



Chapter 1

Introduction

Most studies on the fish larvae engage with the identification, abundance and distribution of larval fishes in some certain waters, that usually take at least one year of studying period in order to interpret the status of fisheries resources. The presence of fish larvae is the indicator of the fertility of the waters. Even fishes are renewable resources, they still need a proper management of utilization and conservation to maintain the continuity of the recruits. The survey on fish larvae is, therefore, a practical check of the fisheries status as well as the survey on adult fishes. Moreover, the informations could be applied to the measure of fisheries resource management.

The survey on fish larvae could clarify the spawning grounds and seasons of fishes particularly the economic important. It is, then, carried out in various countries, as well as Thailand.

Study on distribution of fish larvae in Thailand was firstly conducted, when the Department of fisheries incorporated a survey on larvae of Indo-pacific mackerel (Rastrelliger neglectus) into the project of Indo-pacific mackerel Investigation (1960-1978). The spawning grounds and seasons of the mackerel in the Gulf of Thailand was evidenced and the proclamation of non-fishing areas and periods occurred, that located in 10 - 40 miles outer the

coast of Prachuab-kirikhan, Choomborn and Surat-thani Provinces during February 15 - March 31 and April 1 - May 15 (Boonprakob, 1965, 1967 ; Dheptaranon and Boonprakob, 1972 ; Vatanachai, 1972, 1975 ; Vatanachai and Decharak, 1972 a, b ; Chullasorn, 1979 ; Chayakul and Vatanachai, 1980).

Besides the mackerel project, the survey of fish larvae still has been carried on by the Thai scientists in both the Gulf of Thailand and the Andaman Sea. Vatanachai (1978) studied on abundance of fish eggs and larvae in the inner Gulf of Thailand. Tangkaseranee (1980, 1982, 1983, 1984) reported on larvae of the upper part of the Western Gulf of Thailand. In addition, the larvae of the Tha Chin estuary and the mangroves of Laem Phak Bia in Petchaburi Province were described by Vatanachai (1979 a, b). Chayakul and Uttapong (1983 a, b) described the abundance of fish larvae in the Western Gulf and around Ang-Thong Islands, as well. Chamchang (1986), on the other hand, described on fish larvae obtained from the lower part of the Western Gulf of Thailand. It was agreeable, that the Western Gulf of Thailand was the main spawning grounds, so that the prohibition seasons are practical to protect the precious fisheries resources from over-exploitation. The Western Gulf was, therefore, more widely investigated than other areas.

In the Andaman Sea, the distribution of fish larvae was studied by Termvidchakorn (1987) and Janekarn (1988). Janekarn and Boonruang (1986) also reported on fish larvae from the mangroves of Phuket.

In contrast, the Eastern Gulf of Thailand was poorly studied, even it was also a spawning ground of the Rastrelliger spp. (Chayakul and Vatanachai, 1980). Tangkaseranee (1981) studied the larval fish composition of the Chang Islands, but that in Rayong Bay conducted by Chantarasakul (1987). This work was proposed to clarify the productivity of the Eastern coast in term of fish larval population.

The Eastern Gulf of Thailand is one of the most important fishing grounds. The 345.80 km. of the coastal line, covering 3 Provinces ; Rayong, Chantaburi and Trat is approximately 1/5 of the coastal line of the Gulf. Population of 8,000 families in 1985 was fishermen, 24.3 % increment of 1977. The catch of 200,000 tons from this region was about 1/8 of the total production of Thailand (Department of Fisheries, 1987 ; National Statistics Office and Department of Fisheries, 1987 a, b). There were 51 families of 64 genera of marine fauna caught by push net, which is a highly effective gear, that operated very nearshore. Most animals caught were undersized (Tubtimsaeng, 1986).

The Chang Islands consisting of 52 islands cover about 650 km² area of Trat Province. The location closed

to Thai-Cambodia border in addition to the productive land and natural landscape magnifies its importance in various points, besides the fisheries resources. The study, therefore, aims to evaluate the spawning and nursing potential of the Islands in relations to some environmental factors.

Nowaday, the Eastern Region has been developing by industrialization and tourism. There are many factories, constructed along the coastal area as well as fish farms, residential houses and hotel accommodations. Those activities can spoil the natural ecosystem by releasing waste to the sea, especially the organic pollutants. Study on environmental quality is urgently required not only physical and chemical but also biological properties, to provide the background references for the future plans. The information of fish larvae might be applied to be one of environmental indicators. Petpiroon et al. (1987) reported on seawater quality of the Eastern coast of the Gulf, that the ranges of salinity, temperature, pH, dissolved oxygen, conductivity, transparency, nitrite, nitrate and phosphate were 18-33 ppt, 27.3-33.2 °C, 6.5-8.3, 5.2-8.3 mg/l, 32.9-54.6 μ semen/cm, 3-20 m, 0.00-0.52 μ mole/l, 0.21-45.25 μ mole/l and 0.03-3.86 μ mole/l, respectively. All parameters were well within the range of normal seawater quality. Although the present status of the sea is still in fair condition, this study can be used as a baseline

data.

Objectives

1. To study on the identification of fish larvae of the Chang Islands.
2. To study on the abundance and distribution of fish eggs and larvae of the Chang Islands the whole year.
3. To study on the spawning grounds and seasons of some economic fishes of the Chang Islands.
4. To study on the correlation between the environmental factors and occurrence of the fish larvae.

Thus from the data gathered from this study, it is expected to be able :

1. To explain the occurrence of fish larvae of the Chang Islands.
2. To provide the references for taxonomic study of the fish larvae.
3. To facilitate the study on the spawning grounds and seasons of some economic fishes for the future management.
4. To be used as the baseline information for the impact assessment and the resources management plan if the area were to be developed in the process of industrialization and tourism.

Literature Survey

Most species of fishes pass through a larval stage before attaining their own adult form at metamorphosis. Hempel (1979) defined the larval phase, that begins after hatching until the metamorphosis. Whereas, Blaxter (1969) called all stages to metamorphosis the "larva". The fish larvae in this paper, according to Blaxter (1969), mean both the "egg" and "larva". The term "ichthyoplankton" also identifies the presence of the fish larvae. However, the detail of the early life history of the fish is identified differently (Figure 1).

The early life history of fish is widely studied on various aspects not only in the laboratory but also in the field. In the taxonomic study of the field specimens, the background information from rearing laboratories is necessarily required, otherwise the diagnosis remains difficulty, because the larvae are totally different from their parents. However, the comparative morphology is still the essence of the identification. Characteristics of the body shape, pigmentation, meristic and stricted characters are commonly used for the larval identification (Ahlstrom and Moser, 1976).

The knowledges from hatcheries or nurseries are very useful for aquaculture and the environmental studies in order to develop the fisheries resources. In rearing laboratory, the early life history can be studied on growth mechanism and regulations such as nutritional and

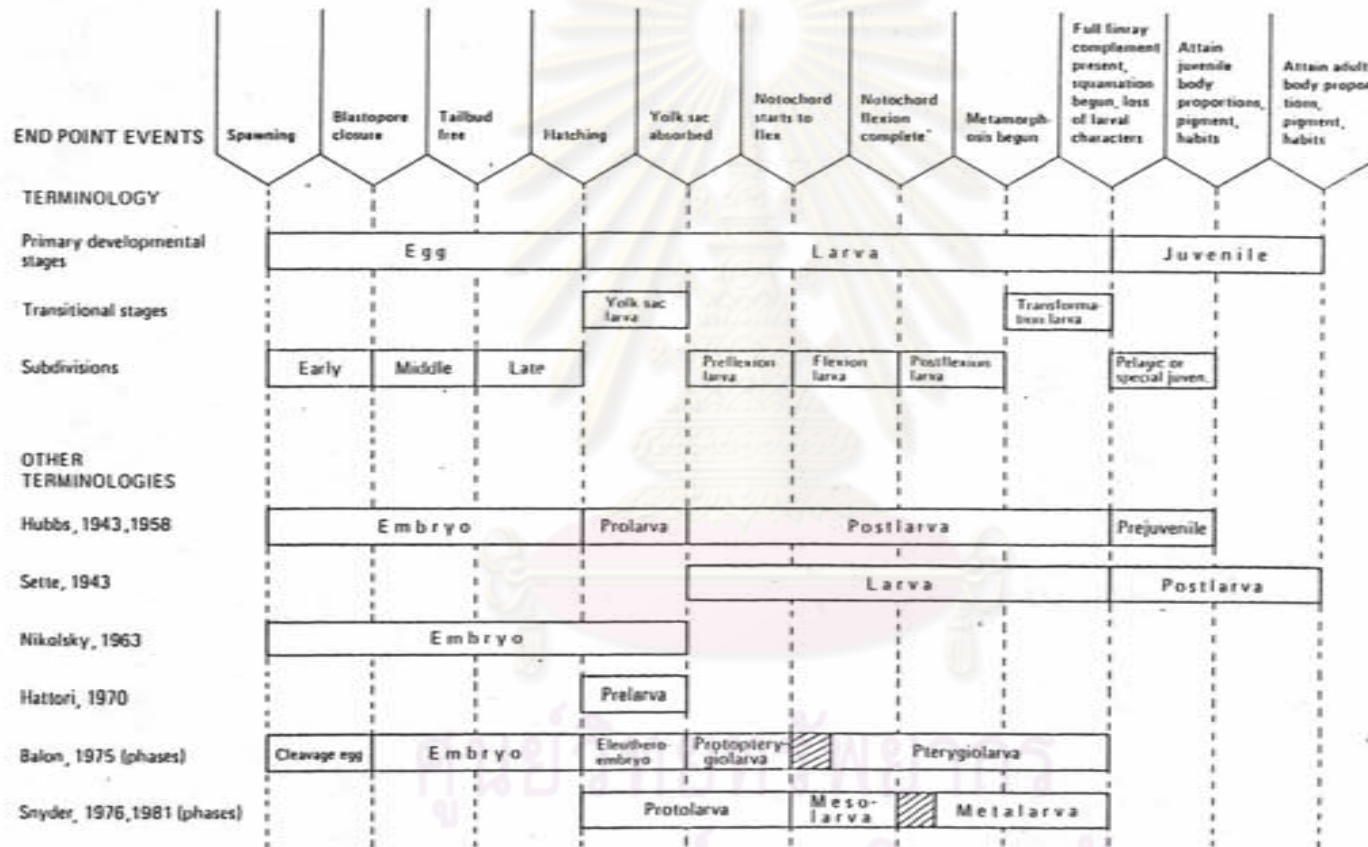


Figure 1 Terminology of early life history stages. (Kendall, et al., 1984)



environmental requirements. Fish larvae are also used as a specimen for toxicological experiment too. Then the tolerant limits of the larvae to the pollutants are assayed. These knowledges can be directly applied to enhance the mass production and culture, and to improve survival of marine fishes by the regulation of allowable concentration of the waste discharged into seawater. The egg and larval surveys are also unignorable in order to trace the population dynamics and destine the status of the natural fishing grounds, the parental stock and recruitment, as well. Eventually, fish larval knowledges are, therefore, practical in fisheries management. To accomplish the knowledge of fish larvae, it is necessary to carry out experimental observations and the field surveys.

Since the middle of the nineteenth century, a lot of fish larvae have been described especially on the taxonomic and ecological approaches. Descriptions of fish larvae were carry out by the following authors.

Ehrenbaum (1909) described on fish larvae of the North Sea. Delsman (1921-1938) studied fish eggs and larvae from Java Sea. In Japan, Mito (1960-1967) described on eggs and larvae of 90 species in Japanese waters; Matsumoto (1958) studied on distribution of 4 tuna species; Neothunnus macropterus, Katsuwonus pelamis, Euthynnus yaito and Auxis thazard in equatorial waters; Ozawa (1986) described the ichthyoplankton in the Western

North Pacific and Okiyama (1988) summarized the early stage fishes in Japan. Leis and Rennis (1984) described the larvae of the coral reef of the Indo-pacific fishes. Miller et al. (1979) described the larval fishes of the Hawaiian waters. Fahay (1983) studied the larvae in the Western North Atlantic Ocean, whereas Jones et al. (1978) studied in the Mid-Atlantic Bight. Russell (1976) also studied on the larvae of British marine fishes. The fish larvae in the inshore waters of the Cape of Good Hope were described by Brownell (1979). The world summarization of the fish larva knowledge is the result of the three international symposia; in 1973 (Blaxter, 1974), in 1979 (Lasker and Sherman, 1981) and in 1983 (Moser et al., 1984). Consequently, the characteristics of the larvae of about 210 Families have been described (Ahlstrom and Moser, 1981).

Fish larvae of the Family Clupeidae were described by Delsman (1926), Ehrenbaum (1964), Mito (1966), Bensam (1971), Jones et al. (1978), Fahay (1983). In Thai waters, these larvae were described by Vatanachai (1975, 1978, 1979 a,b), Chamchang (1986) and Chantarasukul (1987). Boonprakob et al. (1980) studied on the early development of the Sardinella perforata (Cantor) by means of artificial fertilization.

Fish larvae of the Family Engraulidae were described by Delsman (1931), Ehrenbaum (1964), Jones et al. (1978), Miller et al. (1979), Fahay (1983), Ozawa and

Tsukahara (1986). In Thai waters these larvae were described by Vatanachai (1978), Chamchang (1986) and Chantarasakul (1987).

The leptocephalus larvae were described by Jespersen (1942), Castle (1963, 1964 a,b, 1965, 1968 a,b), Smith (1979), Hardy (1978 a), Matsui et al. (1968), Kamovskaja (1975), Tanaka (1975), and Tabeta et al. (1975, 1979). Leptocephalus larvae in Thai waters were described by Termvidchakorn (1986) and Janekarn (1988).

The larvae of the Family Synodontidae were described by Ueno (1958), Shindo and Yamada (1972), Okiyama (1988), Dileep (1977), Jones et al. (1978), Leis and Rennis (1983), and Ozawa (1986). In Thailand Vadhanakul (1983) investigated on the spawning ground and season of the Saurida elongata and S. undosquamis

The larvae of the Family Belonidae were described by Vatanachai (1972), Hardy (1978 a), Fahay (1983), Okiyama (1988). Termvidchakorn (1986) and Janekarn (1988) reported on these larvae in Thailand.

Fish larvae of the Family Exocoetidae were described by Khrapkova-Kovalevskya (1963), Gorbunova and Parin (1963), Kovalevskaja (1972, 1982), Mito (1966), Hardy (1978 a), Miller et al. (1979), Fahay (1983).

Fish larvae of the Family Bregmacerotidae were described by Houde (1981, 1984 a), Fahay (1983), Vatanachai (1972, 1975, 1978) and Chantarasakul (1988).

Fish larvae of the Family Bothidae were

described by Ehrenbaum (1964), Mito (1966), Amaoka (1970-1976), Ozawa and Fukui (1986), John (1951), Futch (1977), Brownell (1979), Martin and Drawry (1978), Fahay (1983), Ahlstrom et al. (1984). In Thai waters the larvae of Arnoglossus spp. were described by Vatanachai (1978) and the larvae of the Psettina sp. and Pseudorhombus sp. were described by Chantarasakul (1988).

Fish larvae of the Family Soleidae were described by Ehrenbaum (1964), Mito (1966), John (1951), Brownell (1979), Martin and Drawry (1978), Fahay (1983), Kinh-luan (1982) and Russell (1976). In Thai waters, 8 species of the soles were reported by Wongratana (1968). The larvae of one type were described and illustrated by Chantarasakul (1988).

Fish larvae of the Family Cynoglossidae were described by Mito (1966), Okiyama (1988), John (1951), Martin and Drawry (1978), Fahay (1983), and Brownell (1979). In Thai waters, 10 species of the genus Cynoglossus and Paraplagusia were evidenced (Wongratana, 1968). The larvae of the Cynoglossus spp. were described with illustration by Vatanachai (1978, 1979 a,b) and Chantarasakul (1988).

Fish larvae of the Family Synathidae were described by Ehrenbaum (1964), Hardy (1978 a). The larvae of Hippocampus sp. and Synathus sp. of Thailand were studied by Chantarasakul (1988).

Fish larvae of the Family Pegasidae were studied

by Jones and Pantulu (1958), Jones and Kumaran (1964), and Leis and Rennis (1983).

Fish larvae of the Family *Fistulariidae* were studied by Delsman (1921), Hardy (1978 a), and Leis and Rennis (1983).

Fish larvae of the Family *Sphyraenidae* were described by Martin and Drawry (1978), Fahay (1983), Leis and Rennis (1983), and Sylva (1984). The *Sphyraena* larvae of Thailand were described by Vatanachai (1972) and Chantarasakul (1988).

Fish larvae of the Family *Scombridae* were described by Ehrenbaum (1964), Ahlstrom and Ball (1954), Kramer (1960), Richards and Klawe (1972), Matsumoto et al. (1972), Richards and Potthoff (1974), Miller et al. (1979), Fritzsche (1978), Fahay (1983), Ozawa (1986), and Collette et al. (1984). Larvae of the *Rastrelliger* spp. were described by Matsui (1970), and Boonprakob and Dhebtaranon (1972 a,b).

Fish larvae of the Family *Trichiuridae* were described by Delsman (1927), Fritzsche (1978), Fahay (1983), Collette et al. (1984), and Ozawa (1986).

Fish larvae of the Family *Carangidae* were described by Ehrenbaum (1964), Miller et al. (1979), Johnson (1978), Fahay (1983), Termvidchakorn (1983), Laroche et al. (1984), and Smith-Vaniz (1984). Ozawa & Manabe (1986) studied on the *Decapterus* larvae of Japan. In Thailand, Termvidchakorn studied on the early development

of the Naucrates ductor (Linneaus) (1984), the Zonichthys nigrofasiata (1987 a) and Chorinemus lysan (Forsk.) (1987 b). Chamchang (1986) and Chantarasakul (1988) also reported on the carangid larvae of Thailand. To date the larvae of 58 of 140 carangid species were described.

Fish larvae of the Family Menidae of the species Mene maculata (Bloch & Schneider) were described by Vatanachai (1972, 1975), Okiyama (1988), and Termvidchakorn (1989).

Fish larvae of the Family Leiognathidae were described by John (1951), Mito (1960), Fujita (1960), and Vatanachai (1972). In Thailand, 14 species of the leiognathids were reported by Kuhlmergen-Hille (1968). The larvae also described by Vatanachai (1975, 1978), Termvidchakorn (1987) and Chantarasakul (1988).

Fish larvae of the Family Apogonidae were described by Vatanachai (1972, 1975, 1978), Leis and Rennis (1983), Miller et al. (1979) and Chantarasakul (1988).

Fish larvae of the Family Epinephelidae were described by Hardy (1978 b), Hussian and Higuchi (1980), and Leis and Rennis (1983). In Thailand, Vatanachai (1975) also described the epinephelid larvae.

Fish larvae of the Family Priacanthidae were described by Fourmanoir (1976), Hardy (1978 b), and Leis and Rennis (1983). In Thai waters, the 4 species of the genus Priacanthus were reported by Wongratana (1968) and



the larvae were also described by Chantarasakul (1988).

Fish larvae of the Family Lutjanidae were described by Vatanachai (1972), Fourmanoir (1976), Hardy (1978 b), and Leis and Rennis (1983), Richards et al. (1980), Collins et al. (1980), and Mari (1983). In Thai waters, the 12 species of the Lutjanidae were reported by Wongratana (1968) and the larvae were described by Vatanachai (1975). Chiampreecha and Chayakul (1985) studied on the development of the Lutjanus argentimaculata.

Fish larvae of the Family Theraponidae were described by Mito (1958), Okiyama (1988), and Vatanachai (1972). In Thai waters, larvae of the Therapon theraps were also diagnosed (Vatanachai, 1975).

Fish larvae of the Family Nemipteridae were described by Leis and Rennis (1983) and Okiyama (1988). Wongratana (1968) reported on the 10 species of the genus Nemipterus evident in Thai waters. Whereas the larvae were described by Vatanachai (1975) and Chantarasakul (1988).

Fish larvae of the Family Mullidae were described by Ehrenbaum (1964), Mito (1966), Miller et al. (1979), Johnson (1978), and Leis and Rennis (1983). In Thailand, larvae of the Upeneus sp. were diagnosed by Termvidchakorn (1987). Chantarasakul (1988) also reported on the mullid larvae in Rayong Bay.

Fish larvae of the Family Sciaenidae were

described by Pantulu and Jones (1951), Johnson (1978), and Fahay (1983). Wongratana (1968) recorded on the 15 types of sciaenid fishes of Thailand, while the larvae were described by Vatanachai (1975, 1978, 1979 a,b).

Fish larvae of the Family Sillaginidae were described by Ueno et al. (1958), Mito (1966), Vatanachai (1972) and Okiyama (1988). In Thai waters, Vatanachai (1979 a,b) and Chantarasukul (1988) described on the Sillago larvae.

Fish larvae of the Family Siganidae were described by Senta et al. (1958), Mito (1966), Leis and Rennis (1983), and Leis and Richards (1984).

Fish larvae of the Family Scorpaenidae were described by Ehrenbaum (1964), Fujita and Nakahara (1955), Moser et al. (1977), Miller et al. (1979), Leis and Rennis (1983), Fahay (1983), and Washington et al. (1984). Chantarasukul (1988) also reported on the larvae in Thailand.

Fish larvae of the Family Platycephalidae were described by Ueno and Fujita (1958), and Leis and Rennis (1983). Chantarasukul (1988) described on the larvae in Thailand.

Fish larvae of the Family Labridae were described by Ehrenbaum (1964), Schultz et al. (1960), Masuda et al. (1975), Fritzsche (1978), Miller et al. (1979), Fahay (1983), and Leis and Rennis (1983). Vatanachai (1975) also described the labrid larvae in the

Gulf of Thailand.

Fish larvae of the Family Gobiidae were described by Dotsu (1955, 1959, 1961), Ehrenbaum (1964), Mito (1966), Vatanachai (1972), Fritzsche (1978), Miller et al. (1979), Fahay (1983), Leis and Rennis (1983), and Ruple (1984). The gobiid larvae are very common and dominant in Thai waters, in all surveys.

Fish larvae of the Family Callionymidae were described by Ehrenbaum (1964), Demir (1972, 1976), Miller et al. (1979), Fahay (1983), Leis and Rennis (1983), and Houde (1984). The larvae are very common in Thai waters, Vatanachai (1975) and Chantarasakul (1988) also described them.

Fish larvae of the Family Champsodontidae were described by Mito (1962), Vatanachai (1972) and Okiyama (1988).

Fish larvae of the Family Blenniidae were described by Ehrenbaum (1964), Mito (1966), Fritzsche (1978), Miller et al. (1979), Fahay (1983), Leis and Rennis (1983), and Matarese et al. (1984). The larvae are very common in Thai waters, Vatanachai (1975) and Chantarasakul (1988) also described them.

Fish larvae of the Family Monacanthidae were described by Fujita (1955), Fahay (1983), Leis and Rennis (1983), and Aboussouan and Leis (1984). Monacanthid larvae in Thai waters were described by Chantarasakul (1988).

Fish larvae of the Family Tetraodontidae were described by Fujita (1958, 1966), Martin and Drawry (1978), Fahay (1983), Leis and Rennis (1983), and Leis (1984). These larvae in Thai waters were described by Chantarasakul (1988).

The study on fish larvae in Thailand is mainly on the abundance and distribution. Since the project of Indo-pacific mackerel investigation (1960-1978), the survey on fish larvae has been carried out in various part of the Gulf of Thailand and the Andaman Sea. There are more than 100 Families of fish larvae evident in Thai waters (Table 1).

Vatanachai (1978) studied on fish larvae abundance in the Inner Gulf of Thailand. He reported on the occurrence of the larvae of 51 Families and the peaks in February, July, September and November. Tangkaseranee (1980, 1982, 1983, 1984) reported on the larvae of 54 Families in the upper part of the Western Gulf of Thailand from Prachuab-kirikhan Province to Surat-thani Province, that peaked in the Northeast monsoon period and also in October and June. She also found the significance correlations between the pelagic fish larvae and the salinity, between eggs and the pH, between the larvae and other plankton abundance, and between depth and the pelagic fish larvae. She also commented on the highest abundance at 20-50 m. depth. Chayakul and Uttapong (1983 a, b) also found the peak of the larvae in this region in

March. Chamchang (1986) reported on the abundance of fish larvae of the lower part of the Western Gulf from Suratthani to Narathiwat Province that peaked in April and August. In the Eastern coast, Chantarasakul (1988) reported on the peaks in the Northeast monsoon period. It is remarkable that the larvae of the Family Gobiidae are highly abundant and widely distributed in all parts of the Gulf of Thailand.

The information of fish larvae led to the investigation of spawning grounds and seasons of certain economic fishes besides the Rastrelliger. Sidthichokpan (1972) reported on the spawning peaks of the Stolephorus spp. during March - April and July - September when the temperature range of 27.1-31.2 °C. and salinity range of 30.16-34.03 ppt. Vadhanakul (1980, 1981, 1983 a) indicated the spawning season of Nemipterus nematophorus and N. mesoprion of the Western coast of the Gulf of Thailand during January - April. She (Vadhanakul, 1983 b) also reported the spawning season of the Saurida elongata and S. undosquamis in the Western coast that peaked during January - March and July - September at the depth of 41-50 m. and 33.17-33.24 ppt. of salinity.

Table 1. Occurrence of fish larvae in the Gulf of Thailand, Andaman Sea and the South China Sea.

Family \ Region	1	2	3	4	5	6
Megalopidae		+				
Dorosomidae			+			
Engraulidae *	+	+	+	+	+	+
Dussumieriidae			+	+	+	+
Clupeidae *	+	+	+	+	+	+
Chanidae		+				
Chirocentridae			+			+
Gonostomidae					+	
Stomiidae					+	
Ipnopidae					+	
Myctophidae					+	+
Paralepidae					+	+
Synodontidae *	+	+	+	+	+	+
Plotosidae			+			
Tachysuridae			+			
Eel leptocephalus *					+	
Ophichthyidae	+		+	+	+	+
Muraenesocidae			+			
Synbranchidae		+				
Schilboidae		+				
Belonidae *		+			+	+
Hemirhamphidae	+	+	+	+	+	+
Exocoetidae *	+	+	+	+	+	+
Bregmacerotidae *	+	+	+	+	+	+
Ophidiidae					+	
Bothidae *	+	+	+	+	+	+
Paralichthyidae			+		+	
Pleuronectidae	+	+	+		+	+
Soleidae *	+	+	+	+	+	+
Cynoglossidae *	+	+	+	+	+	+
Apodes		+				+
Holocentridae			+		+	+
Centriscidae	+					
Fistulariidae *			+	+		
Syngnathidae *	+	+	+	+	+	+
Hypocampidae			+			
Pegasidae *	+	+	+	+	+	+
Moridae					+	
Sphyrinaeidae *	+	+	+	+	+	+
Mugilidae	+	+	+	+	+	+
Atherinidae	+	+	+		+	+
Helostomidae		+				
Polynemidae		+	+		+	
Anabantidae		+				
Scombridae *	+	+	+	+	+	+

Table 1 (cont')

Family \ Region	1	2	3	4	5	6
Scomberomoridae	+	+	+	+		+
Thunnidae	+	+	+	+	+	+
Gempylidae					+	
Trichiuridae *			+	+	+	+
Stromateidae					+	+
Nomeidae					+	
Coryphaenidae			+		+	+
Bramidae					+	
Carangidae *	+	+	+	+	+	+
Cyprinodontidae					+	
Rachycentridae					+	
Percichthyidae					+	
Ambassidae	+	+	+		+	
Trypauchenidae	+	+	+		+	+
Menidae *			+			+
Leiognathidae *	+	+	+	+	+	+
Apogonidae *	+	+	+	+	+	+
Serranidae	+	+	+	+	+	
Epinephelidae *			+		+	+
Grammistidae					+	
Cephalacanthidae	+	+	+			+
Anthiidae					+	
Priacanthidae *	+	+	+	+	+	
Lobotidae					+	
Lutjanidae *	+	+	+	+	+	+
Scolopsidae			+			
Nemipteridae *	+	+	+	+	+	
Pomadasyidae					+	+
Theraponidae *	+	+	+	+	+	+
Lethrinidae			+	+	+	
Sparidae			+	+	+	
Gerridae	+	+	+	+	+	+
Mullidae *	+	+	+	+	+	+
Sciaenidae *	+	+	+	+	+	+
Sillaginidae *	+	+	+	+	+	+
Pempheridae					+	
Drepanidae					+	
Scatophagidae		+			+	
Chaetodontidae					+	
Pomacanthidae					+	
Histiopteridae					+	+
Amphiprionidae						+
Pomacentridae	+	+	+	+	+	+
Cepolidae	+	+	+	+	+	+
Labridae *	+	+	+	+	+	+

Table 1 (cont')

Family \ Region	1	2	3	4	5	6
Scaridae					+	
Opistognathidae	+	+	+			+
Champsodontidae *	+	+	+	+	+	+
Amodytidae					+	
Schindleriidae					+	
Aplodactylidae			+			
Percophidae					+	
Mugiloididae					+	
Blenniidae *	+	+	+	+	+	+
Stichaeidae					+	
Neostethidae		+			+	
Brotulidae					+	
Carapidae	+	+	+	+	+	
Callionymidae *	+	+	+	+	+	+
Siganidae *	+		+	+	+	+
Acanthuridae					+	
Gobiidae *	+	+	+	+	+	+
Periophthalmidae		+				
Eleotridae		+				
Cyprinidae		+				
Ophicephalidae		+				
Platycephalidae *	+	+	+	+	+	+
Scorpaenidae *	+	+	+	+	+	+
Synanceiidae	+	+	+	+	+	
Triglidae				+	+	
Dactylopteridae					+	
Echeneidae						+
Diodontidae					+	
Tetraodontidae *	+	+	+	+	+	+
Balistidae			+		+	
Triacanthidae		+				
Monacanthidae *	+	+			+	+
Aluteridae	+		+	+		+
Ostraciidae						+
Antennariidae					+	

* The larvae also evident in this study.

Remarks

Regions

1-4 The Gulf of Thailand

1. Eastern Coast : from Trat to Rayong
2. Inner Gulf : from Chonburi to Petchburi
3. Upper Southern : from Prachuab-kirikhan to Surat-thani
4. Lower Southern : from Surat-thani to Narathiwat

5 The Andaman Sea

6 The South China Sea

References

1. Chantarasukul, 1988 ; Tangkaseranee, 1981.
2. Vatanachai, 1978, 1979 a, b.
3. Chayakul and Uttapong, 1983 a, b ; Tangkaseranee, 1979, 1980, 1981 ; Vatanachai, 1975.
4. Chamchang, 1986 ; Predalumpaburt et al., 1988.
5. Janekarn, 1988 ; Janekarn and Booruang, 1985 ; Termvidchakorn, 1986.
6. Vatanachai, 1972.

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จุฬาลงกรณ์มหาวิทยาลัย