

**Kinds, Abundance and Distribution of the Fish Larvae in the South China Sea,  
Area I: Gulf of Thailand and East Coast of Peninsular Malaysia.**

**Apichart Termvidchakorn**

Museum and Aquarium Institute, Department of Fisheries  
Phaholyotin Rd., Chatuchak, Bangkok 10900, Thailand

**ABSTRACT**

Fish larvae samples were obtained from 81 stations in the Gulf of Thailand and the east coast of (Peninsular) Malaysia during the pre-northeast monsoon season (4 Sept - 4 Oct 1995) and the post-northeast monsoon (23 Apr - 23 May 1996). About 30 minutes were needed to obtain the samples from the surface layer and an oblique haul at each station. Around 73 families and 97 species of fish larvae were found among these pre and post-northeast monsoon specimens. For the pre-northeast monsoon sampling, there were 10,422 individuals from 66 families and 91 species in the surface horizontal hauls and 34,779 individuals from 63 families and 84 species in the oblique hauls. The post-northeast monsoon collection showed 11,875 individuals from 54 families and 74 species in the surface horizontal hauls and 32,541 individuals from 53 families and 73 species in the oblique hauls. From the surface layer, the most abundant larvae were *Stolephorus* sp., *Sardinella* sp., Gobiidae and *Upeneus* sp. respectively. Specimens from the oblique hauls showed Gobiidae, *Stolephorus* sp., *Bregmaceres rarisquamosus* and *Nemipterus* sp. to be most abundant in the collection.

**Introduction**

Fish resources in the South China Sea is an important subject of consideration by the countries bordering this area. The Gulf of Thailand and the east coast of Peninsular Malaysia are examples of the coastal areas of the South China Sea. The maximum depth within these areas is less than 100 metres and there are many islands and oil platforms able to provide shelter to the fishes and other marine organisms. Knowledge on fish larvae in terms of biology, morphology, spawning period, spawning peak, spawning ground and rearing ground for this area is needed for proper fishery management. Due to the limitation of such knowledge for this area, a collaborative research project between SEAFDEC member countries that included the participation of the Department of Fisheries, Thailand was carried out using M.V. SEAFDEC to investigate the available fish resources as well as the biological and physical oceanographic conditions.

Fish larvae were investigated for their kinds, abundance and distribution. The objectives of this study being to identify the composition of the fish larvae found, as well as the spawning grounds, spawning periods, spawning peaks, rearing grounds and periods, the information of which may then be used to formulate a fisheries management program.

Study on fish larvae in Southeast Asia were first conducted by Delsman from 1922-1938. He described and illustrated the larvae of *Chirocentrus dorab*, *Dussumieria hasseltii*, *Clupea* sp., *Engraulis* sp., *Setipinna* sp. and Myctophoidae sp. from the Java Sea.

Previous important studies on fisheries resources in the Gulf of Thailand were conducted by the Department of Fisheries. As for example, Sidthichokpan (1972) found 2 spawning peaks for the anchovy on the west coast of the Gulf of Thailand from March to April and July to September. Vatanachai (1972) showed that there were at least 107 families of fish larvae in the South China Sea, and around 51 families of them in the upper Gulf of Thailand (Vatanachai 1978). Chamchang (1986) found 47 families of fish larvae in the waters of the west coast of the Gulf of Thailand from Surat Thani to Narathivas with Gobiidae and Engraulidae being the most abundant. Termvidchakorn (1987) showed there were about 54 families of fish larvae in the central part of the Gulf of Thailand where

Carangidae was the most abundant.

### Material and Methods

Sampling for fish larvae was carried out using M.V. SEAFDEC from 4 September - 4 October 1995 during the pre-northeast monsoon period, while the post-northeast monsoon period was between 23 April and 23 May 1996, at 81 sampling stations in the Gulf of Thailand and on the east coast of Peninsular Malaysia. Two types of fish larvae sampling method were employed. The surface horizontal haul represents a study on the diurnal migration and the economically important pelagic families. The standard larvae net, 1.30 metre in diameter with a 5-mm mesh size at the mouth part and 330 micron at the cod end, was used in the surface sampling.

The oblique haul catches all the species which occur in the area. The bongo net, 60 cm. in diameter with mesh size 500 micron at the mouth part and 330 micron at the cod end, was employed for this haul.

A flow meter was attached to the mouth part of the net. The sampling period was for about 30 minutes with the speed of haul at about 2 knots. For the oblique haul, the net went down to a depth of about 5 metres above the bottom (as measured by a depth sensor).

Specimens were preserved in 10% seawater/formalin immediately after each haul. Sorting and identification was done at the laboratory. After sorting, the fish larvae were preserved in 4% seawater formalin. Their identification and illustration was done using the stereomicroscope and a camera lucida attached to the stereomicroscope. Specimens were identified to the genera or species level. Their abundance and distribution were estimated in terms of number of individuals per 1000 cubic metres (No./1000 m<sup>3</sup>) of sea water. The keys used in this identification were taken from Delsman (1922-1938), Leis and Rennis (1983), Leis and Trnski (1989), Mito (1966), Moser *et al.* (ed) (1984), and Okiyama (1988).

Data on temperature, salinity and dissolved oxygen at the surface and mid- depth of each station were also used to relate the abundance, distribution and migration of the fish larvae.

### Results

There were 10,422 and 34,779 individuals of fish larvae obtained from the surface and oblique hauls of the pre-northeast monsoon cruise. The post-northeast monsoon cruise provided 11,875 and 32,541 individuals from the surface and oblique hauls. The specimens were identified to comprise of 73 families and 97 species of fish larvae from the pre-northeast and post-northeast monsoon. The pre-northeast monsoon specimens showed 66 families and 91 species from the surface horizontal hauls and 63 families and 84 species from the oblique hauls. The post-northeast monsoon collection provided 54 families and 74 species from the surface sampling and 53 families and 73 species from the oblique hauls.

The most abundant fish larvae from the surface layer in order of importance in both cruises were *Stolephorus* sp., *Sardinella* sp. Gobiidae and *Upeneus* sp., respectively. For specimens from the oblique hauls in both cruises, the abundant larvae were Gobiidae, *Stolephorus* sp., *Bregmaceros rarisquamosus* and *Nemipterus* sp., respectively.

The most abundant fish larvae from the surface hauls of the pre-northeast monsoon were *Stolephorus* sp. (20.678%), *Sardinella* sp. (14.988%), Gobiidae 12.608% and *Upeneus* sp. (9.713%), respectively. Those from the oblique hauls were Gobiidae (24.087%), *Stolephorus* sp. (12.787%), *Bregmaceros rarisquamosus* (7.542%) and *Nemipterus* sp. (5.070%), respectively. The post-northeast monsoon showed the abundant fish larvae at the surface as *Stolephorus* sp. (33.154%), *Sardinella* sp. (27.192%), Gobiidae (10.165%) and *Upeneus* sp. (4.421%), respectively. Those from the oblique hauls were Gobiidae (26.591%), *Stolephorus* sp. (13.340%), *Bregmaceros rarisquamosus* (6.411%) and *Nemipterus* sp. (6.168%), respectively.

***The abundance and distribution of the fish larvae in the Gulf of Thailand and the East Coast of***

**Peninsular Malaysia .****Family Clupeidae**

Clupeidae larvae which occurred in both the surface and oblique samples were *Sardinella* sp. which formed the second most abundant fish larvae from the surface specimens. There were 1,562 individuals or 14.988% from 40 stations of the surface hauls in the pre- monsoon cruise, while for post-monsoon 3,229 individuals or 27.192% from 42 stations. Larvae were collected in abundance in the early morning, at night and during cloudy conditions. *Sardinella* sp. was the most abundant in the surface layer at densities 489.71 and 244.01 individuals per 1000 cubic metres in the post-monsoon and pre-monsoon samples. It was also the most abundant in the oblique samples at densities of 1544.84 and 512.53 individuals per 1000 cubic metres in the pre-monsoon and post-monsoon samples.

*Dussumieria* sp. larvae occurred in both the surface and oblique samples in pre- and post-monsoon collection. There were 80 and 19 individuals from 17 and 4 stations in the surface sampling from the pre- and post-monsoon cruises, respectively. The oblique sampling showed 34 and 31 individuals from 17 and 14 stations pre- and post-monsoon cruises, respectively with most of the samples collected at night.

**Family Engraulidae**

Engraulidae larvae occurred in both the surface and oblique samples with *Stolephorus* sp. showing the most abundant in the surface samples in both pre- and post- monsoon sampling. There were 2155 individuals from 51 stations of the surface hauls in the pre-monsoon cruise. The most abundant station provided a density of 125.55 individuals per 1000 cubic metres. In the surface sampling of the post-monsoon, there were 3,937 individuals from 54 stations with the most abundant station recording 206.05 individuals per 1000 cubic metres. Amounts of this larvae in the oblique hauls were 4,447 and 4,341 individuals from 73 and 64 stations in the pre- and post-monsoon cruise, respectively. The most abundant station for *Stolephorus* sp. provided 2,080.16 and 1,022.47 individuals per 1000 cubic metres in the post- and pre-monsoon. Light intensity affected their abundance because of Phototaxis but there was no difference between the pre- and post-monsoon collection, the difference being only among the surface and oblique specimens.

**Family Chirocentridae**

*Chirocentrus* sp. occurred in both pre- and post-monsoon cruises and from the surface and oblique specimens, with most abundance in the oblique samples of the pre-monsoon period. There were 111.60 individuals per 1000 cubic metres at station number 22 of the pre-monsoon oblique hauls, this being the highest figure.

**Family Chanidae**

*Chanos chanos* occurred at some stations, with only few specimens obtained from the night stations. Only 8 specimens were obtained from 7 stations.

**Family Synodontidae**

Four species of this family occurred during these research cruises. These were *Saurida elongata*, *Saurida undosquamis*, *Synodus variegatus* and *Trachinocephalus myops*.

*Saurida elongata* showed 13 and 138 individuals from 2 and 24 stations of the surface and oblique hauls in the pre-monsoon and 3 individuals from 1 station of in the oblique hauls of the post-monsoon cruises.

*Saurida undosquamis* showed 4 and 203 individuals from 3 and 35 stations in the surface and oblique hauls from the pre-monsoon cruise and 126 individuals from 24 stations in the oblique hauls from the post-monsoon cruise. *Saurida undosquamis* was the most abundant among the 4 species especially in the oblique haul specimens. The most abundant station showed 83.95 individuals per 1000 cubic metres at station number 33 in the pre- monsoon oblique hauls.

*Synodus variegatus* showed 6 and 52 individuals from 2 and 22 stations in the surface and oblique hauls from the pre-monsoon cruise and 94 individuals from 24 stations in the oblique hauls from the post-monsoon cruise.

*Trachinocephalus myops* showed 22 and 105 individuals from 9 and 27 stations in the surface and oblique hauls from the pre-monsoon cruise. The post-monsoon provided 3 and 62 individuals from 3 and 20 stations in the surface and oblique hauls.

#### **Family Belonidae**

Only 4 individuals of *Tylosaurus coccodylus* occurred in the surface and oblique hauls during the post-monsoon cruise.

#### **Family Hemiramphidae**

*Hemiramphus* sp. occurred in these research cruises in both the surface and oblique hauls but for the oblique hauls, *Hemiramphus* sp. were obtained in the night stations or on cloudy days. Very few specimens were collected in these research cruises. There were 11 and 5 individuals from 8 and 3 stations in the surface and oblique hauls from the pre-monsoon cruise. The post-monsoon showed 36 and 10 individuals from 16 and 5 stations in the surface and oblique specimens.

#### **Family Exocoetidae**

There were 2 genus of exocoetid larvae in these samples. *Exocoetus* sp. and *Cypselurus* sp. are true pelagic species which occurred mostly in the surface specimens, collected at night and on cloudy days. There were very few specimens collected at each station but *Exocoetus* sp. had a wider distribution and was collected at more stations.

*Exocoetus* sp. showed 7 and 3 individuals from 6 and 1 stations in the surface and oblique hauls during the pre-monsoon cruise. There were 32 individuals from 19 stations of the surface specimens in the post-monsoon cruise.

*Cypselurus* sp. showed 4 and 1 individuals from 4 and 1 stations in the surface and oblique hauls in the pre-monsoon cruise and 15 individuals from 10 stations in the surface hauls of the post-monsoon cruise.

#### **Family Antennariidae**

*Antennarius* sp. occurred mostly in the oblique hauls of the pre-monsoon and the post-monsoon cruises. They showed 53 and 38 individuals of larvae from 27 and 20 stations of the oblique hauls in the pre- and post-monsoon cruises. But for the surface sampling, there were only 2 specimens in station 2 during the pre-monsoon cruise.

#### **Family Pegasidae**

*Pegasus* sp. is a small group of larvae which showed 1 and 10 individuals in 1 and 5 stations occurred in both the surface and oblique hauls of the pre-monsoon, but only 2 specimens from 2 stations in the oblique hauls of the post-monsoon cruise.

#### **Family Bregmacerotidae**

*Bregmaceros rarisquamosus* occurred in both the surface and oblique hauls of the pre- and post-monsoon cruises. There were 178 individuals from 20 stations of the surface pre-monsoon cruise and 170 individuals of 9 stations in the surface post-monsoon cruise. They also showed third abundance in the oblique collection in both the pre- and post-monsoon. There were 2,623 individuals of larvae from 72 stations in the oblique hauls during the pre-monsoon cruise and 2,086 individuals of larvae from 60 stations in the obliques of the post-monsoon cruise. The most abundant in the obliques during the pre-monsoon cruise was 577.16 individuals per 1000 cubic metres and for the obliques in the post-monsoon cruise 2,029.82 individuals per 1000 cubic metres. The bregmaceros larvae occurred in the surface sampling when light intensity was limited as in the early morning, on cloudy days or during the night time.

**Family Fistulariidae**

The larvae of *Fistularia* sp. occurred in both the surface and oblique samples of the pre- and post-monsoon. There were 14 and 119 individuals from 9 and 45 stations in the surface and oblique samples in the pre-monsoon, while the post-monsoon period showed 6 and 93 individuals from 3 and 33 stations of the surface and oblique samples. They have the possibility to be a sub-surface or demersal species.

**Family Syngnathidae**

There were 2 genus of *Syngnathus* sp. and *Hippocampus* sp. occurring in the samples but only 1 specimen of *Hippocampus* sp. was obtained from station number 49 in the oblique hauls of the post-monsoon. The *Syngnathus* sp. occurred in both the surface and oblique samplings of the pre- and post-monsoon. There were 2 and 13 individuals from stations 2 and 11 of the surface and oblique hauls in the pre-monsoon. There were 33 individuals from 17 stations in the oblique hauls during the post-monsoon cruise.

**Family Centriscidae**

Only one species of *Centriscus scutatus* occurred in the oblique collection. There were 13 and 4 individuals from 13 and 4 stations of the pre- and post-monsoon cruise.

**Family Holocentridae**

The two genus of Holocentrid larvae occurring in the samples were *Holocentrus* sp. and *Myripristis* sp.

*Holocentrus* sp. showed 5 and 1 individuals from 4 and 1 stations in the surface and oblique hauls of the pre-monsoon cruise. The post-monsoon cruise provided 10 and 2 individuals from 8 and 1 stations in the surface and oblique hauls.

*Myripristis* sp. showed 3 and 2 individuals from 2 stations each from the surface and oblique hauls during the pre-monsoon cruise. The post-monsoon provided 4 and 1 individuals from 3 and 1 stations in the surface and oblique hauls.

**Family Sphyraenidae**

Only one genus of *Sphyraena* sp. occurred in the sampling from both the surface and oblique hauls in the pre- and post-monsoon cruise. There were 74 and 86 individuals of larvae from 27 and 26 stations in the surface and oblique hauls from the pre-monsoon cruise. The post-monsoon cruise showed 63 and 41 individuals from 15 and 19 stations in the surface and oblique samples.

**Family Mugilidae**

Eleven larvae of *Valamugil* sp. were collected from 6 stations of the surface hauls during the pre-monsoon cruise. They were observed to occur mostly at the coastal stations.

**Family Ambassidae**

larvae of *Ambassis* sp. occurred only in the surface hauls of both pre- and post- monsoon cruises. There were 45 and 33 individuals from 6 and 1 stations in the pre- and post-monsoon cruises.

**Family Serranidae**

There were 2 genus of serranid larvae occurring in the samples from both the surface and oblique hauls with the numbers in the oblique haul samples higher than surface hauls in both the pre- and post-monsoon cruise. For the surface hauls, *Epinephelus* sp. showed 5 and 1 individuals from 5 and 1 stations of the pre- and post-monsoon cruises. There were 16 and 2 individuals of *Serranus* sp. from 3 and 1 stations in the pre- and post-monsoon cruises. For the oblique samples, there were 72 and 48 individuals of *Epinephelus* sp. from 27 and 25 stations in the pre- and post-monsoon cruises,



and for the *Serranus* sp. 36 and 12 individuals from 13 and 4 stations in the pre- and post-monsoon cruises.

#### **Family Theraponidae**

Only one species of *Therapon jarbua* occurred in both the surface and oblique specimens in the pre- and post-monsoon cruises. There were 330 and 52 individuals from 29 and 19 stations in the surface and oblique specimens in the pre-monsoon cruise. The post-monsoon provided 464 and 71 individuals from 44 and 11 stations for the surface and oblique specimens most of the larvae were collected from surface hauls.

#### **Family Priacanthidae**

There were 42 and 449 individuals of *Priacanthus tayenus* from 13 and 55 stations of the surface and oblique specimens from the pre-monsoon cruise. The post-monsoon sampling showed 13 and 212 individuals from 6 and 49 stations in the surface and oblique samples.

#### **Family Apogonidae**

There were at least 3 species of apogonid larvae occurring in the sampling of both surface and oblique hauls from the pre- and post-monsoon cruises. These were *Apogon lineatus*, *Apogon nigrofasciatus*, *Apogon* sp. and *Gymnopogon* sp. The occurrence of the *Apogon lineatus* on the pre-monsoon cruise was 19 and 634 individuals from and 65 stations in the surface and oblique specimens and the post-monsoon cruise showed 55 and 339 individuals from 10 and 54 stations in the surface and oblique samples. The *Apogon nigrofasciatus* showed 5 and 712 individuals from 4 and 36 stations of the surface and oblique hauls from the pre-monsoon cruise. The post-monsoon cruise showed 43 and 162 individuals from 5 and 21 stations in the surface and oblique hauls *Apogon* sp. and *Gymnopogon* sp. showed the same pattern of abundance and distribution, while the oblique specimens showed a wider distribution and more abundance than the surface specimens.

#### **Family Sillaginidae**

*Sillago* sp. occurred in the oblique sampling of both pre and post-monsoon but were collected only in the surface haul in the post-monsoon. There were 35 and 17 individuals from 4 and 5 stations of the oblique samples from the pre- and post-monsoon cruises while there were 52 individuals from station number 1 in the surface sampling from the post-monsoon.

#### **Family Coryphaenidae**

The specimens were *Coryphaena hippurus*. There were 3 and 2 individuals from 5 stations occurring in both surface and oblique collection of the pre- and post-monsoon cruises.

#### **Family Carangidae**

Carangid is a large group of larvae comprising the *Decapterus* sp., *Selar crumenophthalmus*, *Caranx leptolepis*, *Caranx mate*, *Caranx speciosus*, *Caranx* sp., *Scomberoides lysan* and *Zonichthys nigrofasciata*.

*Decapterus* sp. were obtained from both the surface and oblique hauls of the pre- and post-monsoon cruises. There were 257 and 765 individuals from 31 and 53 stations in the surface and oblique specimens of the pre-monsoon cruise. The post-monsoon cruise showed 341 and 629 individuals from 38 and 54 stations in the surface and oblique specimens from the post-monsoon cruise.

*Selar crumenophthalmus* occurred in both the surface and oblique specimens of the pre and post-monsoon cruises. There were 4 and 171 individuals from 2 and 18 stations in the surface and oblique hauls of the pre-monsoon cruise. The post-monsoon cruise showed 1 and 65 individuals from 1 and 7 stations in the surface and oblique samples.

*Caranx leptolepis* showed 87 and 415 individuals from 15 and 39 stations of the surface and oblique hauls of the pre-monsoon cruise. The post-monsoon cruise showed 64 and 213 individuals from 4 and 18 stations of the surface and oblique collection from the post-monsoon cruise.

*Caranx mate* was collected in both the surface and oblique sampling of the pre- and post-monsoon cruises. There were 574 and 191 individuals from 19 and 28 stations in the surface and oblique hauls of the pre-monsoon cruise. For the post-monsoon cruise, there were 16 and 10 individuals from 6 and 5 stations in the surface and oblique specimens.

*Caranx speciosus* showed 21 and 89 individuals from 15 and 21 stations of the surface and oblique hauls of the pre-monsoon cruise. The post-monsoon cruise provided 23 and 38 individuals from 16 and 12 stations in the surface and oblique specimens.

*Caranx* sp. showed 94 and 923 individuals from 33 and 45 stations in the surface and oblique hauls of the pre-monsoon cruise. The post-monsoon cruise showed 33 and 234 individuals from 13 and 12 stations in the surface and oblique hauls.

*Scomberoides lysan* showed 20 and 3 individuals from 9 and 7 stations of the surface and oblique hauls in the pre-monsoon cruise. The post-monsoon cruise provided 34 and 1 individuals from 12 and 1 stations in the surface and oblique specimens.

*Zonichthys nigrofasciata* showed 9 and 10 individuals from 7 and 6 stations in the surface and oblique specimens in the pre-monsoon cruise. The post-monsoon cruise provided 29 individuals from 18 stations in the surface collection.

#### **Family Meneidae**

There is only one species of moon fish in the world. *Mene maculata* which occurred in both the pre- and post-monsoon. There were 13 and 38 individuals from 1 and 10 stations in the surface and oblique hauls in the pre-monsoon. The post-monsoon showed only 1 individual from 1 station in the oblique hauls.

#### **Family Lutjanidae**

*Lutjanus* sp. occurred in both the surface and oblique samples in the pre- and post-monsoon cruises. There were 60 and 561 individuals from 16 and 54 stations in the surface and oblique specimens of the pre-monsoon. For the post-monsoon, there were 52 and 330 individuals from 12 and 60 stations in the surface and oblique specimens occurring in the samples.

#### **Family Nemipteridae**

*Nemipterus* sp. was the fourth most abundant fish larvae in the oblique sampling. There were 213 and 1763 individuals from 28 and 73 stations in the surface and oblique sampling in the pre-monsoon cruise. The post-monsoon cruise showed 129 and 2,007 individuals from 20 and 58 stations in the surface and oblique sampling.

#### **Family Gerreidae**

*Gerres* sp. occurred in both the surface and oblique hauls of the pre- and post-monsoon cruises. There were 333 and 221 individuals from 32 and 23 stations of the surface and oblique hauls of the pre-monsoon. The post-monsoon showed 281 and 186 individuals from 27 and 24 stations in the surface and oblique sampling.

#### **Family Lobotidae**

*Lobotes surinamensis* is of only one species in the world and there was only one specimen occurring at one station in the surface collection of the post-monsoon cruise.

#### **Family Leiognathidae**

*Leiognathus* sp. occurred in both the surface and oblique hauls of the pre- and post-monsoon cruises. There were 186 and 1,660 individuals from 22 and 66 stations of the surface and oblique hauls of the pre-monsoon. The post-monsoon showed 26 and 609 individuals from 10 and 62 stations in the surface and oblique collection.

**Family Pomadasyidae**

The genus *Plectorhynchus* occurred in both surface and oblique hauls of the pre- and post-monsoon. There were 4 and 283 individuals from 2 and 41 stations in the surface and oblique hauls of the pre-monsoon cruise. The post-monsoon cruise showed 36 and 52 individuals from 3 and 24 stations in the surface and oblique specimens.

**Family Lethrinidae**

*Lethrinus* sp. showed 7 and 36 individuals from 5 and 21 stations of the surface and oblique hauls of the pre-monsoon cruise. For the post-monsoon cruise, 11 and 14 individuals from 5 and 8 stations in the surface and oblique collection.

**Family Sparidae**

*Acanthopagrus* sp. was identified from the family Sparidae. There were 47 and 218 individuals from 4 and 21 stations in the surface and oblique collection of the pre-monsoon cruise. For the post-monsoon cruise, 2 individuals from 1 station in the oblique collection were identified.

**Family Sciaenidae**

The larvae of *Sciaena* sp. were obtained from the surface and oblique hauls of the pre- and post-monsoon cruises. There were 1 and 22 individuals from 1 and 11 stations of the surface and oblique hauls in the pre-monsoon cruise. There were 5 and 22 individuals from 3 and 7 stations of the surface and oblique hauls in the post-monsoon cruise.

**Family Mullidae**

The larvae in this family, *Upeneus* sp., was the fourth most abundant in the surface collection for the pre- and post-monsoon cruises. There were 956 and 648 individuals from 54 and 35 stations of the surface and oblique hauls in the pre-monsoon cruise. For the post-monsoon cruise, 525 and 139 individuals from 56 and 18 stations in the surface and oblique hauls.

**Family Ehippidae**

*Platax tiara* was identified from the surface and oblique hauls of the pre-monsoon cruise. There were 10 and 12 individuals from 2 and 6 stations in the surface and oblique collections.

**Family Depranidae**

*Depane* sp. was obtained from the surface and oblique hauls of the pre-monsoon cruise, but for the post-monsoon cruise it was obtained only from the oblique hauls. There were 2 and 14 individuals from 1 and 5 stations of the surface and oblique hauls of the pre-monsoon. There were 26 individuals from 9 stations of the oblique hauls in the post-monsoon cruise.

**Family Kryphosidae**

*Kryphosus* sp. was obtained only from the surface hauls of the pre- and post-monsoon cruises. There were 14 and 1 individuals from 3 and 1 stations in the surface hauls of the pre- and post-monsoon cruise.

**Family Chaetodontidae**

*Chaetodon* sp. was obtained from the surface hauls of the pre- and post-monsoon cruises. There were 1 and 2 individuals from 1 station each in the surface collection of pre and post-monsoon cruises.

**Family Cepolidae**

*Acanthocephala* sp. was obtained from both surface and oblique hauls of the pre and post-monsoon cruises but the oblique hauls showed more abundance than the surface hauls. There were 2 and



58 individuals from 2 and 23 stations in the surface and oblique hauls of the pre-monsoon cruise. For the post-monsoon cruise, there were 3 and 37 individuals from 2 and 14 stations in the surface and oblique hauls.

#### **Family Pomacentridae**

There were 3 genera of pomacentrid larvae occurring among these specimens. These were *Pomacentrus*, *Chromis* and *Abudefduf*. *Pomacentrus* larvae were obtained only from the surface hauls of the pre-monsoon cruise. There were 29 individuals from 7 stations. *Chromis* larvae occurred in both surface and oblique hauls of the pre-monsoon, there were 20 and 8 individuals from 7 and 4 stations in the samples. *Abudefduf* larvae were obtained only from the surface hauls of the pre-monsoon cruise, there were 3 specimens from 3 stations.

#### **Family Plesiopidae**

*Plesiops* sp. occurred only in the surface hauls of the pre-monsoon cruise. There were 4 individuals from only 1 station.

#### **Family Labridae**

*Halichores* larvae occurred in both the surface and oblique hauls of the pre- and post-monsoon cruises. There were 66 and 318 individuals from 7 and 53 stations in the surface and oblique hauls of the pre-monsoon cruise. For the post-monsoon cruise, there were 6 and 186 individuals from 1 and 52 stations in the surface and oblique hauls.

#### **Family Uranoscopidae**

*Uranoscopus* sp. occurred only in the oblique hauls of the pre- and post-monsoon. There were 26 and 4 individuals from 10 and 2 stations of the pre- and post-monsoon cruises.

#### **Family Champsodontidae**

The larvae were *Champsodon* sp. There were 7 and 136 individuals from 3 and 40 stations in the surface and oblique hauls of the pre-monsoon cruise. There were 31 and 66 individuals from 11 and 19 stations in the surface and oblique hauls of the pre-monsoon cruise. The post-monsoon showed 7 and 21 individuals from 7 and 14 stations in the surface and oblique haul samples.

#### **Family Blenniidae**

*Blenneus* sp. larvae occurred in both the surface and oblique hauls of pre- and post-monsoon cruises. There were 31 and 66 individuals from 11 and 19 stations in the surface and oblique hauls of the pre-monsoon cruise. The post-monsoon showed 7 and 21 individuals from 7 and 14 stations in the surface and oblique haul samples.

#### **Family Brotulidae**

*Brotulus* sp. occurred in both the surface and oblique hauls of the pre-monsoon cruise but for the post-monsoon cruise, the occurrence was only in the oblique haul samples. There were 7 and 47 individuals from 2 and 20 stations in the surface and oblique hauls of the pre-monsoon cruise. The oblique hauls of the post-monsoon showed 11 individuals from 5 stations.

#### **Family Carapidae**

*Carapus* sp. larvae occurred in both the surface and oblique hauls of the pre- and post-monsoon cruises. There were 3 and 6 individuals from 2 and 5 stations in the surface and oblique hauls of the pre-monsoon cruise. The post-monsoon showed 5 and 7 individuals from 5 and 7 stations in the surface and oblique haul samples.

**Family Callionymidae**

*Callionymus* sp. was the fifth most abundant larvae of the oblique haul samples and occurred in both the surface and oblique hauls of the pre- and post-monsoon cruises. There were 46 and 665 individuals from 18 and 58 stations in the surface and oblique hauls of pre-monsoon cruise. The post-monsoon showed 73 and 1,141 individuals from 9 and 67 stations in the surface and oblique sampling.

**Family Siganidae**

*Siganus* sp. showed only 1 individual from 1 station in the surface hauls of the pre-monsoon and 22 individuals from 7 stations in the oblique hauls of the post-monsoon cruise.

**Family Histiophoridae**

*Histiophorus* sp. larvae were obtained only from the surface hauls of both the pre-and post-monsoon cruises. There was 1 individual from 1 station in the pre-monsoon cruise and 13 individuals from 6 stations in the post-monsoon cruise

**Family Scombridae**

There were 3 genera of Scombrid larvae occurring in this area. These were *Rastrelliger*, *Scomberomorus* and *Euthynus*. *Rastrelliger* sp. occurred in both the surface and oblique hauls of the pre-monsoon cruise.

*Rastrelliger* sp. showed 163 and 365 individuals from 10 and 22 stations of the surface and oblique hauls of the pre-monsoon. For the post-monsoon cruise, there were 109 individuals from 8 stations in the oblique hauls.

*Scomberomorus* sp. occurred in both the surface and oblique hauls of the pre- and post-monsoon cruises. There were 141 and 96 individuals from 26 and 20 stations of the surface and oblique hauls of the pre-monsoon cruise. For the post-monsoon cruise, there were 39 and 5 individuals from 14 and 3 stations in the surface oblique haul samples.

*Euthymus* sp. occurred only in the pre-monsoon cruise in both the surface and oblique hauls. There were 1 and 246 individuals from 1 and 27 stations occurring in the samples.

**Family Trichiuridae**

*Trichiurus lepturus* occurred in both the surface and oblique hauls of the pre- and post-monsoon cruises. There were 6 and 115 individuals from 5 and 34 stations of surface and oblique hauls in the pre-monsoon cruise, The post-monsoon cruise showed 1 and 40 individuals from 1 and 17 stations in the surface and oblique haul samples.

**Family Schneideriidae**

*Schneideria* sp. occurred in both the surface and oblique hauls of the pre- and post-monsoon cruises. There were 18 and 98 individuals from 4 and 9 stations in the surface and oblique hauls of the pre-monsoon cruise. The post-monsoon cruise showed 9 and 121 individuals from 1 and 17 stations in the surface and oblique haul samples.

**Family Typauchenidae**

*Typanchen* sp. occurred in both the surface and oblique hauls of the pre- and post-monsoon cruises. There were 220 and 71 individuals from 21 and 22 stations of the surface and oblique hauls during the pre-monsoon cruise. The post-monsoon cruise showed 19 and 53 individuals from 9 and 8 stations in the surface and oblique haul samples.

**Family Gobiidae**

Gobiidae was the only family identified to the family level, being the most abundant larvae in the oblique hauls of both the pre- and post-monsoon cruises. There were 1314 and 8377 individuals

from 42 and 74 stations in the surface and oblique hauls of the pre -monsoon. The post-monsoon showed 1207 and 8653 individuals from 49 and 76 stations in the surface and oblique haul samples.

#### **Family Platycephalidae**

*Platycephalus* sp. was obtained from the surface and oblique hauls of the pre- monsoon. There were 5 and 141 individuals from 5 and 19 stations. For the post-monsoon cruise, there were 61 individuals from 15 stations in the oblique haul samples.

#### **Family Scorpaenidae**

There were 2 genera of scorpaenid larvae occurring in both the surface and oblique hauls of the pre- and post-monsoon cruise. These were the *Minous* sp. and *Scorpaenoides* sp.

*Minous* sp. showed 14 and 117 individuals from 5 and 49 stations in the surface and oblique hauls of the pre-monsoon cruise. The post-monsoon cruise showed 9 and 92 individuals from 4 and 31 stations in the surface and oblique samples.

*Scorpanoides* sp. showed 17 and 45 individuals from 11 and 24 stations in the surface and oblique hauls of the pre-monsoon cruise. The post-monsoon cruise showed 1 and 20 individuals from 1 and 13 stations in the surface and oblique haul samples.

#### **Family Triglidae**

*Lepidotrigla* sp. was identified as from the family Triglidae. There were 4 and 54 individuals from 3 and 24 stations in the surface and oblique hauls in the pre-monsoon cruise. The post-monsoon cruise showed only 1 individual from 1 station oblique haul.

#### **Family Dactylopteridae**

*Dactylopterus* sp. was identified from the family Dactylopteridae. There were 1 and 3 individuals from 1 and 3 stations in the surface and oblique hauls in the pre-monsoon cruise. The post-monsoon cruise showed 14 individuals from 6 stations in the surface samples.

#### **Family Psettodidae**

*Psettodes erumei* was obtained from the oblique hauls of the pre-monsoon cruise. There were 15 individuals from 4 stations.

#### **Family Paralichthyidae**

*Pseudorhombus* sp. was obtained from both the surface and oblique hauls of pre- and post-monsoon cruises. There were 4 and 75 individuals from 1 and 18 stations in the surface and oblique hauls of pre-monsoon cruise. The post-monsoon cruise showed 1 and 51 individuals from 1 and 16 stations in the surface and oblique haul samples.

#### **Family Soleidae**

*Aserraggodes* sp. were identified from solea larvae. There were 2 and 44 individuals from 2 and 17 stations in the surface and oblique hauls of the pre-monsoon cruise. The post-monsoon showed 3 and 22 individuals from 3 and 8 stations in the surface and oblique hauls.

#### **Family Bothidae**

There were 3 genera of bothid larvae occurring in both the surface and oblique hauls of the pre- and post-monsoon cruises. These 3 genera were *Bothus*, *Engyprosopon* and *Arnoglossus*.

*Bothus* sp. showed 106 and 275 individuals from 22 and 35 stations in the surface and oblique hauls of the pre-monsoon cruise. The post-monsoon cruise showed 2 and 70 individuals from 2 and 4 stations in the surface and oblique haul samples.

*Engyprosopon* sp. was the seventh in abundance of the oblique haul of the post- monsoon cruise. There were 10 and 753 individuals from 3 and 63 stations in the surface and oblique hauls in

the pre-monsoon cruise. The post-monsoon cruise showed 73 and 1,020 individuals from 17 and 75 stations in the surface and oblique haul samples.

*Arnoglossus* sp. was 1 and 135 individuals from 1 and 37 stations in the surface and oblique hauls of the pre-monsoon cruise. The post-monsoon cruise showed 6 and 32 individuals from 1 and 12 stations in the surface and oblique haul samples.

#### **Family Cynoglossidae**

*Cynoglossus* was obtained from both the surface and oblique hauls of the pre- and post-monsoon cruises. There were 28 and 249 individuals from 16 and 59 stations in the surface and oblique hauls of the pre-monsoon cruise. The post-monsoon cruise showed 19 and 177 individuals from 13 and 49 stations in the surface and oblique haul samples.

#### **Family Cithacidae**

*Brachypleura novaezeelandiae* was the only species identified from the family Cithacidae. There were 4 and 97 individuals from 3 and 27 stations in the surface and oblique hauls of the pre-monsoon cruise. The post-monsoon cruise showed only 1 individual from 1 station in the oblique haul.

#### **Family Echeneidae**

*Echeneus* sp. was obtained from the surface and oblique hauls of the pre-monsoon cruise. There were 2 and 30 individuals from 2 and 6 stations in the surface and oblique haul samples.

#### **Family Tetraodontidae**

*Tetraodon* sp. was obtained in both the surface and oblique hauls of the pre- and post-monsoon cruises. There were 1 and 158 individuals from 1 and 45 stations in the surface and oblique hauls of the pre-monsoon cruise. The post-monsoon cruise showed 2 and 188 individuals from 2 and 56 stations in the surface and oblique haul samples.

#### **Family Diodontidae**

*Diodon* sp. was obtained from both the surface and oblique haul in the pre- and post-monsoon cruises. There were 11 and 4 individuals from 7 and 1 stations in the surface and oblique hauls of the pre-monsoon cruise. The post-monsoon cruise showed 4 and 2 individuals from 2 and 1 stations in the surface and oblique haul samples.

#### **Family Balistidae**

*Balistes* sp. was obtained from both the surface and oblique hauls of the pre- and post-monsoon cruises. There were 28 and 6 individuals from 8 and 6 stations in the surface and oblique hauls of the pre-monsoon cruise. The post-monsoon cruise were 1 station each of the surface and oblique haul samples.

#### **Family Monacanthidae**

There were 2 genera occurring in these samples.

*Monacanthus* sp. was obtained from both the surface and oblique hauls in the pre- and post-monsoon cruises. It was the sixth in abundance of the oblique haul samples in the pre-monsoon cruise. There were 63 and 1,122 individuals from 15 and 58 stations in the surface and oblique hauls of the pre-monsoon cruise. The post-monsoon cruise showed 13 and 263 individuals from 10 and 37 stations in the surface and oblique haul samples.

*Aluterus* sp. showed 14 individuals from 6 stations in the surface hauls of the pre-monsoon cruise and 2 individuals from 1 station in the oblique hauls of the post-monsoon cruise.

*Leptocephalus* sp. The eel larvae were sorted out from the sample but were not identified to the family or genus because of time constraints.

## Discussion

Fish larvae in The Gulf of Thailand and on the east coast of Peninsular Malaysia were studied for their kinds, abundance and distribution in the surface and oblique sampling. There were 73 families and 97 species of fish larvae occurring in the Gulf of Thailand and on the east coast of Peninsular Malaysia. This showed more families than the study of Vatanachai (1972) conducted in the South China Sea, and it is also greater than those in the studies of Chamchang (1986), Songchitsawat (1989), Chansakul (1988) and Termvidchakon (1985) conducted in the Gulf of Thailand. *Stolephorus* sp. was the most abundant larvae in the surface sampling and the second most abundant in the oblique sampling similar to the study of Vatanachai (1972), Chamchang (1986), Songchitsawat (1989) showed Engraulidae as the most economically abundant family and Clupeidae as the second most abundant. Gobiidae was the most abundant in the oblique sampling. Vatanachai (1972), Chamchang (1986), Songchitsawat (1989), Chansakul (1988), Termvidchakorn (1985) showed Gobiidae as the most abundant larvae in their studies in the Gulf of Thailand in both the coastal and deeper areas. There were some larvae that showed occurrence or abundance in the oblique sampling of the early morning, night time or cloudy days and some of these larvae also occurred, and were more abundant, in the surface sampling due to phototaxis activities.

There was no difference between the species composition of larvae in the Gulf of Thailand and on the east coast of Peninsular Malaysia. Similar types of larvae were obtained on the east coast of Peninsular Malaysia. Coastal areas near islands showed more abundance than the offshore stations.

The pelagic and demersal characters of larvae were shown from their abundance and distribution in the surface and oblique sampling.

Larvae which showed pelagic characteristics were *Sardinella* sp., *Dussumieria* sp., *Stolephorus* sp., *Hemiramphus* sp., *Exocoetus* sp., *Cypselurus* sp., *Sphyraena* sp., *Ambassis* sp., *Therapon jarbua*, *Caranx mate*, *Gerres* sp., *Histiophorus* sp. and *Scomberomorus* sp.

The demersal of larvae observed were *Saurida elongata*, *Saurida emdosquamis*, *Synodus variegatus*, *Trachinocephalus myops*, *Antennarius* sp., *Bregmaceros rarisquamosus*, *Fistularia* sp., *Holocentrus* sp., *Myripristis* sp., *Epinephelus* sp., *Serranus* sp., *Priacanthus* sp., Apogonidae, *Lutjanus* sp., *Nemipterus* sp., *Leiognathus* sp., *Acanthocephala* sp., *Upeneus* sp., *Blenneus* sp., *Callionymus* sp., *Rastrelliger* sp., *Euthynnus* sp., *Trichiurus lepturus*, Gobiidae, *Pseudorhombus* sp., *Aserraggodes* sp., *Bothus* sp., *Engyprosopon* sp., *Arnoglossus* sp., *Cynoglossus* sp., *Tetraodon* sp., *Balistes* sp., and *Monacanthus* sp.

The abundance of *Sardinella* sp., *Stolephorus* sp., etc. (Table 10) between the pre- and post-monsoon showed spawning peaks in the post-monsoon period.

There were differences in the abundance of fish larvae in the surface and oblique haul samples. The early morning, night and "cloudy" stations showed that larvae from the surface hauls were more abundant than the oblique hauls due to positive phototaxis activity and larvae from the day time, the oblique haul specimens were more abundant due to negative phototaxis and their demersal characteristics.

*Histiophorus* sp. showed true pelagic characteristics from its occurrence only in the surface hauls while species that showed demersal characteristics from their occurrence in the oblique specimens were *Lutjanus* sp., *Nemipterus* sp., *Acanthocephala* sp. and *Engyprosopon* sp.

This study showed the occurrence and abundance of the fish larvae the coastal areas or around the islands are greater than those in the deeper or open sea.

## Conclusion

- 1) Species composition of fish larvae in the Gulf of Thailand and East Coast of Peninsular Malaysia was the same.
- 2) Fish larvae found in abundance from the surface hauls of the pre- and post-monsoon



soon were *Stolephorus* sp., *Sardinella* sp., Gobiidae and *Upeneus* sp., respectively. For the oblique hauls these were Gobiidae, *Stolephorus* sp., *Bregmaceros risquamosus* and *Nemipterus* sp., respectively.

- 3) The difference in the abundance of larvae between the pre and post northeast monsoon period indicates the spawning period and spawning peak.
- 4) The day - night catch of larvae was different because of phototaxis and their other living characters.
- 5) In the shallow or coastal areas around the island, the larvae were more abundant than the deeper waters or open sea.

#### Acknowledgements

I am grateful to Dr. Maitree Duangsawasdi, for his encouragement and valuable suggestions. Sincere appreciation is expressed to the Captain, crew and scientists on M.V. SEAFDEC for their cooperation at sea. Many thanks are due to the SEAFDEC staff who have supported this work.

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