spp. T.L 15.8 mm



Family Opichthyidae T.L 17.0 mm



Hemirhamphus spp. T.L 10.0 mm

Fig. 3

Figs. 2-11 Some fish larvae found in the South China Sea

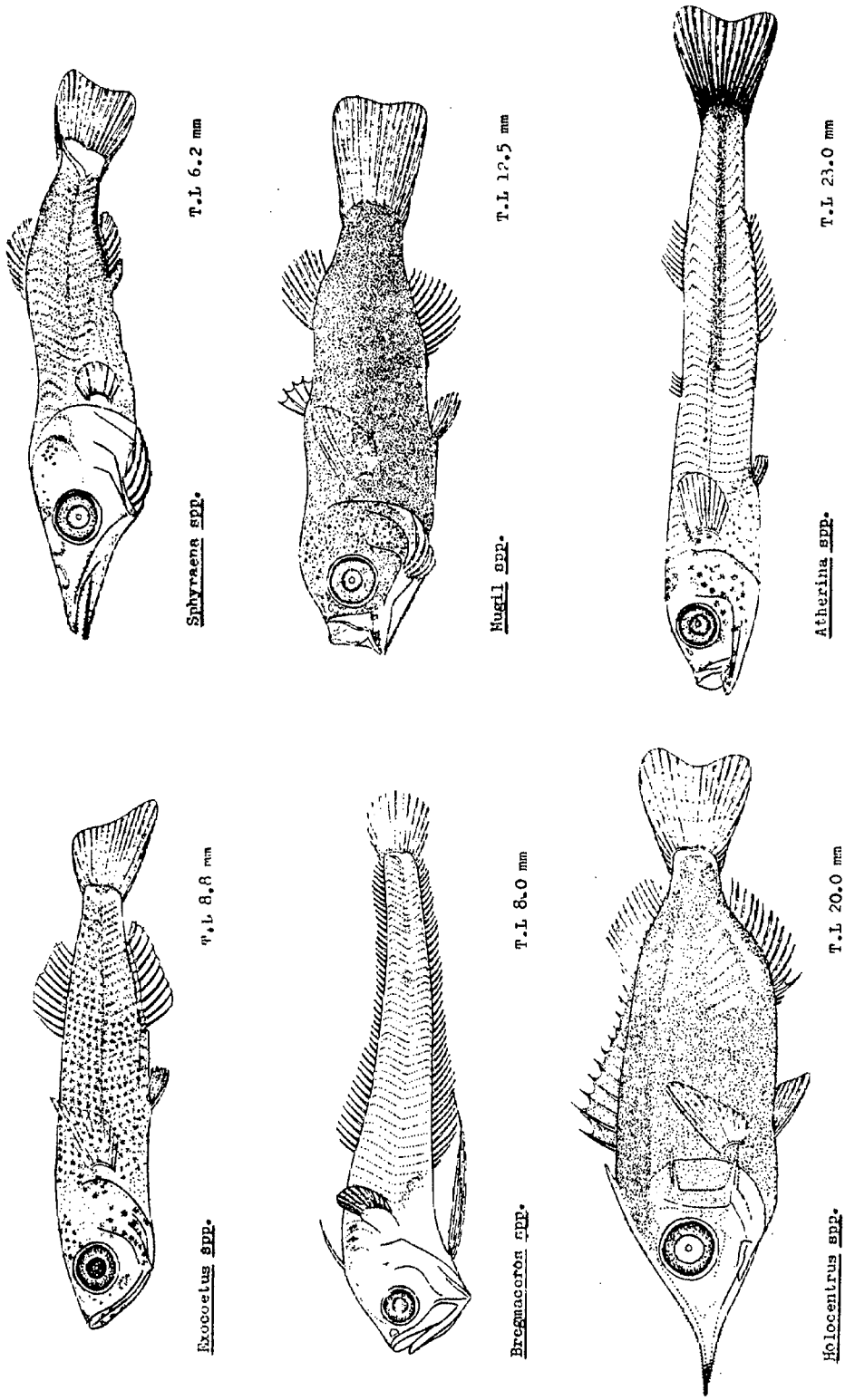

T.L 6.2 mm
Sphyraena spp.
T.L 12.5 mm
Mugil spp.
T.L 23.0 mm
Atherina spp.
T.L 8.8 mm
Exocoetus spp.
T.L 8.0 mm
Bregmaceros spp.
T.L 20.0 mm
Holocentrus spp.

Fig. 4

Fig. 5

i_4 less than 24 myotomes;
Balistidae, Aluteridae, Monacanthidae, Tetraodontidae, Cephalacanthidae.

3.3 Some important characteristics of fish larvae

The best way to carry out taxonomical studies on larval fish is to identify a series of developmental stages and to trace their morphological changes through smaller and smaller individuals. However, as for some species only one or a few larvae were collected, the identification to specific level was not possible.

In Clupeoid larvae, especially in their early stages, the differentiation between Engraulidae and Clupeidae is quite difficult. The main differences between these two families are: (1) shape of the head, (2) position of mouth, (3) number of pre-anal myotomes, (4) relative position of dorsal and anal fin, (5) number of fin rays, (6) pigmentation (Fig. 2).

The Engraulid larvae are characterised by the following features: (1) head somewhat round, mouth subterminal, (b) maxillary very long and extending beyond the eye, (c) dorsal and anal fins overlapping or close together in a straight line. It is very difficult to separate the genera Engraulis and Stolephorus (Fig. 2), because the number of their pre-anal myotomes varies from 24 to 30 according to developmental stages.

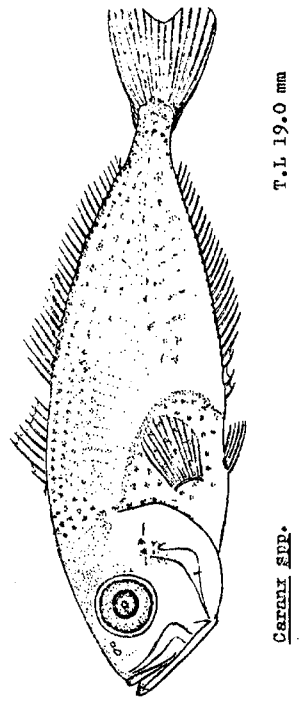
The larvae of Synodontids are rather common, especially in October and November. There are at least three species in the South China Sea. All the laryae have an elongated body, the differences among the species being the number and position of big round black-brown pigment spots, number of fin rays, and number of vertebrae and myotomes (Fig. 3).

The most important character to separate Hemirhamphids from Belonids is the myotome number: 47-60 for Hemirhamphids and 90 for Belonids (Fig. 3).

The family Exocoetidae, includes many species of flying fish occurring in the South China Sea. Generally, the genus Exocoetus has fan shaped pectoral fin extending behind the ventral fins, which are usually rather small in the post-larval stage (Fig. 4). The genus Cypselurus has a pair of large ventral fins which extend to the anal fin; in some species the ventral fins extend further to the origin of the caudal. Hirundichthys and Oxyporhamphus, have intermediate characteristics of Cypselurus and Exocoetus. Parexocoetus has a pair of large ventral fins, but normally smaller than Cypselurus, and the posterior part of the dorsal fin is elevated.

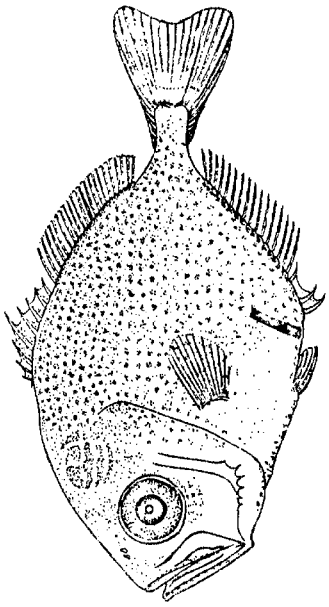
The Theraponidae larvae made up 2.88% of the total collection and occurred throughout the year in coastal waters. At least two species are represented in the collections: One species is characterised by many pigments scattered all over the body, and by its resemblance with Mullid larvae; the other with few pigments and similar to those found around Japanese waters.

Carangid larvae were one of the most abundant fish in the area. 413 individuals were collected, representing 8.3% of the total collection. At least 10 species of Carangid larvae appeared in surface layers. Their identification into species was carried out by observations on the pigmentation during the developmental stages, number of fin rays and spines, number of preopercular spines and position of bony ridge or bony crest on the head, etc. (Fig. 7).



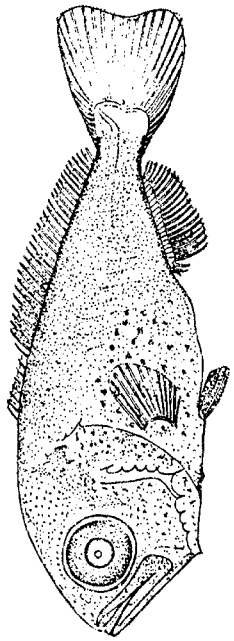
T.L 19.0 mm

Caranx spp.



T.L 11.0 mm

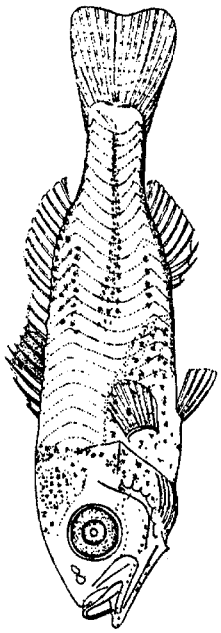
Caranx spp.



T.L 9.2 mm

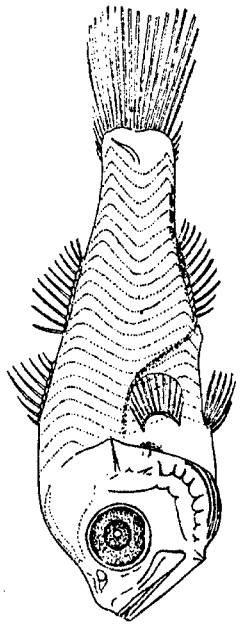
Seriola spp.

Fig. 7



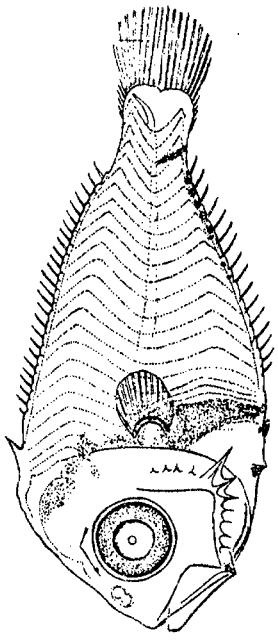
T.L 11.8 mm

Therapon spp.



T.L 7.9 mm

Apogon spp.



T.L 5.6 mm

Leiognathus spp.

Fig. 6

The genus Lutianus was one of the most abundant in trawl catches, but the larvae were seldom collected by the surface plankton tows. In the collection only 8 larvae were found. It is supposed that they are not surface dwellers. The larva is characterised by its big head and compressed body with elongated and serrated spines of dorsal and ventral fins (Fig. 8).

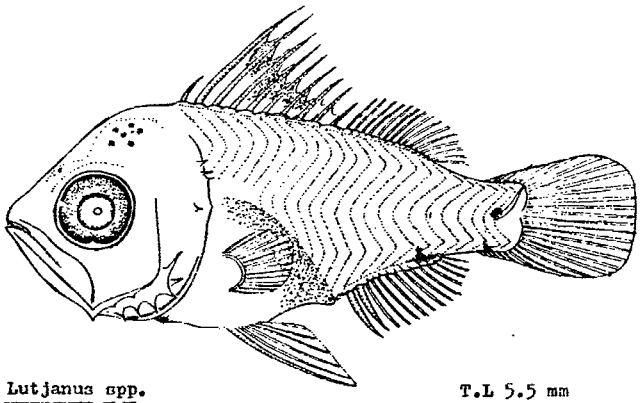
The Serranid larva is more or less the same as the Lutianid larva in appearance, both having elongated and serrated spines in dorsal and ventral fins. The differences of larvae between these two families are: higher body in Lutianid, different number of fin rays, different pigmentation pattern and so on. The Serranid larvae were rare in the collections, only 5 specimens were collected in offshore waters.

The Mullid larvae were the most dominant in our collection: 2,146 specimens were found, representing 43.9% of the whole catch. Although they occurred throughout the year the main spawning season seems to be June when as many as 1,009 specimens were caught. At least 3 or 4 species occurred in the collection. The pigmentation pattern and the number of fin rays should be available for identification of the larvae (Fig. 9).

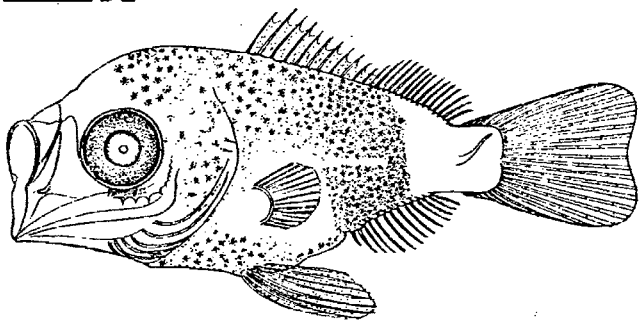
The larvae of Scombroid fish were not very common in the collections; among them the Thunnid larvae were more abundant than other groups. From June to August 21 individuals were collected in offshore waters. Only one Rastrelliger larva (2.5 mm) was collected in April (Fig. 9). However, this kind of larvae commonly appeared in the Gulf of Thailand, especially in April and August. It seems either that their spawning ground is not in the South China Sea, but in the Gulf of Thailand or that the post larvae are distributed at mid layers in the South China Sea. Another member of Scombroid larvae, Scomberomorid is rather rare in the collections; the main characteristics to identify these larvae are number of myotomes, appearance of preopercular spines, number of fin rays, the pigmentation pattern in various developmental stages, and so on.

The appearance of the Gobiid larva is much more slender with two dorsal fins separated not far apear (Fig. 10). Soft dorsal and anal fins located opposite and with nearly equal number of rays. In larval stage it can easily be distinguished by the existence of an air bladder above the abdominal part. About 7 species were separated. The Gobiid larvae were among the most abundant following the Mullid larvae in the collections. A total of 549 individuals were collected, and as 282 individuals were caught in November, the author presumes that this month might be their main spawning season.

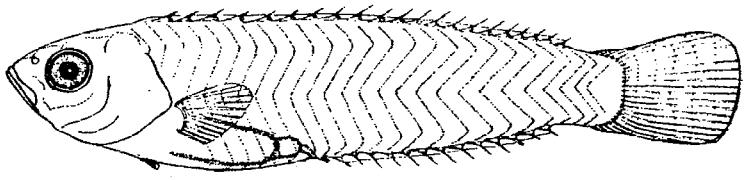
Flat fish larvae are easily distinguished by their extremely compressed and somewhat elongated body (Fig. 11). The dorsal fin originates far forward on the top of the head and continues to the caudal. The dorsal and anal fins are separated from the caudal fin in the larvae belonging to the families Bothidae and Pleuronectidae. In some of the larvae belonging to the family Soleidae, these three fins are fused together as found in the genus Cynoglossus. Other characteristics for closer identification of these larvae are as follows: (a) the number of fin rays, (b) number of myotomes, (c) pigmentation such as seen in one of the Pleuronectidae larvae which has 9 blotches of rhodophores on the dorsal from the interorbital to the caudal, (d) the existence of elongated dorsal rays which were easily broken during the collection.



Lutjanus spp. T.L 5.5 mm

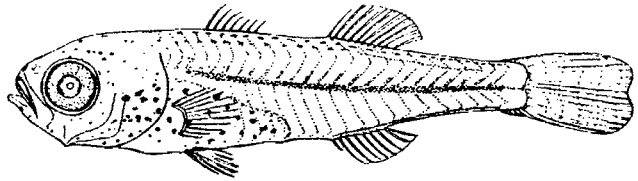


Amphiprion spp. T.L 7.4 mm

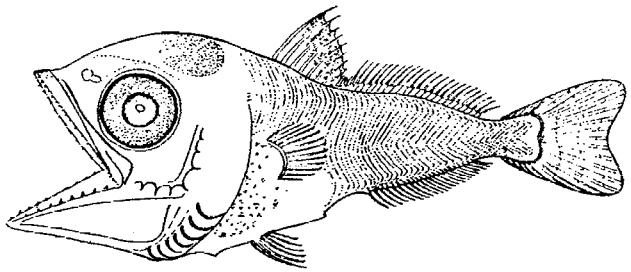


Novaculichthys spp. T.L 15.0 mm

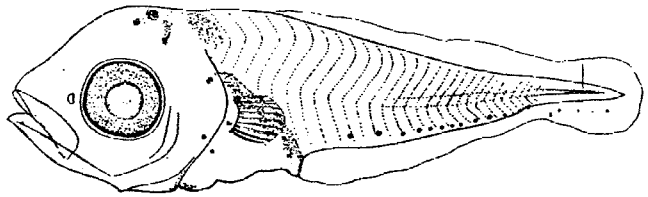
Fig. 8



Upeneus spp. T.L 7.0 mm

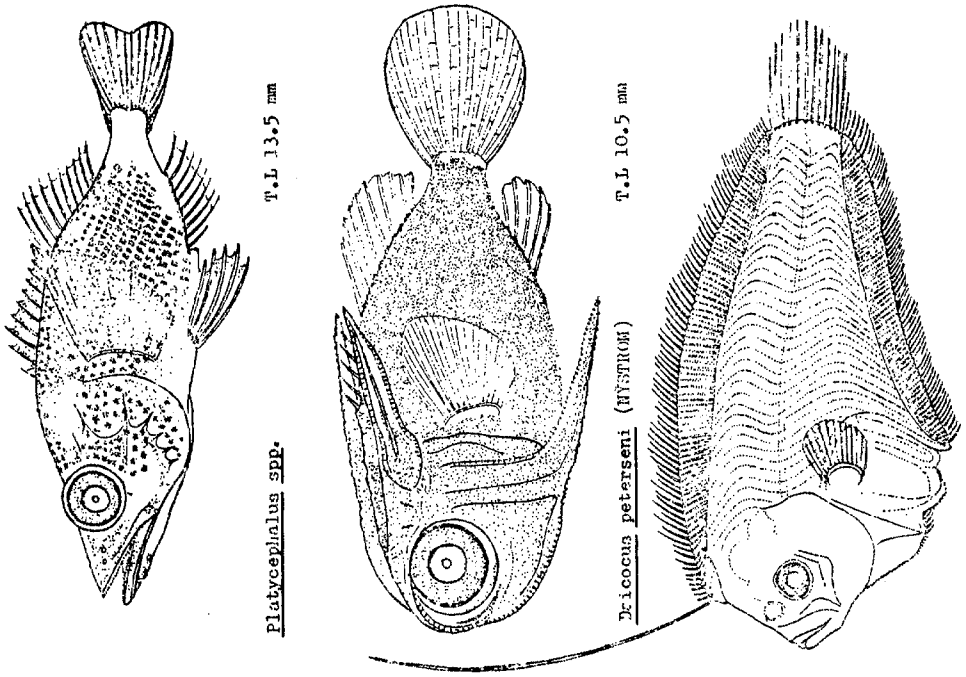


Family Thunnidae T.L 9.8 mm



Rastrelliger spp. T.L 2.5 mm

Fig. 9

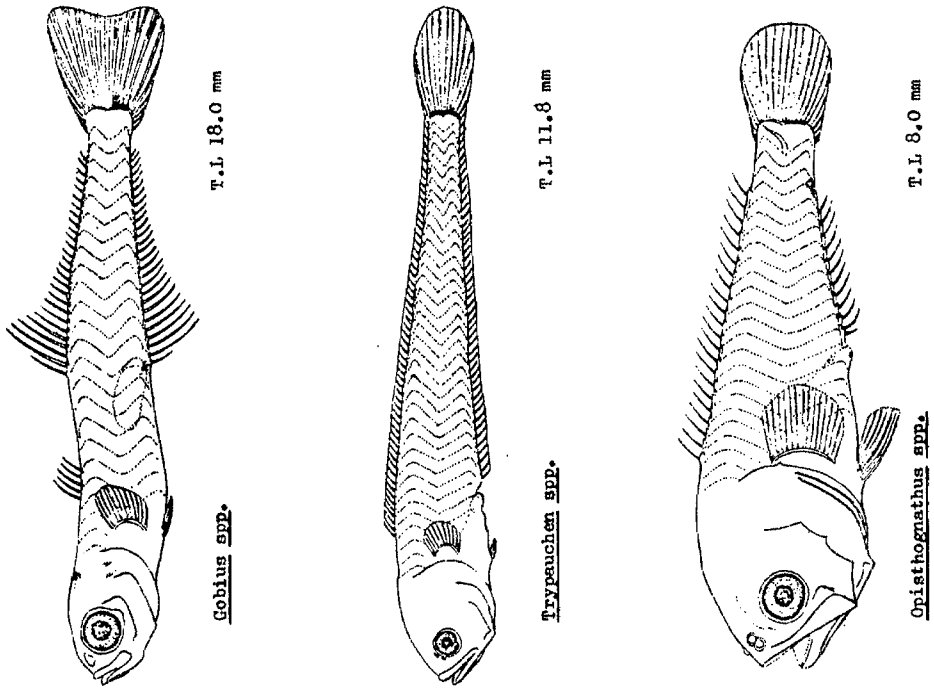


Platycephalus spp. T.L 13.5 mm

Dicocus petersoni (MYSTOM) T.L 10.5 mm

Amblagnus spp. T.L 12.5 mm

Fig. 11



Gobius spp. T.L 18.0 mm

Trypauchen spp. T.L 11.8 mm

Opisthognathus spp. T.L 8.0 mm

Fig. 10

Only one larva of trigger fish was collected (in November), whereas, the adult fish (Abalistes stellatus Bleeker) is one of the most abundant fish in trawl catches in the South China Sea. At the length of 16.5 mm, the body was encased already with spiny scales. The strong and serrated dorsal spines were situated behind the nape and the ventral spine was prominent. The melanophores were distributed densely on the whole body, especially at the ventral and caudal region.

The identification of the Priacanthid (big-eyed snapper) and Nemipterid larvae (threadfin breams), which are widely distributed in the South China Sea, is not yet possible.

Some examples of fish larvae are shown in Figs. 2 - 11.

4. SUMMARY

During the period from January 1970 to April 1971, 10 survey cruises were made in the South China Sea, and a total of 4959 fish larvae and 3666 fish eggs were collected. The larval material was identified by family, genus, or species: 137 species belonging to 64 families and 21 unknown species have been identified.

The most dominant larval fish was Mullid which occupied 43.9% of the whole larval catch, followed by Gobioid 11.1%, Clupeoid 8.4%, Carangoid 8.3%, Exocoetid 4.6%, Theraponid 2.9%, Synodontid 2.2%, others 13.2%, and unknown 5.4%.

A key for classification of fish larvae found in the South China Sea into taxonomic groups or families is given as well as brief descriptions of some systematic characteristics of the larval fishing group for the sake of a closer identification.

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